

	Report	Hendrina Power Station
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Title: **Refurbishment & Repair of MV
Motors Scope of Work**

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1. Introduction

Hendrina Power Station is in the process of setting up repair and refurbishment contract for MV motors. The contract will be for “as and when” required basis for a period of 5 years and managed by Hendrina Power Station Materials Management Department. The scope of work is required to document all the activities that will be required during the repair and refurbishment of the motors by the service provider.

2. Supporting Clauses

2.1 Scope

This scope of work covers the requirements for the stripping and assessment, redesign of weak features, general updating of design in accordance with modern design practise, rewinding, repair, impregnation, inspection, testing and certification of repaired MV motors.

2.1.1 Purpose

The document provides appropriate steps that needs to be taken when MV motors have to undergo repairs and refurbishment. It provides details that are required for an effective development of repair contract such as motor breakdown report, contractual requirements, failure analysis, technical details of repairs to be carried out, documentation of work performed, and quality control and assurance requirements.

Its objective is to provided assurance that while Eskom procurement procedures have to be adhered to when sourcing the repair and refurbishment services, adequate failure investigations are conducted to gain more complete understanding of why the motor failed, and Repairer provide high quality, reliable electric motor repair. It includes steps that must be taken and details that must be captured and provided from the instant a motor repair and/ or refurbishment need is identified to the delivery of a repaired and/ or refurbished motor back to Hendrina Power Station.

2.1.2 Integrated Business Improvement objectives

Management, assurance, and independent oversight control to ensure that the procurement process is adequately followed and that all the documentations are traceable and auditable.

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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] 240-48929482: Tender Technical Evaluation Procedure
- [2] [2] MV Motor Repair/Refurbishment Technical Schedule
- [3] [3] 240-89217674: Refurbishment and Repair of Power Station Motors Works Instructions

2.2.2 Informative

- [4] None

2.3 Definitions

None

2.4 Abbreviations

Abbreviation	Explanation
DC	Direct Current
DE	Drive End
EMD	Electrical Maintenance Department
Ex	Explosion Proof
MV	Medium Voltage
NDE	Non Drive End
PR	Purchase Request
QCP	Quality Control Plan
RPM	Revolution Per Minute
VPI	Vacuum Pressure Impregnation

2.5 Roles and Responsibilities

System Engineer – responsible for compiling the strip & assessment scope of work and also the repair scope of work.

Maintenance (EMD) – responsible for completing the initial failure report and return the failed motor to stores.

Stores (RF Controller) – responsible for creating PRs for strip & assessment as well as repairs and to ensure that there is minimum motor stock level.

2.6 Process for Monitoring

Each MV motor that undergoes repair and/ or refurbishment shall generate the following.

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- Motor breakdown report
- Protection operating report
- Assessment sheet received from the Repairer.
- The final repair scope of work, including cost thereof.
- All tests and check reports received from the Repairer.
- Replacement recommendations where applicable

2.7 Related/Supporting Documents

The following document(s) contain(s) provisions that, through reference in the text, constitute requirements of this document. At the time of publication, the edition(s) indicated were (was) valid.

These documents are subject to revision and users are responsible to ensure that the most recent edition(s) of the document(s) listed below are used / referenced.

[1] Eskom Std 240-56361435 Transport of Power Station Electric Motors.

[2] Eskom Std 24-56360387 Storage of Power Station Electric Motors.

[3] Eskom 240-89217674 Refurbishment and Repair of Power Station Electric Motors Work Instruction

3. Scope of Work

The scope of the contract covers for the refurbishment and repairs of MV electrical motors for Hendrina Power Station. The process, procedure, technical, quality requirements for the refurbishment and repair of the MV motor for Hendrina Power Station are detailed in the Eskom document 240-89217674 that is shared with the potential service providers during the commercial process.

1. General
1.1 Lock rotor before transport to repairer workshop and before transport to Hendrina Power Station Stores.
1.2 Collect motor from Hendrina Power Station and deliver motor to Hendrina Power Station
1.3 Open motor and conduct detail failure analysis and inspection

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1.4 Assemble the motor, replace all bolts, nuts and washers
1.5 Paint the motor complete (Emerald Gray – G29)
1.6 Eskom to witness assembly on sleeve bearing motors and final run
1.7 Do not remove any original nameplate or numbers from motor
3. Stator core and windings
<p>3.1 Flux test stator cores (Core loss test) prior to stator winding removal. Flux test stator core at full load rated flux. Hotspot temperature may not be higher than 5°C of the average core temperature.</p> <p>Note: Certificate to ESKOM Hendrina Power Station</p>
<p>3.2 Remove all the windings.</p> <p>Record of temperature in center of stator core during bake out to customer. Bake out temperature may not exceed 380°C. No open flame or torch may be used to remove windings. Flames may not be allowed to sustain in the stator core center. These restrictions are for the protection of the Stator Core lamination insulation.</p>
<p>3.3 Flux test stator cores (Core loss test) after stator winding removal. Flux test stator core at full load rated flux. Hotspot temperature may not be higher than 5°C of the average core temperature.</p> <p>Note: Certificate to ESKOM Hendrina Power Station</p>
3.4 Manufacture new windings according to insulation rating and current capacity, use original design, unless if it can be improved with better materials. Supply certificate to customer to inform of all deviations of design.
3.5 Fit new windings in same configuration as previous design.
3.6 Fit new winding temperature detectors in the same positions as previously.
3.7 Perform interterm impulse test on each coil after fitting before connecting. Certificate to customer
3.8 Winding resistance test. All 3 phases must be balanced within 1%. Certificate to customer
3.9 Winding impedance test. All 3 phases must be balanced within 1%. Certificate to customer

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4. Wedges and VPI
4.1 Number all the stator wedges
4.2 Set the wedge check sheet
4.3 Test each wedge to determine if it is loose or faulty and mark it off on the wedge check sheet.
4.4 Replace the loose or faulty wedge with a new epoxy resin wedge
4.5 VPI stator and cure in oven.
5. Coolers
5.1 Pressure test coolers before stripping.
5.2 Remove and clean cooler.
5.3 Repair all leaks.
5.4 Replace all rubbers and gaskets.
5.5 Pressure tests the cooler again after repairs. Certificate to customer to inform of results of final pressure testing.
6. Rotor
6.1 Clean, treat and paint the rotor with anti-rust paint.
6.2 Test for broken rotor bars or high resistance connections to end-rings.
6.3 Repair rotor laminations and broken rotor bars or high resistance joints.
6.4 Fit motor-side halves of coupling and supply fan-side halve of coupling.
6.5 Balance rotors at running speed with a half-key fitted and mark the magnetic center.
7. Space heaters
7.1 Replace the space heater wiring with suitable heat resistance wiring. Space heater power rating according to original design.
7.2 Test the space heater operation.
8. End rings and connection boxes
8.1 Ensure that contact ends in both terminal box and star point box are sufficiently long to serve as terminals or star points on either side.
8.2 Ensure that the end ring insulation is intact at all points and that there are no weak spots in the insulation.

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8.3 Winding insulation resistance and polarization index test using:

- For 6.6 kV motors: 5.0 kV Mega-Ohm meter

If insulation resistance exceeds 3.0 Giga-Ohms PI reading must be higher than 1.5 otherwise PI reading must be higher than 2. Insulation resistance of lower than 1.0 Giga-Ohms is unacceptable. If PI test results do not comply then correct by dry-out as described below. Certificate of final PI test to customer.

8.4 AC High voltage test on each separate phase at the following voltages:

- For 6.6 kV motors: 10 kV, Alternative DC test at 15 kV

Other phases earthed. Certificate to customer.

8.5 Stator voltage surge test on rewind motor. Certificate to customer.

8.6 Tan-delta test on each phase. Certificate to customer.

9. Bearings and seals

9.1 Replace labyrinth seals.

9.2 Replace roller bearing

9.3 Replace ball bearing

9.4 Polish and/ or remetal sleeve bearing

9.5 Supply and replace sleeve bearings.

9.6 Onsite repair of sleeve bearing

9.7 Repair bearing insulation facility.

9.8 Replace inner DE and NDE seals and insulation.

9.9 Repair bearing grease slinger

10. Assembly

10.1 Assemble all parts.

10.2 Fit new desiccators on the terminal box.

11. Test

11.1 Elcid test on the stator

11.2 Elcid test on the rotor

11.3 Rotor bar to bar

11.4 IR and PI

11.5 Stator winding tan delta

11.6 NDT on the fan impeller or runner

11.7 NDT on the rotor shaft

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11.8 AC high potential test
11.9 DC step voltage
11.10 Core flux test
11.11 DC high potential

4. Annexures

Bill of Quantity

Technical Schedule A&B

5. Acknowledgements

None

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