Eskom	Scope of work	Matimba Power Station

Title: **Refurbishment and Repairs of LV Motors for Matimba Power Station**

Document Identifier:	**N/A**
Alternative Reference Number:	**N/A**
Area of Applicability:	**Matimba Power Station**
Functional Area Applicability:	**Maintenance**
Revision:	**1**
Total Pages:	**17**
Next Review Date:	**2030**
Disclosure Classification:	**Controlled Disclosure**

Compiled by:	Recommended by:	Supported by:	Authorized by
G Sehlako	**AW Besseling**	**B Lesejane**	**Elton Lemboe**
Senior Supervisor Maintenance	**Electrical Manager Maintenance**	**System Engineer Engineering**	**Middle Manager Maintenance**
Date:2025/03/25	Date: 2025/3/25	Date: 2025-03-26	Date: 2025-04-08

Contents

1. Introduction

1.1 Matimba Power Station.

Matimba Power Station is in Lephalale, in South Africa's Limpopo Province. Designed to generate 4000 MW, Matimba - the Tsonga word for "Power" – was once the largest direct dry-cooled Power Station in the world, with six 665MW turbo-generator units. Coal reserved guarantees Matimba a minimum lifespan of 35 years, extending to a possible 50 years at 2100 - 2130 tons of coal per hour. The annual send-out power from Matimba amounts to approximately 24,000GWh. Matimba is the holder of the world record of 80 days for six units on load.

Technical details:

- Six 665 MW units
- Installed capacity: 3 990MW
- 2001 capacity: 3 690 MW
- Design efficiency at rated turbine MCR (%): 35.60%
- Ramp rate: 28.57% per hour
- Average availability over last 3 years: 93.67%
- Average production over last 3 years: 23 789GWh

2. Supporting clauses

2.1 Scope

2.1.1 Purpose

The purpose of this scope is to define Refurbishment and repairs of LV motors requirements for Matimba Power Station. It is imperative that each supplier aligns their organisation fully to the systems and requirements laid down in this document.

2.1.2 Applicability

This scope is applicable to LV motors associated with Matimba Power Station.

Normative/Informative References

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

2.1.3 Normative

- Occupational Health and Safety Act, 85 of 1993.
- ISO 9001:2008: Quality management systems.
- SANS IEC 60034-1 to 30: Rotating electrical machines.
- SANS IEC 60085: Electrical insulation- Thermal classification.
- ISO 10816: Vibration severity standard.
- Eskom 240-89217674: Refurbishment and repair of power station electrical motors Work instruction.
- Eskom 240-56361435: Transport of Power Station Electric Motors Standard.
- Eskom 240-56360387: Storage of Power Station Electric Motors Standard.
- Eskom 240-95138097: Standard Electric Motor Test Certificate.

2.1.4 Informative

ISO 1940-1:2003: Mechanical vibration- Balance quality requirements for rotors in a constant (rigid) state- part 1: Specification and verification of balance tolerance.

2.2 Definitions

Definitions	**Explanations**
Medium Voltage	Any AC voltage exceeding a 1000V
Outage	A planned or unplanned shutdown project related to one or more of the *Employer's* Power Station units
Induction Motor	Electric motor in which the electric current in the rotor needed to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding
Contractor	Service provider contracted for supply specific service to Eskom Matimba power station.
Employer	Eskom or Eskom Matimba power station representative appointed in writing.

2.3 Abbreviations

Abbreviations	**Explanation**
AC	Alternating Current
KPA	Key performance area
KPI	Key performance indicators
DC	Direct Current

DE	Drive End
IBI	Integrated Business Improvement Model
MV	Medium Voltage
MM	Material Management
NDE	Non- drive end
SOS/SOW	Scope of service/ Scope of work
OEM	Original Equipment Manufacture
PPE	Personal protective equipment
QC	Quality control

2.4 Roles and Responsibilities

- N/A

2.5 Process for Monitoring

2.5.1 Technical KPIs

Item	KPI	Targets
1	Breakdown or emergency reaction time	Within 12 hours
2	Delivery on emergency work (Overhaul)	24/7
3	Delivery on emergency work (Rewind)	24/7
4	Normal turnaround time for refurbishment and repair	10 days

2.5.2 SHEQ KPIs

Item	KPI	Targets
1	SHEQ Performance Report	>95%

3. Site Visit

1. Clarification meeting and site visit is compulsory for all contractors.
2. Procurement officer to form part of the site visit team.
3. Invited contractors to bring own PPE during site visits.
4. All official communication will be in the form of writing.
5. A register will be signed by all in attendance and kept as record.

4. Document Content

4.1.1 Scope of Work

KW	Pole	STRIP & ASSESS	REWIND	BRAKE	OVERHAUL	TOTAL
0.18	2			N/A		
	4			N/A		
	6			N/A		
0.25	2			N/A		
	4			N/A		
	6			N/A		
0.37	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
0.55	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
0.75	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
1.1	2			BRAKE		
	4			BRAKE		
	6			BRAKE		
	8			BRAKE		
1.5	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
2.2	2			N/A		

	4			N/A		
	6			N/A		
	8			N/A		
3	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
4	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
5.5	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
7.5	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
7.5	2			BRAKE		
	4			BRAKE		
	6			BRAKE		
	8			BRAKE		
10/15	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
11	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		

15	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
18.5	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
22	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
22/14	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
25	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
30	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
37	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
45	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		

55	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
75	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
75/9.4	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
90	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
110	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
132	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
160	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
	2			N/A		

185	4			N/A		
	6			N/A		
	8			N/A		
200	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
250	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
270	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
275	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
280	2			N/A		
	4			N/A		
	6			N/A		
	8			N/A		
FLYGHT PUMPS				**N/A**		
	2.4 KW			**N/A**		
	3.1 KW			**N/A**		
	7.5 KW			**N/A**		
	18.5 KW			**N/A**		
	15KW			**N/A**		
	30 KW			**N/A**		

DC MOTORS				**N/A**		
	5.9 KW			**N/A**		
	6 KW			**N/A**		
	11.5 KW			**N/A**		
	25 KW			**N/A**		

5. Requirements on repairing all LV motors including DC motors

Appropriate specifications, procedures and work instructions are used. In the absence of the manufacture's specifications, or Eskom specifications, IEC 60034 shall be used, as appropriate for the class of the motor. Whether using Eskom specifications, national or international specifications, instructions for the testing to be done on each motor are required.

- No spare parts to be swapped between the motors.
- No original nameplate or other nameplate to be removed or damaged.
- Motor end leads to be clearly marked A1, B1, and C1.
- QCP / Test sheet to be supplied for each motor.
- Copper Delta pieces to be installed on 270/280 kw motor when required (Size 32 Width X 3mm Thick.
- Only flat brass nuts to be used on motor studs. +/- 6mmThick not thicker
- Vibrations to be done on each motor and Report to be submitted.
- Only Viton Double Lip Seals are preferred.
- Eccentricity checks to be done on each repaired motor (See attached sheet)
- Thermistors to use pin lugs.
- Gaskets between motor stator and Terminal Box must be cork packing only 3mm.
- Gaskets between motor terminal cover must be cork packing only 3mm.
- Fan Cowls to be painted signal red.
- Motors to be painted Plascon light Grey Only (Eskom G29)
- Grease ports to be open and No silicon to be used.
- Data base of all LV Motors to be kept for period of contract.
- All bolts to have one 1 x flat and 1 x spring washer
- Care must be taken of Type One and Type Two cable entries and NOT TO BE CHANGED.
- Only Almaplex 1275 grease to be used in all motors.
- Motor shafts for 270/275 and 280kw must be locked.
- Motor shaft to be painted with anti-rust material.
- All LV motors including DC motors must be fitted with a nameplate indicating Serial No: and Type Number as per customer specifications (Letters must be engraved 10mm High x 1.5mm (Aluminium).

- Eskom reserves the right to inspect the motors or associated parts at any stage of maintenance, and to witness routine and performance tests (IT2 or IT3). Procedure 65-A **001
- All motors are to be tested by the Contractor prior to delivery, and test results are approved by the Employer.
- Test certificates are required for all tests performed.
- Routine tests are performed on all repaired motors.
- Special tests are performed when specified by the Employer.
- All the motors are to be cleaned properly. Shot blasting is preferred. (No sandblasting or chemical are to be used)
- Removal of the windings is to be carried out strictly in accordance with SABS? Specifications.
- Method of varnishing to be double dipped and baked, unless otherwise called for.
- Paint work to be done as per SABS 064 for the type of paint and the method of application.
- After painting of the motors is completed, the shafts should be treated for rust prevention. [Shaft journals are to be micro welded or new shafts are to be provided, according to SABS 0242] Metal spraying of shafts is not accepted.
- Two sets of Thermistors [i.e. 2 per phase = 6] are to be installed on all motors at all times where Thermistors were originally provided, and one set of Thermistors are to be installed on all actuator motors.
- Terminal leads must be clearly marked and of a reasonable length to enable joints to be carried out, particularly actuators.
- Only OEM cooling fans must be used unless otherwise specified.
- Original motor seals to be used. Or otherwise specified by employer.
- All motor Frame sizes must be checked and be 100%. Proof of that must be incorporated in the Test Sheet of each motor and must be signed by a Qualified person stating that it have been checked.
- No name plate what so ever maybe removed at all. If no name plate, new one must be fitted and the Serial No: must be 100% correct. Incorrect Serial number will result in an NCR (Non-Conformance Report) to be issued to the supplier.
- Bearings shall be of a make as approved in the Eskom directive PA/172001. FAG, INA, Koyo, NSK, NTN, SKF, RHP and Timken bearings have been evaluated and approved. No other make of bearing shall be used unless approved by a Matimba system engineer*, Refer to NWS 1551.
- C3 clearance bearings are required both on drive and non-drive end.
- Bearings supplied by Eskom shall be in accordance with the list of approved bearings before acceptance.
- The bearings must be fitted in area free of dust and/or workshop related particles and debris that may contaminate the bearing or bearing lubricant. Cleanliness is of the utmost importance when fitting the bearings and all reasonable precautions taken to ensure that bearings are fitted in a clean & tidy environment.
- New bearings should be washed with suitable cleaner and dried properly before packing with grease. The anti-rust agent in new bearings is usually not compatible with the synthetic grease required for this motors.
- New bearings must be fitted by heating the bearings. (85□ C - 100□ C). If an induction heater is used, the bearings shall be demagnetized before fitting. A guide sleeve must be used on the shaft to guide the drive end roller bearing onto the inner race

- Bearings must be well packed with grease to ensure the rolling elements are fully and completely covered with grease. An Adequate empty space must remain in the bearing covers (about 50%) to allow for expansion of the grease.
- If an end shield has been machined the acceptance criteria for axial shaft to the flange face perpendicular squareness shall be ≤ 160 micron, or 0.16 mm. For the radial check the shaft to spigot shoulder should not be eccentric more than 0.3 mm.
- Whenever in doubt as to if re-working of any component is needed, contact the System Engineer at Matimba.
- Rotor shafts that have to be re-worked because the bearing has seized and/or overheated shall be tested for cracks before reworking of the shaft. Magnetic particle test is preferred.
- A test certificate must be submitted indicating the testing authority, method of testing and the test results. .
- When not already machined, grease escape ports must be machined on the bearing covers at the areas provided for this. The ports must be machined a depth flush with the grease cover backplate.
- If re-sleeving or any other work was carried out on the end-covers, ensure that the grease ports are drilled through the sleeves to lubricate the bearings.
- If not installed, grease pipes must be fitted. If the threaded ports are blocked with silicon or other material, it must be opened and the pipes fitted to allow for greasing of the bearings.
- Grease pipes must be manufactured as per sample. Samples are obtainable from Matimba power station. If not supplier to arrange,
- The joint between the grease escape channel on the DE bearing cover and the grease escape channel on the end shield sometimes have an excessive joint clearance. The joint must be sealed with heat resistant (100°C) silicon sealant where the two channels join. This is to prevent oil fumes and droplets to enter the bearing cover and contaminate the synthetic grease.
- External cooling fans must be inspected for cracks, looseness on the shaft or any other defects that may lead to failure of the fan. Replace fans if there is a strong possibility of failure.
- Fans that are deemed unfit for further use shall be returned to Matimba together with the repaired motor.
- The internal cooling fans should be inspected for looseness around the shaft or other defects. Aluminium shavings are usually a sign of a loose fan.
- Internal cooling fans must be fitted with grub screws to tighten the fans to the shaft
- Fans that are scrapped must be returned to Matimba power station.
- Motor drive end oil seals shall be viton seals able to withstand high temperatures
- Double lip seals are preferred. If double lip seals are not immediately available, single lip seals may be used. Matimba however prefer the use of double lip seals.
- Rotors must be balanced with all rotating parts fitted to the rotor shaft and certificate to be issued with each.
- These parts shall be mated with the rotor with some identification to ensure that the parts remain mated on final assembly. Typical mating parts will be the rotor, shaft, and cooling fans and pin coupling.
- Vibration measurement of the running motor shall be taken before the motor being dispatched to Matimba. Load the drive end bearing to at least 100 kg whenever the motor is run for the duration of the test. (Rotor mass is ± 500 kg)
- Equipment used in the vibration measurement shall be suitable to measure the bearing ball/roller pass frequency and important harmonics. The results of the vibration measurement shall accompany the motor to Matimba.

- Damage to the drive-end bearing is possible if it is run without load for extended periods in the vertical position. The rolling elements may slip during running tests in the vertical position. The motor should preferably be run in the horizontal position or at a 45 degree slant to load the bearing
- Motor external be painted with (Plascon Light Grey Eskom G29) and fan covers with signal red enamel paint. Fans not to be painted to facilitate inspection for cracks.
- The rotors of refurbished motors that are transported to Matimba must be locked to prevent damage to the bearings. A suitable device must be used to lock the rotor without removing the coupling from the shaft.
- When a motor arrives at the supplier with bearings that are in a serviceable condition, actions will be as follows:
  - The run-out of the flange face (perpendicular to the shaft), and the radial spigot (concentric to the shaft), will be measured.
  - The measured values will be forwarded to Matimba for notice and directive. For example, a 1.3mm difference on the flange face will be repaired, and a 0,17mm – 0.3mm difference will be referred for directive, whether to repair or not.
- When a motor arrives at the supplier's w/shop with bearings which are damaged, actions will be as follows:
  - The damage of the bearings would mean that no readings could be taken of the run-outs before hand.
  - The bearing housing and shaft journals would thus be repaired, and the motor would be submitted to the complete measurement (and if required), further repair process.
  - Measurement process, to which a motor would be submitted:
  - When it is required for the motor to undergo concentricity checks or corrective machining (as listed in 3.2 and 4.2), the measurement process will be followed as listed below:
  - Firstly, the concentricity and parallel of the stator core will be checked (Co-ordinates A & B).
  - Then the concentricity of spigots C & D, will be checked to A & B, as well as the perpendicularity of E & F.
  - Thirdly, the concentricity of the bearing housings (G & H), with regard to A & B will be checked.
  - Lastly, the concentricity of spigot J, and the perpendicularity of I will be checked against A & B.
  - Any corrective machining necessarily have to be approved by Eskom Matimba Power Station.

5.1.1 Deficiencies and modifications

No modifications shall be done on the motor without the approval of the employer.

5.1.2 Turnaround time

The maximum turnaround time per motor for assessment shall be three (3) working days. The repair work will depend on the scope of work, which shall be agreed beforehand between Eskom and the supplier, and the scope must indicate timelines per task. When necessary, the employer may request, by telephone or email.

5.1.3 Painting

At least one primer coat and two finish coats of compatible outdoor paint shall be applied in accordance with the paint manufacturer's instructions. Two-part epoxy-type paint is required because of its toughness and durability. (Examples: DuPont's Variprime 615S and 616S). Unless otherwise specified on the Refurbishment form and check sheet, the finish colour shall be emerald grey (G29) on external metal. Coatings: coatings shall be applied in accordance with the manufacture's procedures. Details of coating requirements can be obtained from purchaser's technical contact, if there are not clearly defined on the check sheet.

5.1.4 Record keeping

The supplier will keep originals of the test results, quality and any other documents used on the motor for the period of the contract plus three (3) years.

The Employer shall be given the copy of the tests results.

5.1.5 Data pack

The motor shall be returned to site only if it's accompanied with a data pack comprising as a minimum on the following:

- Failure analysis report.
- Results of the tests specified on the scope of work.

5.1.6 Warranty

Any refurbished motor shall have a 1-year warranty granted by the supplier to the Employer.

5.1.7 Transport

The supplier is responsible and accountable for transporting the motors from Matimba Power Station to their sites and from their sites to Matimba Power Station. All motors shall be transported as per Eskom 240-56361435: Transportation of power station electric motors standard.

5.1.8 Quality

The supplier provides a complete Quality Control Plan in accordance with the requirements of ISO 9001:2008 to the Employer for approval. This plan must ensure an integrated quality service as part of the contract. All quality hold point, and witness point must be done in the presence of an Eskom employee. Quality documents to be handed over to the Employer. The final motor test at the factory test bay must be done with the employer's representative present.

5.1.9 Adherence to Eskom generic policies

The supplier employees shall comply with Eskom's policies and site regulations, including but not limited to, use of cell phones in restricted areas, adherence to Eskom's lifesaving rules, smoking policy, zero tolerance on alcohol usage etc. These requirements will be detailed during the induction training process.

5.1.10 Quality control standards:

Quality control plan shall be produced, maintained and implemented per task as agreed by the employer. The QCP must be discussed with the employer for approval. This QCP shall comply with ISO 9001:2008 standards. Any amendments to the QCP shall be discussed with the employer for approval.

5.1.11 Special tests and investigations

The supplier will perform special tests, investigations and recordings of all findings. The findings shall be shared with the Employer.

5.1.12 Insurance

All motors insurance shall be covered by the supplier as from the time they leave Employer's site until delivered back on the Employer's site.

5.1.13 Quotations

All quotations shall be given in South African Rands (ZAR).

5.1.14 Industrial Relation

Any industrial relations issues from the supplier should be discussed with the contract manager.

5.1.15 Program

A detailed program should be drafted in the form of bar chart or any software that will specify the plan and progress of repairs and be submitted to the contract manager together with the quotation. Contract manager and System Engineer must have opportunity to influence the bar chart for holding points. Employer can send any personnel to witness holding points and if it happens that the witness cannot be done, the supplier will only proceed after approval from the Employer.

5.1.16 Deviations

Non-compliance from the agreement will result in NCR being issued to the supplier and when the third NCR is issued, the supplier will be referred to the supplier reconciliation committee.

6. Acceptance

This document has been seen and accepted by:

Name & Surname	Designation
Gwadamani Sehlako	Senior Supervisor
Elton Lemboe	Middle Manager Maintenance
Adriaan Besseling	Electrical Maintenance Manager
Hendrik van Zyl	Senior Supervisor
Boleo Lesejane	System Engineer
Louisa Bamuza	Manager Elec Heavy Current
Frans Mokobodi	Senior Supervisor
Aaron Mabasa	Senior Supervisor
Silus Tisane	Senior Technician
Solley Rankapole	Senior Technician

7. Revisions

Date	Rev.	Compiler	Remarks

March 2025	1	G Sehlako	To act as an instruction to service provider for the refurbishment of LV Motors.

8. Development Team

Gwadamani Sehlako

9. Acknowledgements

N/A