Eskom	Scope of work	Kriel Power Station

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1. Introduction

Mill maintenance demands a well-planned effort to have all mills available and reliable when on load. This document defines the scope of work required to achieve the goal of reliable and available mills.

2. Supporting Clauses

2.1 Scope

2.1.1 Purpose

The purpose of the document is to define the work a contractor has to execute on the milling plant on unit 1 – 3 to have all mills available, sufficient preventative maintenance done and minimum mill UCLF.

2.1.2 Applicability

This document shall apply to Kriel Power Station.

2.1.3 Effective date

This document is effective from the date of authorisation.

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] EBP1059 Maintenance Execution Strategy for Milling Plant

[3] EPB1147 Kriel milling plant operation and protection philosophy

[4] OPS0265 Mill Commissioning check sheet

2.2.2 Informative

[5] EBP1212 Kriel combustion control philosophy protections and operational ranges

2.3 Definitions

2.4 Abbreviations

Abbreviation	Explanation
BPE	Boiler Engineering Department
CID	Control and Instrumentation Department (Maintenance)
CM	Corrective Maintenance
DCS	Distributed Control System
FD	Forced Draught
FFFR	Fossil Fuel Firing Regulation
GA	General Arrangement
GO	General Overhaul
MGO	Mini General Overhaul
MMD	Mechanical Maintenance Department
NDT	Non Destructive Testing
OPS	Operating department
PA	Primary Air
PF	Pulverised Fuel
PM	Preventative Maintenance
PSR	Plant Safety Regulations
P&T	Performance & Testing department
RP	Responsible Person
QC	Quality Control
rpm	Revolutions per minute
VSD	Variable Speed Drive

2.5 Roles and Responsibilities

Boiler Engineering – Responsible for the technical content of the scope

Boiler Maintenance – Responsible to get the contract in place and for the implementation of the work describes in the scope of work.

2.6 Process for Monitoring

N/A

2.7 Related/Supporting Documents

N/A

3. Mill maintenance contract scope of work

3.1 Scope overview

The contract scope covers the works required to maintain the mills on unit 1, 2 & 3. The works includes all labour and equipment required to maintain the mills with the aim to have good reliability and availability. The scope excludes the spares required to execute the works.

The scope includes maintenance activities on 18 mill groups. A mill group consists of a coal gate, feeder, mill, PA fan, seal air fan and distribution box.

3.2 System description

Mills are used to grind coal into small particles to enable a large amount of coal to be burnt in the boiler (per second). This is necessary to achieve the required heat input to the furnace to achieve the correct boiler steam flow and pressures.

3.2.1 Coal feeder

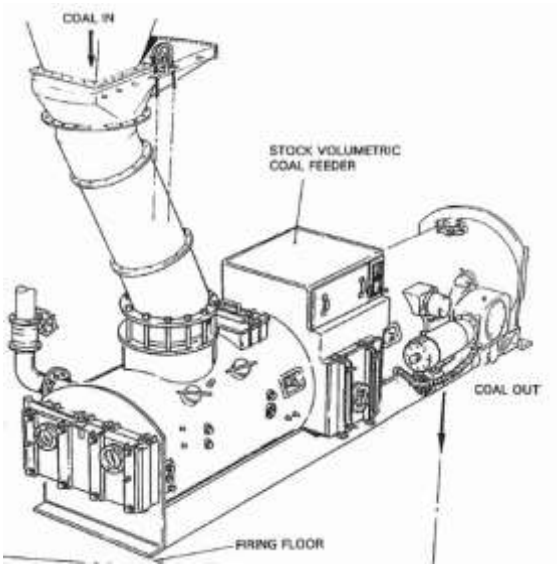


Figure 1: Coal feeder assembly

Each coal feeder is located on 15m level above the mill. The coal feeder comprises a main belt conveyor and a cleanout chain conveyor housed is a cylindrical steel tube, each having its own independent drive unit. The purpose of the coal feeder is to supply the mill with a measured amount of coal, controlling the coal flow on the set point provided by the DCS. The coal firing rate is adjusted to control the boiler main steam pressure.

Coal is gravity fed from the bunker and passes through the bunker outlet gate (coal gate) down through the coal pipe to flow onto the enclosed main belt conveyor. Side and end skirts are fitted at the inlet section of the feeder to guide the coal onto the belt and a levelling bar sets the coal height.

The main conveyor belt drive unit comprises of an electric motor, VSD and a gearbox mounted on the conveyor drive pulley.

At the inlet end of the feeder there is a seal air pipe which pressurises the feeder with cold air from the FD fan discharge, it stops hot PA from blowing up from the mill into the feeder casing. Quick release access doors and covers are provided for inspection and maintenance purposes.

The feeder profile bar must be kept in a good condition and set with an accuracy of ±2%. See Table 1: Feeder profile settingsTable 1 and Figure 2: Feeder profile are dimensionsFigure 2 for details of the feeder profile area.

	Unit 1 - 3	**Unit 4 - 6**	
A	0,61	0,61	[m]
B	0,325	0,325	[m]
C	0,135	0,14	[m]
D	0,053	0,058	[m]

Table 1: Feeder profile settings

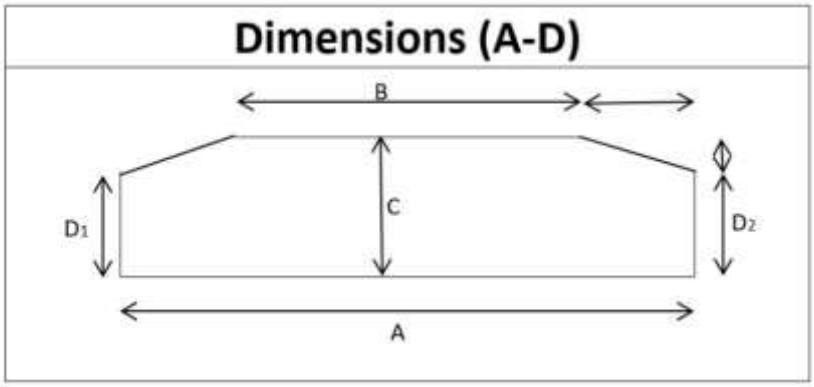


Figure 2: Feeder profile are dimensions

3.2.2 Mill assembly

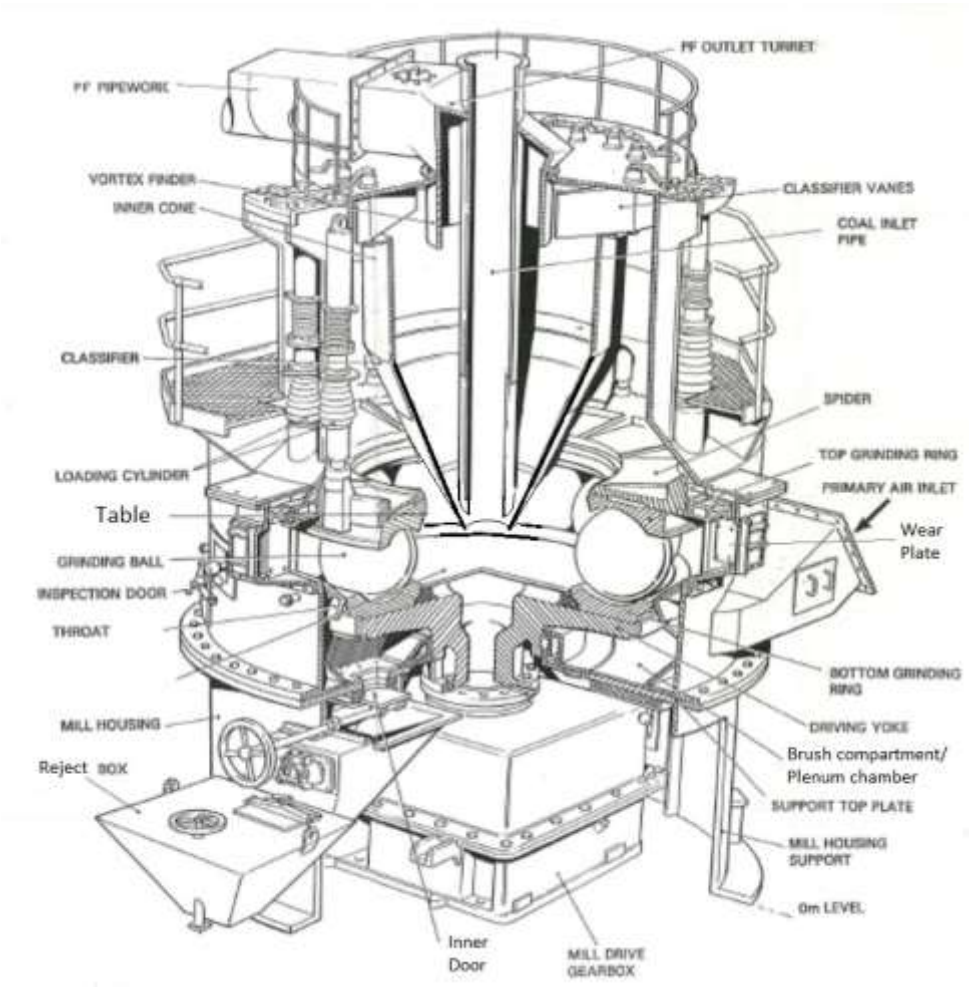


Figure 3: Mill assembly

The mills used at Kriel Power station are medium speed ball mills, type E. The mills were manufactured by Babcock. The mills differ in sizes for Unit 1 -3 and Unit 4 -6, the sizes are denoted by the centre to centre distance of ball races 180º apart. The 10.8E mills (108 inches) are used in Unit 1 -3 while 12E mills (120 inches) are used in Unit 4 -6.

Each coal mill can be divided into four levels for descriptive purposes, see Figure 3 above for details. The first level is the mill housing which is cylindrical in shape. Within the housing is the mill drive gearbox and access to the gearbox is obtained through the cut outs in the housing. The mill housing is mounted on its own steel foundation frame and the gearbox is mounted independently on its own foundation frame. Welded to the top of the mill housing support is the support top plate which has six wear plates bolted to it. One wear plate and top plate have a cut out in them so that the pyrite rejects fall into the reject bin.

The support top plate provides the base for the second level which is the mill housing barrel; the mill housing barrel is cylindrical in shape and is bolted to the support top plate. Mounted in the mill housing is the driving yoke, the bottom grinding ring, grinding balls, the top grinding ring and the spider. Access to this area is through inspection doors and “ball filling” door fitted to the mill barrel. Two ducts welded to the mill housing supply the primary air to this section of the mill.

Level three is the Pulverised Fuel (PF) classifier which comprises a lower cylindrical shell with a wide bottom flange which is bolted to the top of the mill housing. Bolted to the top flange of the lower classifier is the upper classifier which is a cylindrical top piece and houses the sixteen (16) adjustable vanes. The lower flange of the upper classifier is the mounting point for the loading cylinders of the air bag loading cylinders.

PF is graded in the classifier and when the PF has reached the required fineness it passes through the vortex finder into the PF outlet turret which comprises the fourth level. In appearance, the turret resembles a top hat with a cylindrical section, and the rectangular PF pipe section is attached to the outlet turret. The raw coal pipe is attached to the top and passes through the cylindrical section to the bottom of the classifier.

Access to the top of the mill is via fixed steel ladders. There is a platform at the access door and ball loading cylinders (same level) and a platform on top of the classifier.

Each Coal Mill is mounted on an inertia block which is cast as a rectangular block of concrete, with reinforcing steel bars and with a 50mm space all around. The coal mill, gearbox and plinth for the gearbox drive motor are mounted on the inertia block. This inertia block is in turn seated on spring units and visco dampers; the idea is to dampen the vibrations that are generated by the coal mill. Access to the base are of the inertia block is via a manhole and steel rungs cast into the vertical concrete face of the access shaft which is approximately six (6) meters in depth.

The block is supported by eight (8) spring units of the Type GS - 8-2715/33 and twelve (12) visco dampers (four (4) at each corner) of the Type V5R - 871.

COMPONENT DESCRIPTION	**LARGE SPRIGNGS**	**SMALL SPRINGS 1**	**SMALL SPRINGS 2**
MATERIAL	BS 970: Part 5: 250A58	BS 970: Part 5: 735A50	BS 970: Part 5: 250A60
HARDNESS	455 - 474 Hv	328 - 350 Hv	440 - 455 Hv
LENGTH	260 mm	126 mm	247 mm
NUMBER OF COILS	6	5	9
WIRE DIAMETER	35.5 mm	24 mm	20 mm
OUTSIDE DIAMETER	179 mm	133.5 mm	90 mm
RATE	2.24 kN/mm	0.66 kN/mm	0.5 kN/mm

Table 2: Damper and spring technical data

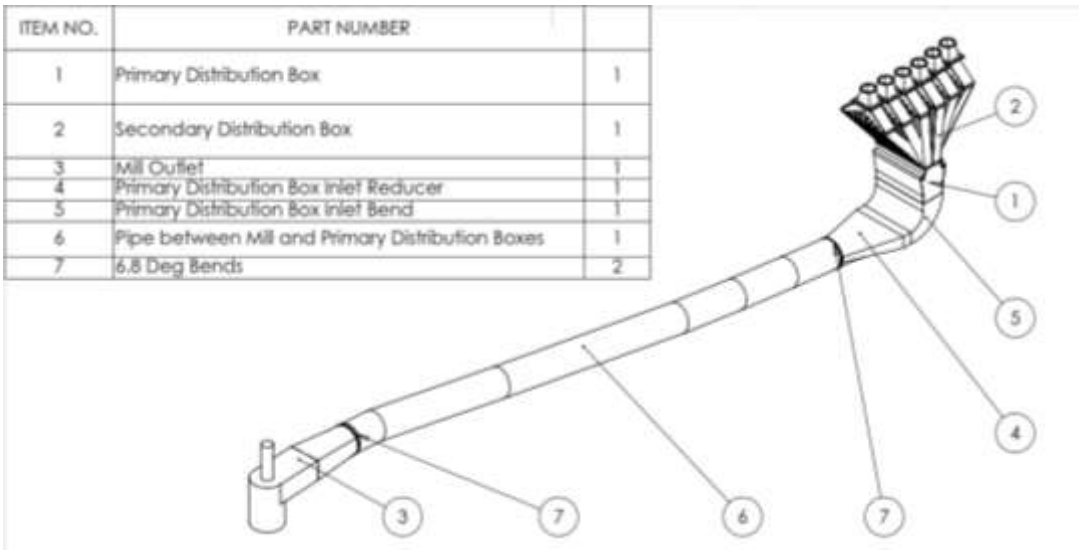
3.2.3 Mill Reject system

The rejects are removed manually by OPS, minimum twice a shift with the boiler ashing. OPS must unblock the inner and outer doors when necessary and notify Maintenance if there are defects.

The system consists of a reject bin, inner and outer reject doors and brushes inside the plenum chamber. The rejects/pyrites falls in to a sluice way fitted with nozzles to blow the material to the ash sump with high pressure jets. The sluice ways, grating, and nozzle maintenance is not part of the milling plant maintenance scope.

3.2.4 PF pipes and distribution

The PF is transported to the PF burners through the PF pipes, with a distribution box installed to split the flow into six. The PF leaves the mill through a single outlet turret to the distribution box, where the flow is split in two stages, see Figure 4 below. The six PF pipes from the distribution box is routed to each burner.



ITEM NO.	PART NUMBER	
1	Primary Distribution Box	1
2	Secondary Distribution Box	1
3	Mill Outlet	1
4	Primary Distribution Box Inlet Reducer	1
5	Primary Distribution Box Inlet Bend	1
6	Pipe between Mill and Primary Distribution Boxes	1
7	6.8 Deg Bends	2

Figure 4: Mill outlet PF pipe and distribution box

The mill outlet, main pipe to the distribution box and the distribution box damper is maintained by the Mill maintenance team.

The main PF pipe from the mill to the distribution box is tiled, it requires minimal maintenance.

3.2.5 Mill gearbox lubrication system

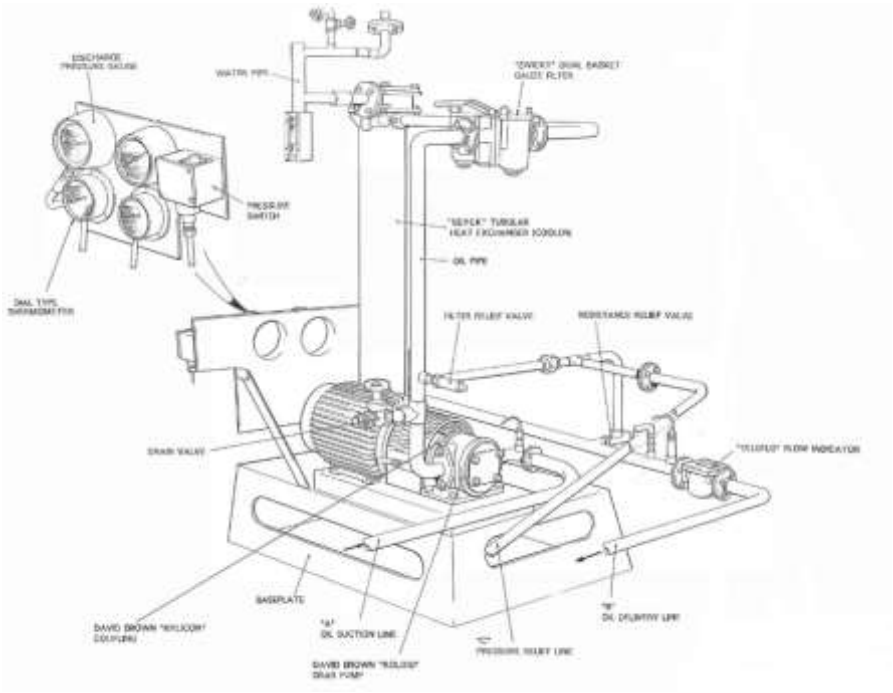


Figure 5: Unit 1-3 mill gearbox lube oil system

The oil is circulated by a gear type oil pump directly connected to a three-phase induction motor by a flexible coupling, which draws oil from the sump of the gearbox. The oil is discharged under pressure to the duel basket strainer, flows from the strainer through an oil cooler, through the delivery pipe to the gearbox distribution system.

The oil cooler is a cast iron cylinder containing aluminium/brass tubes through which the cooling water flows. The oil enters at the top of the Unit and is directed over the tubes by a series of baffles, leaving the unit at the bottom. The cooling water is supplied from a secondary cooling system, entering at the top of the cooler, and then makes a double pass through the cooler before leaving at the outlet branch, also at the top of the cooler. The cooling water flow is regulated by means of valves on the inlet and outlet pipes and should flow at a rate of 31,8 litres per minute, as shown on the flow indicator on the inlet pipe.

A pressure gauge is mounted on the pipeline between the oil pump and the strainer indicating the oil pressure before the strainer. Under normal conditions the oil pressure should not differ by more than 50 kPa and shown on the pressure gauge on the strainer outlet. If the strainer is blocked the differential pressure across the filter will increase. If the filter is totally blocked the oil is relieved by the pressure relief valve back to the gearbox sump.

The other pressure relief valve is situated after the oil cooler, which returns oil back to the gearbox if the supply line of the gearbox becomes blocked.

The temperature of the oil leaving the oil cooler should be about 50 C; it should not exceed 71 C as this will cause overheating in the gearbox. The flow rate of oil to the gearbox is normally 55 litres per minute at 110 kPa.

3.2.6 Mill Gearbox

The power is transmitted by the gear unit at reduced speed from the prime mover, an electric motor, to the coal mill. The motor drives the gear unit input shaft at 920 rpm and the gear unit output shaft rotates the mill table at 26.7 rpm.

The 10.8E mills are driven by double reduction gearboxes powered by three phase induction motors. The mills operate at a speed of 37.443 rpm, this being the output speed of the gearbox. The input speed to the gearbox is 970 rpm and the speed reduction translates to a speed reduction ratio of 25.906 to 1. The rotation of the input shaft is "Clockwise" when viewed from the motor and the output coupling also rotates "Clockwise" when viewed from above.

The gearbox installation is done with a special trolley built for this purpose. The trolley runs on rails installed in the concrete to an area where a crane has access to lift it to a trailer.

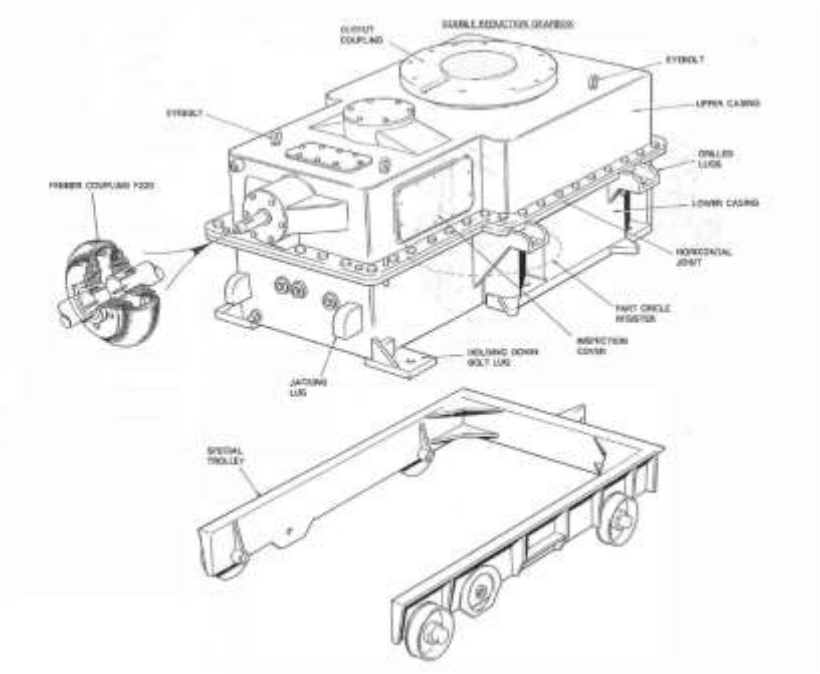


Figure 6: 10.8E Gearbox

3.2.7 PA fans

All mills have dedicated PA fans that forms part of the mill group, following the same operating and maintenance philosophy. The PA fans blow hot air through the mill to the furnace, taking suction from the windbox. The ash load on the PA fans are relatively low and the impellers have very little cracks when tested biannually, impeller replacement or repair frequency is normal.

Units 1-3 (L2 fan)

Manufacturer		Howden power
Type		L2
Size		12000, arrangement 516, handing LO
Rotation		C CW B
Impeller:	Type	L2 with 12 off blades
	Effective Diameter	2114
	Approximate weight	1600 kg
	Boss Diameter	270 mm
	Bore	180 mm
	Key	28mm X 16mm
Speed		1485 rpm
Output		42 m^3/sec
S.W.G.		31,77 inches
Bearings		4" thrust & journal, sleeve, SAFL
		4" journal only, sleeve, SAFL
Coupling		Wellman Bibby HLC 290

The PA flow rate is controlled with “Axial Vane Control” (AVC). The vanes are installed with their axis of rotation parallel to the PA impeller’s axis of rotation. The vanes are opened and closed with links installed on an operating ring to synchronise the movement.

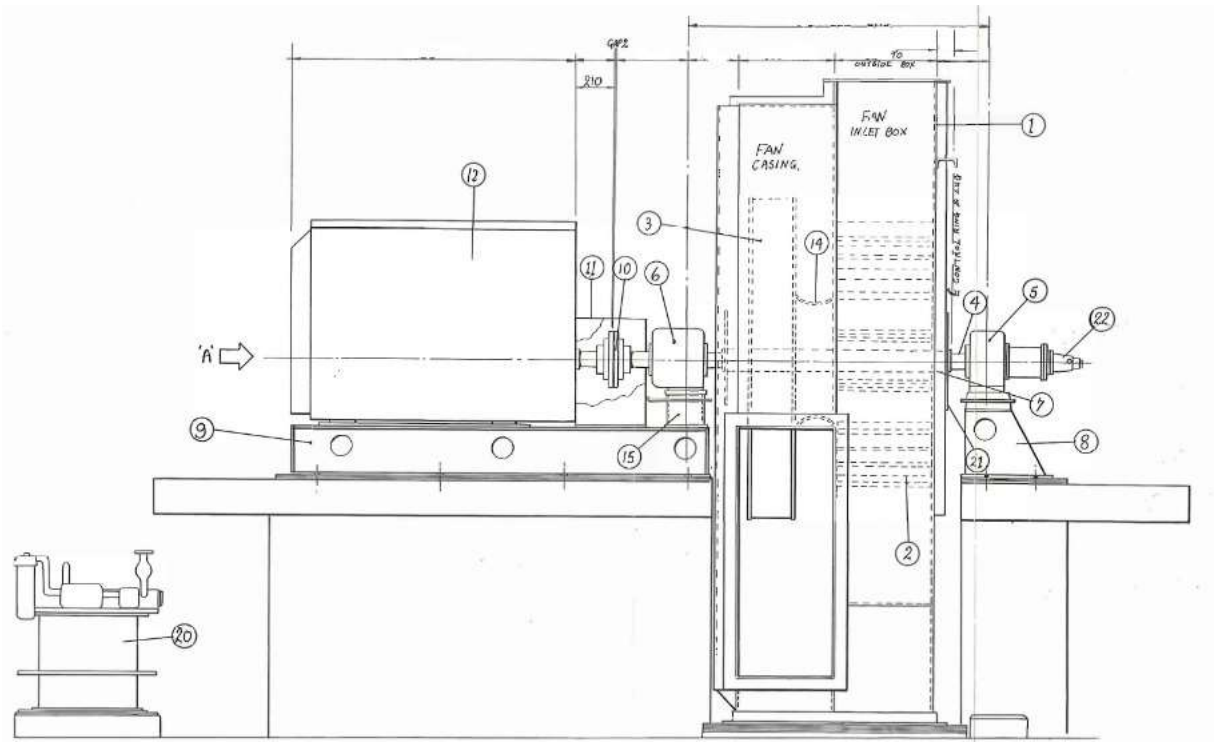


Figure 7: L2 PA fan side view GA drawing

3.2.8 Mill and PA fan motors

There are two types of motors used on the mills and PA fans, supplied from different manufacturers: GEC and Actom.

The motors are 3,3 kV induction motors. The motor is cooled by a heat exchanger mounted on top of the motor. There is a cooling air fan outside the motor casing which is attached to the motor non-drive end. This allows cooling air to be circulated through the heat exchanger as soon as the motor starts. Air is also used in a closed circuit in the motor which is circulated by two fixed fans on either end of the motor.

The rotor is supported at either end by a disc lubricated plain white metal journal bearing. The bearing makes use of an oil pick up disc. The oil is picked up from the reservoirs by the disc and transported to the top of the bearing, running down, back to the reservoir through ports. The oil level is monitored through sight glasses on the side of the bearing housing.

The bearings are naturally cooled, oil lubricated journal bearings. The oil level is viewed through a sight glass on one side of the bearing. The oil level must be maintained at half the level of the glass.

	Power	**Speed**
Mill motor	328 kW	985 rpm
PA fan motor	465 kW	1490 rpm

Table 3: Electrical motor data

3.2.9 Seal air fan

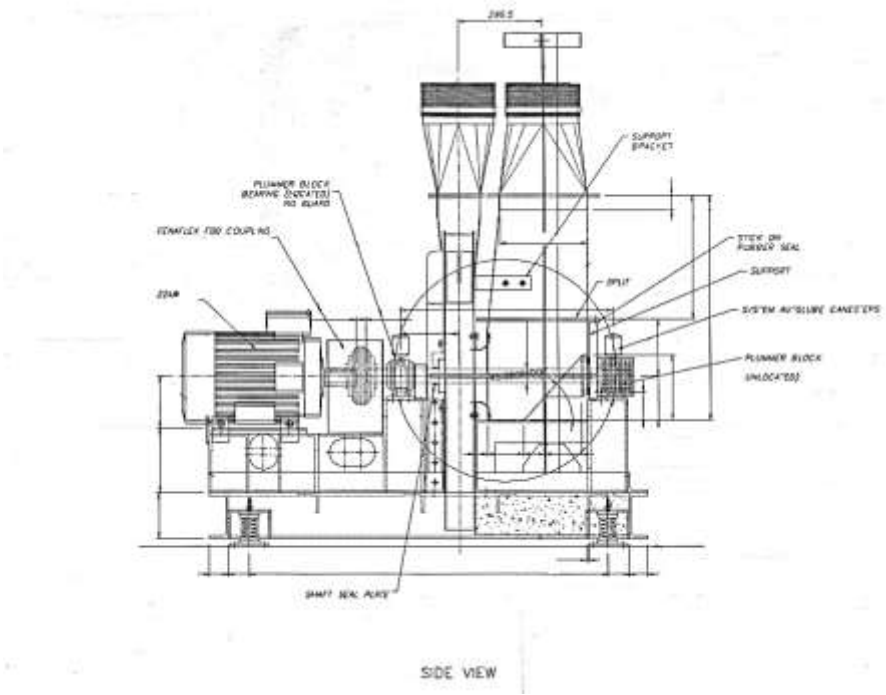


Figure 8: Seal air fan side view GA drawing

The seal air fan is a CFW 900 m diameter TRB-B Blower driven direct inline via a fenner flex rubber coupling by a 22 kW/ 2 pole/ 3ph/ 380V/ 50Hz/ IP65/ class F/ cast iron/ foot mounted motor.

Fan duty:	0.817 m^3/s @ 14717 Pa @STP
Impeller	CFW Industries Ø900 mm TRB-B
Motor	22 kW 2 pole 3ph 380V
	50Hz IP65 class F
	Cast iron foot mounted – B3
	Frame size 180M
Coupling	F80 Fenner flex rubber coupling
	C/w taper locks Ø50 mm bore on one side
	Ø48 mm on opposite side
Fan bearings	Ø50 mm Plummer Block
	Spherical roller bearings: SNL 511-609 Housing
	22211 EK Bearings
	H311 Sleeves
	FRB 9.5/100 Locating rings
	TSN 511 G seals
Bearing lubrication	Auto lube plastic canisters
	Grease LGMT2
Paint finish	SAS Cargoline Battleship Grey
Anti-Vibration Mounting	SLF-B 450 Red
	Spring type anti vibration mountings
Fan paint	SAS Cargoline Battleship Grey

3.2.10 Weight of mill components

Mill Type: 10,8E Babcock and Wilcox Vertical Spindle Mill

Item	Component Description	Dimensions	Mass
1	Top and Bottom Grinding Ring Set	Outer Diameter 3404 mm	7 tons each
		Ring Thickness 244mm	
2	Hollow Ball (11 off)	Outer Diameter 768mm	1.11 ton each
		Wall Thickness 103mm	
3	Hollow Ball (Filler Ball 1 off)	Outer Diameter 690mm	0.86 ton each
		Wall Thickness 60mm	
4	Spider		8 tons
5	Yoke		14 tons
6	Mill top (classifier)		14 tons
7	Gearbox (empty)		17 tons
8	Mill motor		4 tons

Table 4: 10.8E internal component info

3.3 Maintenance Philosophy and Limitations

The mills should be serviced every 5000 hours (breaker running hours). The mill motor running hours are recorded on the DCS for good record keeping. The contractor must ensure all resources and equipment are available to service the mills in time and attend to breakdowns. The work must be planned to have all mills below 5000 running hours (±500 hours), do ball changes in time and replace rings when required.

When the grinding rings are at their end of life; the mill should be re-built with new rings, balls, throat, classifier, vanes, ball loading cylinders, raw coal pipe and refurbished outlet bend.

The plant area must be inspected on a weekly basis to identify defects and abnormalities (see, hear, feel), notifications must be loaded for the work to be planned.

The PA fan impellers must be tested for cracks and their thickness measured every two years, if it does not fall in the outage philosophy (GO/MGO) it must be done by shutting down the mills one by one to get access.

3.3.1 Mill Ball Cycle Unit 1 – 3, 10.8E Mills – High Chrome Material

Cycle 0: 11 balls 765 mm to 690 mm diameter
Cycle 1: 11 balls 765 mm to 690 mm diameter
Cycle 2: 12 balls 690 mm to 640 mm diameter
Cycle 2: 12 balls 690 mm to 640 mm diameter

Cycle 0: 765 mm balls are used in a set of 11 balls until they reach 690 mm. When the set reaches 690 mm, they are removed and cycle 1 starts.

Cycle 1: 765 mm balls are used in sets of 11 balls until they reach 690 mm. When the set reaches 690 mm a filler ball is added and cycle 2 starts.

Cycle 2: The same balls from cycle 1 are used with the filler ball added, now 12 in total. The balls are used until they wear down to the scrap size of 640 mm when they are removed.

Cycle 3: The original balls from cycle 0 are used with the filler ball added, now 12 in total. The balls are used until they wear down to the scrap size of 640 mm when they are removed.

The above cycles are based on the high chrome material with an approximate wear rate of 220 h/mm for the balls and 645 h/mm for the top ring and 750 h/mm on the bottom ring.

The rings are discarded at the thickness of 50 mm to avoid ring cracking. Mills that have overrun the minimum thickness of 50 mm start forming cracks in the top of the ball profile and then fails completely when the thickness is about 30 mm.

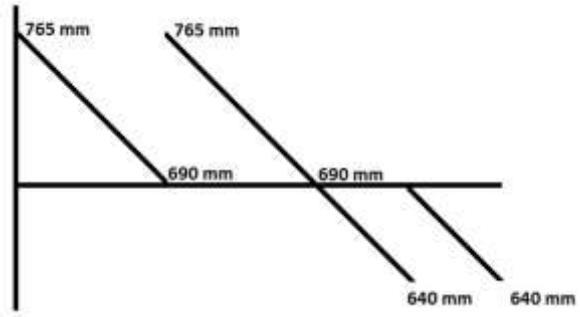


Figure 9: Ball cycles

3.4 Contract boundaries

For the purpose of this contract, the following are the physical boundaries of the plant worked on:

1. Coal gate inlet flange below the bunker
2. PA fan inlet bellow and inlet flange
3. Mill inertia dampers and springs
4. Distribution box damper

The following equipment are included:

5. Coal gate, knife gate, feeder assembly, inlet and outlet raw coal pipes, discharge square to round
6. PA fan casing, actuator, impeller, bearings, lube oil system, motor, motor base
7. Mill inertia block, dampers, springs, seal around inertia block, motor and gearbox bases
8. Mill assembly, motor, gearbox, lube oil system, PF pipes and hangers up to the distribution box, distribution box damper assembly
9. Seal air fan assembly

3.5 Maintenance activities and specifications

3.5.1 Technical specifications

1. The mill performance is measured in its ability to grind the coal to the required fineness and deliver the required throughput. Mill maintenance must be executed strictly on schedule to ensure this requirement is met. Where performance issues are identified the contractor must attend to the defect with urgency to get the performance in specification.
2. The mill must pass the “Clean air curve” test after each mill service, this proves the restrictions to flow in the mill are acceptable. Too much restriction will cause PA fan saturation when it is on load (vanes opening 100%) or too little restriction will allow too much material to be rejected or there are air leaks.
3. The mill must pass the “PF fineness” test, failing to do will result in clinkering on the unit. Changes to the classifier vanes is required to correct the PF fineness.
4. The feeder profile area must be set accurately to prevent the mill from choking due to excessive coal. Performance and Testing (P&T) must be called to verify the area after any work on the profile area.
5. The “Load line” test is done by P&T to confirm the calibration of the coal flow and air flow transmitters, defects on these will be loaded for repairs (normally C&I defects).
6. The vibration of the mill motor, gearbox, seal air fan, seal air fan motor, PA fan, PA fan motor must be below 5 mm/s. Eskom performs vibration monitoring on these components and load defects when necessary.
7. The gearbox and PA fan lube oil condition is monitored by Eskom, defects are loaded when necessary.
8. All welding procedures must be to BS EN, not ASME. The boiler design code is BS EN 12952.

3.5.2 Commissioning

The contractor is responsible for the commissioning of all plant when the permit is cleared. The equipment must be tested and run (where applicable) to confirm the instrumentation and protections are working and the mechanical components are in order (pressure and flow are in spec). Commissioning must be done with OPS according to the commissioning procedure (OPS0265). When the plant is commissioned, it will be handed back to OPS for use.

3.5.3 Ad hoc tasks

There are tasks on the milling plant that are not done frequently, but should be done when required. The following are tasks that will be scoped when failures occur:

1. Repair ceramic tiles (high alumina content) in the PF outlet turret, PF pipe to distribution box, feeder outlet square to round.
2. Repair PF pipe hangers.
3. Replace motor base plate and install new grout (Mill and PA fan).
4. Replace mill inertia block dampers and springs.
5. Clean mill gearbox lube oil coolers

3.5.4 Work procedures

The detailed work procedures are recorded on work packages (Eskom documents) and captured on SAP where work is grouped and scheduled.

The contractor must review the work packages before the start of the contract and annually from the start of the contract. The procedures on the work packages must be improved in terms of safety, methods, manpower and equipment used to ensure all work is done safely and in the best reasonable time while achieving the goal of reliability and availability.

3.5.5 Welding

All welding must be done according to 240-106628253 Eskom Welding Standard.
All welding must have an approved WPS with an approved ITP/QCP.

3.6 Site management and reporting

The site manager is responsible to ensure there is good communication between Eskom and the contactor at all times. Eskom official communication is done via emails, Microsoft Teams calls and messages.

It is the contractor’s responsibility to install and maintain a telecommunication network on site to enable good communication with Eskom and to have access opSUITE (FLIP) for perimetry, meeting minutes and defects.

Drawing of spares will be done by the Eskom supervisor responsible for the mills.

The contractor’s supervisor is responsible to manage the work teams to execute the planned work (Preventative Maintenance) and breakdowns (corrective maintenance).

The contractor must supply transport for all the workers on site (home-work-home) and vehicles for two standby teams.

The contractor must have two teams on standby for emergency work (after hours) at all times. The first team must consist of fitters and assistants of which at least one is an RP. The second team must consist of at least one Boilermaker and one Welder – this team will be called out by the fitters if the defect requires cutting and welding.

3.6.1 Site establishment

The contractor must establish a work site on Kriel Power Station's premises. The site must be fenced off and have a board with the contractor's name easily visible.

The site must include a staff facility, restrooms and changing facility, workshop with work benches.

It is the contractor's responsibility to maintain the yard (site establishment), including the fence around it.

Eskom will provide electricity to the site.

3.6.2 Breakdowns

Plant breakdowns causing UCLF must be treated with the utmost urgency, it should be priority to clear the load loss as soon possible. When the damage is assessed the contractor must give a repair program with timelines and progress feedback as the milestones are met.

The expected response time for a call out is one hour.

3.6.3 Mill outage duration

The mill outage duration shall be measured from the time the permit to work is taken until the permit to work has been cleared. The mill outage duration for each maintenance activity to be agreed upon by both the Contractor and the contract manager. The contractor is responsible to submit a detailed plan and programme for the execution of the Scope of Work.

The standard duration of a mill 5000 hour service is 7 days and a mill rebuild 21 days. Where there is extra scope or delays that will extend the duration, permission is required from the contract manager to extend the planned end date.

3.6.4 Inspection and quality control

The contractor must inspect the plant (normal services or breakdowns) and issue Eskom with an inspection report. The contractor must propose the repair that must be done to restore the design base of the plant. Eskom will evaluate the inspection report and repair proposal and amend if necessary, the signed report from Eskom will be the approved scope of work.

Where technical specifications cannot be met for any reason, a Technical Notification (TN) must be raised to the System Engineer to inform Eskom of the condition (i.e. temporary repairs, alignment or vibration that is out of spec). The contractor is responsible to maintain a database of Technical notifications. When the condition is repaired the TN must be closed out on the database with the agreement of the System Engineer.

All work must have an approved QCP with intervention points for the contractor, contractor QC, Eskom QC and Eskom System Engineer.

3.6.5 Eskom meetings

All Eskom meetings must attended by the relevant personnel. The following are the minimum requirements:

1. Departmental meeting: Daily meeting at 07:30 with the Boiler Maintenance Manager
2. Plant focus meeting: Daily meeting at 08:00 attended by the supervisor to discuss defects loaded in the 24 hours prior the meeting.
3. Production meeting: Daily meeting at 09:00 attended by the site manager to discuss urgent production matters and risks.
4. Lockdown meeting: Weekly meeting with Works Management to discuss the planned work for the coming week, attended by the supervisor.
5. Outage meeting: Daily meeting when a unit is on outage, attended by the site manager.
6. Short-term opportunity outages: Ad hoc meetings scheduled when a unit is off load, attended by the supervisor.
7. Contract management and KPI meeting: Monthly meeting with the contract manager.

3.6.6 Mill database

Maintaining the mill database is very important for effective mill maintenance planning. The contractor has to keep the database updated by sending the relevant information (ball and ring sizes) to Eskom.

When a mill service or rebuild is done, the contractor must inform the CID supervisor to reset the running hours of the mill.

3.6.7 Eskom Training requirements

The contractor has to send employees for the following Eskom training:

1. PSR – Responsible Person (RP): The contractor must send all artisans trained and authorised as RPs (including the supervisor) within 6 months of contract award.
2. FFFR – Competent person: All artisans have to attend FFFR training on site and be authorised as a competent person.

3.6.8 PPE specification

The contractor must supply all employees with the necessary PPE. All employees must be easily identifiable by their PPE; the overalls and hardhats must have the name of the company clearly embroided or printed on. The employees are not allowed to wear PPE with a different company's logo or name on.

The standard PPE includes: Overalls, gloves, safety shoes, hardhat, goggles, hearing protection, dust masks

The RPs must be issued with PPE to enter the switchgear room with arc flash protection rating of ATPV 8 cal/cm^2.

The overall material must be; Type D59, flame retardant finish complying with SANS 1423-1.

3.6.9 Equipment list

The equipment and tools required to execute the scope of work must be supplied by the contractor, including consumables (petrol, diesel, welding consumables etc.). The contractor is responsible for the maintenance, calibration and load testing of all equipment where applicable.

1. Office and communication equipment with planning package software (computers, printers, network etc.)
2. Alignment equipment for the mill and PA fan motors
3. Balancing equipment for the PA fans
4. Lead lights and extensions
5. Hydraulic power pack for jacking the mill yoke, rings, balls and spider
6. Hydraulic jacks to lift the mill yoke, rings, balls and spider (see 3.2.10 for the weight of the components)
7. Mobile winch for the installation of the raw coal pipe and square to round below the feeder.
8. Welding machines (contractor to determine quantity)
9. Hot boxes and oven for welding consumables
10. Grinders (contractor to determine quantity)
11. Cutting torches (contractor to determine quantity)
12. Pneumatic tools and piping (contractor to determine quantity)
13. Drilling machines
14. Tractor
15. Trailer – 8 ton
16. Forklift; Lifting capacity 5 tons, lifting height 5 meter, tooth length 2 meter
17. Chain blocks, shackles, slings and eyebolts

Tools and equipment to be in good working order. It is required that all electrical equipment, lifting equipment and any support trestles be listed on a Preventative Maintenance Schedule.

The following equipment does not have to be supplied by the contractor, Eskom will arrange the works:

1. Scaffolding and insulation material; Eskom will arrange all, insulation installation, scaffold erection, inspection, modification and dismantling
2. NDT equipment; Eskom will arrange all NDTs required on welding and PA fan impellers
3. 90 ton mobile crane; Eskom will supply the crane and driver for the rigging required for the works.

3.6.10 Tools and consumables

The contractor must supply all tools required for the execution of the works, including;

1. Fitter toolbox
2. Boilermaker tools
3. Welder tools
4. Drill bits
5. Screw thread cutting taps and dies inclusive of die nut sets
6. Special measuring tools; clock gauges, vernier callipers, micrometers, torque wrenches, torque multipliers, socket spanners
7. Gauges for measuring sizes and clearances (bearings, wear plates, labyrinth seals, classifier vanes, feeder profile)

3.6.11 Spares

The procurement and the holding of spares shall be the responsibility of Eskom (Kriel Power Station) for the duration of the contract.

The contractor must make sure all spares are available before planned work starts. Where spares are not available in Kriel Stores, the contract manager must be notified a week in advance.

3.6.12 Requirements and responsibilities of personnel on site

3.6.12.1 Site manager

Minimum qualification: N6 National Diploma OR Trade Test Certificate OR approved Red Seal Certificate (certified copy) as welder/ boilermaker/ fitter OR a higher technical qualification.

Minimum experience:

1. 5 years in a supervisor position
2. 3 years in a site manager position
3. 5 of the 8 years must be on milling plant

Responsibilities:

1. Managing human resources.
2. Ensuring that all machinery and equipment are maintained and available.
3. Implementation of plant safety programmes.
4. Maintaining staff authorisations on plant as per legislative requirements.
5. Enforcing Permit to Work System.
6. Managing section budget according to PFMA.
7. Manage section priorities and ensuring planning and scheduling is done.
8. Ensuring the contract scope of work is done.

3.6.12.2 Supervisor

Minimum qualification: N5 National Diploma or Trade Test Certificate or approved Red Seal Certificate (certified copy) as welder/ boilermaker or fitter.

Minimum experience:

1. 5 years' experience on milling plant maintenance
2. 3 years in a supervisor position

Responsibilities:

1. Supervising staff.
2. Verifying that information on notifications and work orders are correct.
3. Prioritisation of work.
4. Reporting progress accurately.
5. Allocating tasks to the workforce to attend to PM and CM work.

3.6.12.3 Quality Controller

Minimum qualification: Welding inspector level 1 @ SAIW

Minimum experience of at least one of the QCs on site:

1. Experience on mechanical fitting QC on milling plant, minimum 5 years.
2. SAIW Welding inspector qualification for 3 years.

Responsibilities:

1. First-line inspection (when the permit is issued) and reporting on the findings.
2. Drafting QCPs in line with the scope of work.
3. Reviewing welder qualifications.
4. Quality control inspections on all fitting and welding work.

3.6.12.4 Fitter

Minimum qualification: Qualified fitter, Trade Test Certificate or approved Red Seal Certificate

3.6.12.5 Boilermaker

Minimum qualification: Qualified boilermaker, Trade Test Certificate or approved Red Seal Certificate

3.6.12.6 Welder

Minimum qualification: Qualified welder, Trade Test Certificate or approved Red Seal Certificate

3.6.13 Key Performance Indicators

The KPIs will be discussed in the monthly contract management meeting.

Key Performance Indicator	**Objective**	**Measure**	**Weight**	**Source of evidence**
Mill UCLF	Maintaining low mill induced UCLF	1 Mill UCLF > 0.75% 2 Mill UCLF < 0.5% 3 Mill UCLF < 0.3% 4 Mill UCLF < 0.2% 5 Mill UCLF < 0.1%	50%	GPSS
Overdue mill services	Servicing mills on time	1 > 10 Mills overdue 2 > 5 Mills overdue 3 > 2 Mills overdue 4 > 0 Mills overdue 5 = 0 Mills overdue	10%	Mill database
Works Management indicators	Works Management compliance	PM compliance (10%) 1 ≥ 80% 2 ≥ 90% 3 ≥ 95% 4 ≥ 98% 5 = 100% Schedule compliance (10%) 1 ≥ 80% 2 ≥ 90% 3 ≥ 95% 4 ≥ 98% 5 = 100%	20%	Works Management
Safety	Preventing safety incidents	1 > 0.4 LTIR 2 > 0.3 LTIR 3 > 0.2 LTIR 4 > 0.1 LTIR 5 < 0 LTIR	20%	Safety report

3.6.14 Mill master task list - Mechanical maintenance

Sub-System	PMT	PMT task	Task description	Frequency	Department	Group name
Seal air fan	1054	105406	**Inspect**/replace fan bearings.	AR	MMD Mills	Mill service
Seal air fan	1054	105408	Thickness Testing Impeller and Ducting	4Y	MMD Mills	
Seal air fan	1054	105409	Non-Destructive Testing and Magnetic Partical Inspection	2Y	MMD Mills	Seal air fan inspection
Seal air fan	1054	105410	Coupling Inspection	2Y	MMD Mills	Seal air fan inspection
Seal air fan	1054	105411	Refurbishment	AR	MMD Mills	
Seal air fan	1054	AT105414	Grease fan bearings	3M	MMD Mills	
Mill	1085	108505	Major Repairs	AR	MMD Mills	
Mill	1085	108506	Ball Change	AR	MMD Mills	
Mill	1085	AT108560	Replace gearbox	AR	MMD Mills	
Mill	1085	AT108561	Replace labyrinth seal	AR	MMD Mills	
Mill	1085	AT108563	Mill Service	AR	MMD Mills	
Gearbox	1056	105604	Inspection	AR	MMD Mills	
Gearbox	1056	105605	Major Inspection	AR	MMD Mills	
U1-3 Mill motor coupling	1038	103803	Coupling Inspection	AR	MMD Mills	
U4-6 Mill motor coupling	1046	104603	Coupling Inspection and Lubrication	AR	MMD Mills	
U1-3 Gearbox lube oil coupling	1038	103803	Coupling Inspection	AR	MMD Mills	

Sub-System	PMT	PMT task	Task description	Frequency	Department	Group name
PA fan aux lube oil pump coupling	1037	103703	Coupling Inspection	2Y	MMD Mills	
Feeder	1151	AT116110	Refurbish feeder	AR	MMD Mills	
Feeder gearbox	1057	105703	Inspection	AR	MMD Mills	
Clean out conveyor gearbox	1057	105703	Inspection	AR	MMD Mills	
PA fan	1055	105502	Major Inspection and Rebuild	6Y	MMD Mills	
PA fan	1055	105503	Minor Inspection and Cleaning	2Y	MMD Mills	
PA fan	1055	105507	NDT	2Y	MMD Mills	
PA fan coupling	1046	104603	Coupling Inspection and Lubrication	2Y	MMD Mills	
Distribution box damper	1210	121003	Damper actuator inspection	6M	MMD Mills	
Distribution box damper	1210	121006	System Testing - Functional Tests	AR	MMD Mills	
Mill sump pump	1023	102305	Inspection	2Y	MMD Mills	
Mill sump pump	1023	102306	Major Inspection and/or Refurbishment	AR	MMD Mills	
Mill sump pump	1023	102307	Functional Testing	AR	MMD Mills	
Ball loading system pressure regulating valve	1119	111901	**Set Point Verification** / Clean / Lubricate	AR	MMD Mills	
Ball loading system pressure regulating valve	1119	111904	Functional Testing	AR	MMD Mills	
Ball loading system PRV	1017	101701	Set Point Verification / Clean / Lubricate	AR	MMD Mills	
Ball loading system PRV	1017	101704	Functional Testing	AR	MMD Mills	

4. Acceptance

This document has been seen and accepted by:

Name	Designation
Phelelani Khumalo	Boiler maintenance manager
Zama Mkondweni	Senior advisor boiler maintenance

5. Revisions

Date	Rev.	Compiler	Remarks
September 2021	0	FW le Roux	The document is compiled to start of the procurement process.
February 2022	1	FW le Roux	Comments from the maintenance manager included.

6. Development Team

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

- Frik le Roux
- Phelelani Khumalo

7. Acknowledgements

Appendix A – Contract price list schedule

KRIEL POWER STATION

TASK DESCRIPTION: Kriel Mill Maintenance

LABOUR RATE SCHEDULE

	Support	Fitting	Welding	QC	Normal Hrs	Overtime Hrs	Total Hrs	Rate	Cost	Monthly Cost
Site Establishment								R 1,00	R 1,00	
Site De-Establishment								R 1,00	R 1,00	
Site Manager	1				11200	0	11200,00	R 1,00	R 11 200,00	R 186,67
Quality Control / Assurance Co-Ordinator	1				11200	0	11200,00	R 1,00	R 11 200,00	R 186,67
Trade Supervisor Repair		1			11200	3360	14560,00	R 1,00	R 14 560,00	R 242,67
Planner	1				11200	3360	14560,00	R 1,00	R 14 560,00	R 242,67
Safety Officer	1				11200	3360	14560,00	R 1,00	R 14 560,00	R 242,67
Quality Officer				2	22400	6720	29120,00	R 1,00	R 29 120,00	R 485,33
Fitter		6			67200	20160	87360,00	R 1,00	R 87 360,00	R 1 456,00
Rigger		1			11200	3360	14560,00	R 1,00	R 14 560,00	R 242,67
Boilermaker			1		11200	3360	14560,00	R 1,00	R 14 560,00	R 242,67
Welder			1		11200	3360	14560,00	R 1,00	R 14 560,00	R 242,67
Storeman	1				11200	3360	14560,00	R 1,00	R 14 560,00	R 242,67
Semi-skilled		6			67200	20160	87360,00	R 1,00	R 87 360,00	R 1 456,00
Manpower Sub Total	**5**	**14**	**2**	**2**	257600		328160		R 328 162,00	R 5 469,37
Manpower Total	**23**									
Transport cost								R 1,00	R 33 600,00	R 560,00
Consumables as required avarage R/ph worked								R 1,00	R 328 160,00	R 5 469,33
Equipment as required avarage R/ph worked								R 1,00	R 328 160,00	R 5 469,33
others (e.g. overtime food/extra transport)								R 1,00	R 328 160,00	R 5 469,33
Safety								R 1,00	R 328 160,00	R 5 469,33
Total									R 1 674 402,00	R 27 906,70