Eskom	Works Information	Kriel Power Station/Engineering

Title: **Kriel Power Station Electrostatic Precipitator (ESP) Plant Maintenance and Outages Scope of Work (SOW)**

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Content

1. [i]Introduction

Kriel Power station uses Electrostatic Precipitators (ESP) and SO_3 Conditioning Plant to control particulate emissions within the limits set by the Departmental of Environmental Affairs. 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/Nm^3 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.

The ESP plant for each unit consists of two parallel casings, each having two gas passes without any division wall. The design is different for unit 1-3 and 4- 6, in such a way that the North plants, units 1-3 have three electrical fields in series and the south plant unit 4-6 have four electrical fields in series.

2. Supporting Clauses

2.1 Scope

The scope of work involves inspecting the ESP, providing an inspection report, and repairing and/or replacing components within the ESP 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 Electrostatic precipitator (ESP) plant.

2.1.2 Applicability

This document shall apply to electrostatic precipitators (ESP) plant maintenance and repairs during outages, opportunity and running maintenance at Kriel power station.

2.1.3 Effective date

This document is effective from June 2023, any previous version will be superseded by this version.

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

2.2.2 Informative

[5] National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004).

[6] Kriel Eskom Power Station Atmospheric Emissions Licences.

2.3 Definitions

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. 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

2.4 Abbreviations

Abbreviation	Explanation
ESP	Electrostatic Precipitators
ISO	Internal Organisation for Standardization
DHP	Dust Handling Plant
GO	General Overhaul
MGO	Mini General Overhaul
QCP	Quality Control Plan

2.5 Roles and Responsibilities

Operating Section

- Operate ESP plant from start-up until shutdown within the technical specifications to achieve optimal performance and meet the PM emissions.

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.

Engineering Section

- Affirm plant reliability by providing operating and maintenance sections with a comprehensive technical plant specification on opportunity and planned outages.

2.5.1 System Engineering

- Develop maintenance scopes of work of the ESP plant.

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

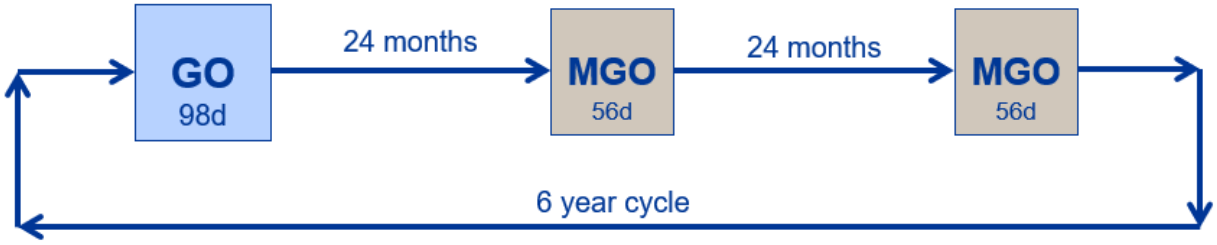
- **240-105731176**: High Level Trouble Shooting Guideline and Information for Electrostatic Precipitator
- **QM 58**: Supplier Contract Quality Requirements
- **240-49230111**: Hazard and Operability Analysis (HAZOP) Guideline

3. Description of the scopes.

The scope of work involves electrostatic precipitators (ESP) maintenance and repairs during outages, opportunity and running maintenance. Online monitoring will include but not limited to U1-6 daily inspection of the ESP and compile detail inspection technical report, repair and/or replacement of components within the ESP at Kriel power station for a period of 5 years.

3.1 Scope of work

The outage philosophy for Kriel Power Station is as follows:



The life expectancy of each Electrostatic Precipitator (ESP) at Kriel Power Station is at least 25 years from the midlife upgrade or refurbishment. Components such as pedestal bearings, tumbling hammers, v-pads, anvils, inlet, outlet screens and turning vanes as well as refurbished components are to last at least 2 years of operation, which is until the next mini outage (MGO).

SUBSYSTEM		DECOMMISSIONING AND PRESEVATION				
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)**
1		**Inlet duct work**				
		▪ **Gas inlet turning vanes`**	Inspect and repair/replace	Inspect for any wear or damage, remove ash. Replace, or window patch, cut to size.		W
		▪ **Deflector Plates**	Inspect and repair/replace	Inspect for any wear or damage. Replace or window patch if required, cut to size.		W
		▪ **ESP casing side and floor area**	Inspect and Replace	Inspect for wear, window patch with plates (300x300mm)		W
		▪ **Inlet tube support (rounds) & shields**	Inspect and Replace	80mm mild steel tubes, shields/ plates w=150mmx t=6mm (cut to size.		W
		▪ **Structural supports**	Inspect and Replace	Inspect, cut, and replace damaged areas.		W
		▪ **Walkways**	Inspect and Repair	Inspect and repair worn walkway		W
2		**Gas distribution perforated screens**				
		▪ **Perforated screens**	Inspect and replace	Replace worn perforated screen per square meter area. **Plan 80 % work**		W
		▪ **Perforated screens support**	Inspect and replace	Replace worn perforated screens supports per worn section, **Plan 80 % work**		W
		▪ **Lattice screens**	Inspect and replace	Replace worn lattice screen per square meter area, **Plan 80% work**.		W
		▪ **Lattice supports**	Inspect and replace	Replace worn lattice supports per worn section. **Plan 80% work**		W
		▪ **Perforated screen buffer plates**	Replace	Install new plates on the outer perforated screen to prevent foreign material entering the blow pots		W
		▪ Minimum thickness: Primary Screen: 3mm Secondary Screens: 1.5mm				W
3		**Collecting Electrode (CE) plates**	Inspect, wash and repair	• Inspect the collector plates for wear, cracking especially around the rapper bar bushing. • Repair holed, bowed, cracked plates especially at the rapper bar bushes, use conical washers for repair and straighten bend plates. • Install conical washers on the whole (1st and 2nd field), replace on the damaged or holed CE plates conical washers ones on other fields. • Check for misalignment and align, plate to plate clearance to be 300 mm. **Make a provision for 10% replacement of worn or damaged plates**.		W
4		**DE wire frames**	Inspect and Repair	• Inspect frames for looseness (slack wire). • Tack welding of the discharge electrodes wires. • Brocken wires or frames and alignment, 150 mm spacing frame to plate frames to be repaired.		W
		▪ **DE frame support insulators**	Inspect and replace	• Full replacement of support insulators on the 1st and 2nd fields. • Inspect for wear, cracks, clean, and replace the damaged insulators on the remaining fields. • Check for misalignment and align **Provisions to be made for rigging of DE Frame.**		W
		▪ **DE frame support carrier beams**	Inspect and replace	Inspect and replace all buckled or damaged DE structural support beams (use square flat washers). **Riggers needed, Outage to plan for the provision for the scope** **Prioritise alignment on all the fields.**		W

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		▪ **Penthouse**	Inspect and repair	• Inspect the penthouse for water and ash penetration • Full replacement of the seals (PTFE cones) • **Roof:** Inspect roof for water leaks and seal where necessary		W
5		**CE Rapping system**				
		▪ **CE rapper shaft**	Inspect and Replace	• Inspect roller supports for wear, if damaged replace (Engineering to advice), otherwise align if out **Full replacement on the first field and inspection and repair on the remaining fields.**		W
		▪ **Pedestal rollers**	Inspect and replace	• Full replacement of the pedestal rollers on the first fields. • Inspect for excessive wear, replace damaged pedestal rollers on the remaining fields.		W
		▪ **Roller bushes**	Inspect and repair/replace	• Repair roller bushes that are stuck/rusted and replace damaged ones. • New bushes to be hardened to ***HV 196***, Material certs required		W
		▪ **CE Rapper bar**	Inspect, repair/replace.	• Inspect for straightness and straighten if required. • Check bushes in place and bolts torqued to specification. • Check rapper bar strike plate for wear/damage and repair if necessary • Check anvil welding and bolts for wear/damage and repair if necessary.		W
		▪ **Rapper bar bushes**	Inspect and replace.	Check for wear on the bushes and replace with conical washer bushes, new bolts (Gr 8.8) M16 torqued to 213 Nm.		
6		**DE rapper shaft bearings and sleeves(v-pads)**				
		▪ **V-pads**	Inspect and Replace	Inspect and replace if worn (ensure like to like to replacement on clearances)		W
		▪ **Split bearings**	Inspect and Replace	Inspect and replace if worn (ensure like to like to replacement on clearances)		W
		▪ **DE Torque insulators**	Inspect and replace	Inspect and replace damaged torque insulators in the rapper box.		W
		▪ **DE drive unit**	Open, inspect and lubricate	• Remove the drive unit, open, inspect the two bearings, replace if damaged, • Repack with new grease • Inspect, repair/replace, and paint drive shaft unit and install on plant.		W
7		**Access doors**				
		▪ **Hopper and casing**	Inspect and Repair	Inspect for any damage and wear / corrosion and repair if required (send to platter shop if needs be)		W
		▪ **Door seals**	Replace	**NB: Replace all door seals**		W
		▪ **Door hinges and locking mechanism**	Clean and lubricate	Clean and lubricate, repair damaged hinges and door latches		W
		▪ **Replace inner door with a lighter door (AA alloy)**	replace	Replace heavy inner doors with a lighter material one (621329)		W
8		**Hoppers**				
		▪ **Agitating chains**	Inspect and repair	• Inspect all connections for wear, clean and lubricate chains • Replace damaged or missing ones		W

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		▪ **Poker rods/agitating handles**	Inspect and repair	• Inspect all the poker rods for free movement, repair if not moving freely. • Use 6.3 mm style C1065 packing to ensure free movement of the handle		W
		▪ **Baffle plates**	Inspect and Repair	Inspect for damage, repair/replace if required and correct position.		
		▪ **Hopper slope walls**	NDE	• Carryout Wall Thickness Test on the hoppers internal slope. • Report to be submitted to engineering for Review. • Check wall thickness to be no less than 3mm		W
		▪ **Hopper internal support welds**	NDE	• Carryout MPT test on the Hopper internal support welds. • Report to be submitted to engineering for review. • Inspect all welding joints for cracks and repair, if required		W
		▪ **Fluidising system**	Inspect, Repair and Refurbish	• Dismantle the fluidising nozzles • Inspect, clean and unblocked nozzles. Inspect fluidising pipework for wear or leakages. • Badly damaged/worn nozzles to replaced **Refurbish the fluidizing system, Provisions to be made for the work. <u>Prioritise all hoppers</u>**		W
		▪ **Emergency ashing**	Install	Reinstate emergency ashing to facilitate ease of ash removal in emergency situations or full hoppers.		W
9		**Collector rapper hammers**				
		▪ **CE hammer**	Inspect and Repair	• Grind sharp edges on the hammer striking faces, if striking face is flat turn, it around, replace all hammers with a movement or play on the gripper • Tag weld all bolts (use spring washers not flat washers). **<u>Full replacement on the 1st and 2nd fields and replacement of the badly damaged hammers on the remaining fields.</u>**		W
10		**<u>CE rapping gearboxes</u>**				
		▪ **Gearbox protection/straight coupling**	Install/Repair	• Install or repair CE shaft coupling to limit mechanical overloads on the CE shaft, QTY=16 . Nu-Epex coupling installation. • Inspect and replace the gearbox base as per drawing number 0.45/57218**.**		W
		▪ **Gearbox (2,1 rpm)**	Inspect and replace	• Remove the gearbox from plant if damaged, otherwise, inspect for oil leaks, clean the fan cowling, the gearbox, drain old oil, flush gearbox, inspect for wear on seals, bearings etc. • Refill with new oil (Shell Omala EP320), do balancing at EMD and paint the gearbox, send for refurbishment if damaged.		W
11		**<u>Discharge Electrodes and DE hammers & anvils</u>**				
		▪ **Discharge electrodes**	Inspect and repair	• Check the deflector frames for wear, cracks, check for misalignment and align,		W

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				plate to frame clearance to be 150mm, straighten bend spike • check for buckling at the carrier beams on the penthouse and repair if damaged.		
		▪ **DE hammer and anvils**	Inspect and replace badly damaged	• Inspect hammers for wear and damage. Replace badly damaged), inspect and replace associated anvil. • Tack weld all bolts (use spring washers not flat washers). **Full replacement of hammers and associated anvils on the 1st and 2nd fields and replacement of the badly damaged hammers and associated anvils on the remaining fields.**		W
11		**Discharge Electrodes rapper shafts/bearings**				
		▪ **Split bearings**	Inspect and replace	Replace damaged split bearings		W
		▪ **V-pads**	Inspect and replace	Replace damaged v-pads bearings		W
		▪ **DE rapper shaft**	Inspect and replace	• Inspect the DE shaft for wear, replaced if damaged after the inspection. • Check alignment on the bearing and shaft. Inspect shaft coupling and repair if required. **Full replacement of the DE shaft on the 1st field and inspection and repair on the remaining fields.**		W
		▪ **Gearbox (0,42 rpm)**	Inspect and replace	• Remove the gearbox from plant if damaged otherwise inspect for oil leaks, clean the fan cowling, the gearbox, drain old oil, flush gearbox, inspect for wear on seals, bearings etc. • Refill with new oil (Shell Moala EP320), do balancing at EMD and paint the gearbox, send for refurbishment if damaged.		W

3.2 Battery limits

PLANT	START	END	EXCLUSIONS	INCLUSIONS	P&ID DRAWINGS
ESP PLANT	Precipitator inlet- diffuser start, 15mL	Precipitator outlet	All Electricals apparatus, turning vanes, guide vanes and Flue Gas ducting Below hopper slide gates	Deflector plates, inlet perforated screens, K-supports, lattices, screen walkways gratings, vertical structure support, downstream deflector vane vertical support structure badly eroded, Perforate walkway before the screen, Deflector vanes Precipitator casing, Casing internals (rapper hammers, anvils, rapper bars and rapper bar bushes rapper shafts, roller pedestals, DE sleeves bushes and V pads, shafts bearing journals, CE& DE frames), Casing side walls, floor and roof portion on K support Penthouse: damaged carrier beam, PTFE cones, square flat washers, HT tubing and DE Support Insulators. Hoppers, baffle plates, access doors ESP Structural supports Fluidising system	0.45/12159, *rev 2*

4. Acceptance

This document has been seen and accepted by:

Name	Designation
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Harry Mokabane	Boiler Plant Engineering Manager
Bheki Mkhabela	ESP Supervisor
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5. Revisions

Date	Rev.	Compiler	Remarks
May 2023	01	[redacted]	First Compilation.

6. Development Team

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

- [redacted]
- [redacted]

7. Acknowledgements

- [redacted] ESP Maintenance Supervisor
- [redacted] Outage Co-Ordinator

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