Eskom	Specification	Technology

Title: **Duvha Power Station Unit 5 and 6 Seal Air Fan Concrete Repairs**

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1. INTRODUCTION

Duvha Power Station Seal Air Fans are experiencing high vibrations during operations, which causes damages to the equipment. Condition monitoring has issued several vibration reports; according to the reports one of the findings that are contributing to the high vibrations and alignment challenges is the structural looseness that has been picked up during monitoring of the equipment. It is evident in the plant that the equipment is mounted on uneven surfaces and currently balanced with shims. Over a period of time when the equipment is in service high vibrations are picked up due to the shims becoming loose and the equipment are misaligned and end up getting damaged. An inspection was conducted by Civil Engineering and minor cracks were observed on the main concrete plinth for the motor and damages on the grout finish layer that is varying from 25mm to +/- 60mm thick from different fan sets. The grouting layer has been damaged by both operational and mechanical damages. It is recommended that the concrete bases are repaired, and the equipment is restored without the use of shims to ensure a reliable and stable operation for the seal air fans.

2. SUPPORTING CLAUSES

2.1 SCOPE

This document covers the technical specification for the scope of the works. The scope covers removal of fan casing and motor, partly demolition of concrete, inspect and replace current motor mounting plate, repair of concrete, repair of grout and ensure correct alignment is achieved.

2.1.1 Purpose

The purpose of this document is to provide technical specification for concrete repairs for unit 5 and 6 Seal air fans

2.1.2 Applicability

This document applies to Duvha Power Station only.

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] 474-58 (Rev1): Document and Records Management

[3] SANS 2001 CC2 Construction works: Part CC2: Concrete works (minor works)

These documents are indispensable for the application of this document, i.e. documents to be used together with this document.

2.2.2 Informative

[4] Occupational Health and Safety Act No. 85 of 1993,

[5] 32-727 - Eskom Safety, Health, Environment and Quality (SHEQ) Policy

2.3 DEFINITIONS

2.3.1 Disclosure Classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 ABBREVIATIONS

Abbreviation	Description
ISO	International Organisation of Standards
SANS	South African National Standards
SHEQ	Safety, Health, Environmental & Quality
SE	System Engineer
QA	Quality Assurance
QC	Quality Control
QCP	Quality Control Plan

2.5 ROLES AND RESPONSIBILITIES

2.5.1 Employer

Safety, Health and Environmental

The Employer shall ensure the following:

- The Contractor is in good standing with the compensation fund, or any licensed compensation insurer as contemplated in the compensation for occupational injuries and diseases act, before work commencing work on site.
- A Health and Safety specification or plan is in place/available, implemented and maintained. The Employer shall also ensure that a copy of the Principal Contractor's health and safety plan is available on request to an Employee, Inspector or Contractor. Non-compliances will result in work stoppages.
- Audit periods are mutually agreed between the Client and Principal Contractor.
- Adequate provision is made for the cost of implementation of all health and safety measures.
- The Contractor is notified promptly of situations which may affect the health and safety of any person carrying out works on site.
- Sufficient health and safety information as well as resources are made available to the Principal Contractor, where changes are brought about.
- Persons appointed by the Employer may at any stage during the term of the contract:
    - Conduct health and safety audits to establish the effectiveness of the Contractor’s health and safety management systems.

- Refuse employees or agents of the Contractor access to the Power Station Site if such persons commit unsafe acts or unsafe working practice or is found not competent or authorised.
- Stop works should there be unsafe working practices and procedures.

General
The Employer shall ensure the following:

- The work is performed in accordance with the specifications prescribed herein the document.
- The desired quality of work is achieved, by ensuring all prescribed tests and inspections required are done in accordance with specified standards and specifications.
- Employees of the Contractor have the necessary competencies and resources to carry out works.
- The work is carried out by appropriately by competent person(s)

2.5.2 Appointed Contractor

Safety, Health and Environmental
The Principal Contractor shall ensure the following:

- Compliance with all requirements of the Occupational Health and Safety Act no 85 of 1993 and its regulations and all other relevant health and safety legislation to ensure the health and safety of persons carrying out works. This shall also be applicable to sub-contractors.
- A health and safety plan, based on the employer's health and safety specification is provided to the employer. This shall be applied from the date of commencement and duration of works. Contents of the health and safety plan shall also be discussed and negotiated with sub-Contractors. The health and safety plan shall be implemented and maintained on site.
- Compliance with Eskom's SHE policy, procedures, standards, guidelines, specifications, and site regulations.
- All employees undergo safety induction training on-site.
- All employees or agents, visitors of the Contractor are medically, physical, and psychologically fit to enter the Power Station and carry out works. Employees shall also have a valid medical certificate of fitness specific to the work to be performed.
- Sub-Contractor(s) is in good standing with the compensation fund or any licensed compensation insurer as contemplated in the compensation for occupational injuries and diseases act, before work commencing work on site.
- Safeguard all employees by maintaining a safe and hygiene working environment and culture.
- A safety profile is kept for tracking and auditing purposes.
- All safety and health related incidents around site or working areas and threats that pose a danger to one's life or health are immediately reported.
- Sufficient health and safety information as well as resources are made available to the Contractor, where changes are brought about.
- The Contractor shall also ensure that ergonomic related hazards are evaluated and addressed in the risk assessment.

- The Contractor's employees and/or sub-Contractors are notified promptly of situations which may affect the health and safety of any person carrying out works on site
- The Contractor shall wear the full PPE as displayed at different plant areas. The provision of the PPE to the Contractors' Employees is the responsibility of the Contractor.
- Employees/agents are supervised. Full responsibility and accountability shall be taken to ensure that all employees are competent and aware of all requirements needed to execute works safely.
- Perform quality control and risk assessments on all on-site inspection activities or works. These shall be performed by a competent person appointed in writing. The risk assessment shall form part of the health and safety plan to be applied on the site and shall include at least:
    - The identification of the risks and hazards to which persons may be exposed to.
    - The analysis and evaluation of the risks and hazards identified.
    - A documented plan of safe work procedures to mitigate, reduce or control the risks and hazards that have been identified;
    - A monitoring plan; and
    - A review plan
- Compliance with all applicable environmental laws and regulations, guidelines, and procedures during the execution of maintenance services. Subcontractors and others under the Contractor's direction and control shall observe and comply with the latter.
- The Contractor's employees or agent shall abide to Eskom's Life Saving Rules. If found to have violated any of the Eskom Life Saving Rules, they may face disciplinary action.
    - Open, isolate, test, earth, bond, and/or insulate before touch.
    - Hook up at heights.
    - Buckle up.
    - Be sober.
    - Ensure that you have a permit to work.
    - Wear correct PPE at all times
    - Report all incidents

General

- All Contractors shall work within the parameter of the job description and scope of work. To keep all instructions/ procedures on hand and supply Eskom power station with reference to be included in this document and supply record and history requirements.
- The Contractor is liable and fully accountable for the works and the constructability thereof.
- The Contractor interacts with others through the Contract Manager, to ensure seamless integration of the various works.
- Execute the scope of work as per the employer’s specification.
- Shall interface and liaise with the other functions/structures of the Employer.
- Resources and tools required by personnel for executing works are provided by the Contractor.

- Shall produce and submit to the Employer for approval, the number and details of personnel that will execute the works. Qualifications and proof thereof shall also be provided to the Employer.
- Shall procure or co-ordinate the supply of required consumables.
- Shall assist the System Engineer in planning, organizing and managing all inspection related activities
- Shall take adequate precautions to prevent damage to civil and structural assets

2.6 REQUIRED CRITERIA FOR CONTRACTOR

Not Applicable

2.7 RELATED/SUPPORTING DOCUMENTS

Not Applicable

3. SCOPE OF WORKS

3.1 DESCRIPTION OF THE *WORKS*

The Contractor is responsible for executing the works as detailed in this document. The Contractor takes all necessary precautions that may be required to safeguard existing infrastructure and services including protection of all surface works. These additional works are formally documented in method statements for the Employer's review and acceptance.

The Contractor takes note that review and acceptance of any document/ drawing/ design calculations by the Project Manager in no way relieves the Contractor of his liability for the works. The Contractor remains liable for all works conducted as per this document.

The Contractor is liable and fully accountable for the works and the constructability thereof.

The Contractor interacts with others through the Project Manager, to ensure seamless integration of the various works.

Only trained personnel allowed in performing the works detailed herein.

Records of training are maintained by the Contractor's Quality Control Department

3.2 EMPLOYER'S DESIGN REQUIREMENTS

3.2.1 Civil Scope

The scope of work is applicable to all Seal air fans A to F in unit 5 and 6.

3.2.1.1 Preparations

- Prior to demolition of the damaged sections of grouting each fan set shall be surveyed to verify the straightness of the motor steel base plate and elevations in accordance with attached drawing 0.57/33403 rev 0 and 0.57/43109 rev 0.
- Survey report to be submitted to Auxiliary and Boiler Engineering for review and acceptance prior demolition works.
- The survey points shall include a fixed-point benchmark as well as all the mounting positions for the motor and the fans foundations.
- Based on the survey report results.

- If the steel base plate is in good condition and the surface is still straight without deformation (distortion or deflection), the steel plate shall be kept in tack for reused.
- if steel base plate is deformed beyond the acceptable deformation, a newly fabricated steel plate shall be installed onto the concrete prior placing of fresh grout.

3.2.1.2 Demolition of grouting

- Remove grouting on top of the concrete motor base.
- Demolish and dispose the rubble for the damaged grouting on the fans, carefully not to damage the mounting steel flat bars on the floor.

3.2.1.3 Replacement of motor steel base plate if found to be deformed.

- Cut off the anchor bars of the currently installed steel base plate.
- Prepare the concrete surface by ensuring that the surface is levelled without protruding concrete material or anchor bars. Fill areas with grouting to ensure levelling allow for curing as per product manufacturer's instructions.
- Identify, mark, and drill new anchor holes into the motor concrete base.
- Hole sizes to be for 8 off M20 HD bolts for 300mm long chemically anchored to the concrete.
- Hole size shall be guided by the chemical anchor material technical datasheet or product manufacturer's instructions.
- Procure and fabricate new steel base plates of 500mm x 600mm and 25mm thick.
- Procure, fabricate new motor steel mounting plates of 150mm x 150mm x 25mm thick.
- Each steel base plate shall have 4 off welded at each corner of the steel base plate.
- Drill and create threaded holes on the mounting plates for M20 hold down bolts for the motor.
- Positions of each hole shall be verified with the existing motor footing on site for correct positioning.
- Procure and install/weld 8 new threaded anchor bars into the steel base plate at the edges as well as intermediate on both Y and Z axis (both directions) of the base plate.
- Anchor bars to be installed at 40mm from the edge of the steel base plate or unless stated otherwise by the Client's Engineer/representative in writing.
- Clean the anchor holes on the motor concrete base and ensure free of dust, grease, water and/or any contaminant.
- Clean the anchor bars to ensure free of any contaminants.
- Inject heavy duty chemical anchor into the holes as per manufacturer's instructions.
- Install the steel base plate into position ensure alignment of anchor points is correct without strain that might cause cracks into the concrete or the weld connections between the anchor bars and the base plate.
- Check prior installation, the base plate for straightness and correct any distortion or deformation caused during fabrication or welding process.
- Material datasheets for consumables as well as steel material certificates shall be submitted to the Engineer for review and acceptance prior commencement of steel work.

3.2.1.4 Grout repair works.

- Clean concrete surface and remove all loose material and contaminants.
- Erect smooth finish shutter boards around the motor base as well as fan 1 & 2 for the preparation of receiving fresh grouting.
- Repair concrete motor base as well as the fans foundation using high strength non-shrink grouting to achieve a minimum of 35MPa strength.
- Float the grout to achieve smooth top surface.
- Material datasheets to be submitted to the Engineer for review and acceptance prior commencement of grout works.
- Ensure all grouting is cured properly in accordance with the grout material datasheet or manufacturer's instructions.

- Shutter boards shall be removed once concrete has cured, and final finish shall be shall on the grout to make good and achieve a smooth finish surface.
- Correct any grout defects resulted from removal of shutter boards.
- Conduct a post survey after curing of grout to confirm the final finish elevations.

3.3 SPECIFICATIONS

3.3.1 Steel works

3.3.1.1 Material

- All steel flat plates shall be manufactured using grade S355JR steel.
- The steel used shall comply with the requirements of SANS 50025 - 1

3.3.1.2 Fabrication

Cutting or hole forming may be done by sawing, shearing, cropping using a mechanical saw, guillotine, cropper, punch, drill, profile cutter or combinations thereof. When cutting the following shall be observed:

- The profile of cut outs shall have no sharp corners (to inhibit stress-raising effects);
- Gussets shall be profiled by cropping corners to avoid burning of corners during welding and to prevent the interruption of continuous welds; and
- Edges shall be free from any defects or distortions and burrs. Notches shall be removed. Holes for fasteners shall comply with the following:
- Flame cutting or forming of holes by flame cutting is prohibited.
- Holes may be punched, provided the diameter of the hole is the lesser of 12 mm or the thickness of the structural material involved.
- All structural steel, both before and after fabrication shall remain within the tolerances specified in SANS 50025.

3.3.1.3 Welding requirements

All welding of structural steelwork shall be carried out in accordance with Standard for Welding requirements on Eskom Plant 240-106628253 and AWS D1.1.

- All welds shall be E70XX
- All welds shall be a minimum of 8mm thick continuous fillet weld.

Testing and Inspections for steel works

- Non-destructive procedures, techniques, and acceptance criteria shall be executed in accordance with the Standard for Non-Destructive Testing (NDT) on Eskom Plant – 240-83539994.
- All materials and components shall be inspected during and after manufacture by the main Contractor's and Eskom's Inspectors.
- Visual Examination - All welds shall be 100% visually inspected to check the following:
  a) Presence of undercuts
  b) Visually identifiable surface cracks in both welds and base metals.
  c) Unfilled craters
  d) Improper weld profile and size

e) Excessive reinforcement in weld

f) Surface porosity

Note: Before inspection, the surface of weld metal shall be cleaned of all slag, spatter matter; scales etc. by using wire brush or chisel.

- 100% Magnetic Particle Inspections (MPI) - This shall be carried out for all welds to check the following:

g) Surface cracks

h) Surface porosities

Acceptable level of defects in welds

Limits of Acceptability of welding defects shall be as follows:

Visual inspection & MPI Test - The limits of acceptability of defects detected during inspection Test shall be in accordance with clauses 6.9 & clause 6.10 of American National Standard ANSI/AWS D1.1 for statically as well as dynamically loaded structures respectively.

Rectifying defects in Welds

In case of detection of defects in welds, the rectification of the same shall be done as follows:

1) All craters in the weld and breaks in the weld run shall be thoroughly filled with weld.
2) Undercuts, beyond acceptable limits, shall be repaired with dressing to provide smooth transition of weld to parent metal.
3) Welds with cracks and welds with incomplete penetration, porosity, slag inclusion etc. exceeding permissible limits shall be rectified by removing the length of weld at the location of such defects plus 10 mm from both ends of defective weld and shall be re-welded. Defective weld shall be removed by chipping hammer or grinding wheel. Care shall be taken not to damage the adjacent material.

3.3.2 Formwork

- Formwork with damaged edges or faces shall not be used. Open joint in timber forms shall be sealed. Plywood surfaces and cut edges shall be sealed to prevent the absorption of moisture.
- Immediately before placing grout, the forms and all other surfaces which are in contact with the fresh concrete, are cleaned of loose materials and debris including shavings, woods chips, sawdust, pieces of wire, nails, foamed plastic, fragments of hardened concrete and mortar.

3.4 CONTRACTOR ‘S DESIGN

Not Applicable

4. QUALITY REQUIREMENTS

No work shall commence before the approval of the QCP. The Contractor is expected to compile the QCP document and submit it to the Employer for review and approval. The Contractor is also expected to thoroughly go through the standard: 240-105658000 Supplier Quality Management Specification. Find the standard attached. The following shall be submitted to the Project Manager before work commence;

- Method statements and specifications adhered to;
- Material Certificates;

- Calibration Certificates;
- Calculations for any temporary works that may be required for the safe execution of the works;
- Steel grade certificates;

4.1 HANDOVER

Apart from any statutory data packages required, the Contractor also compiles a data package of the relevant drawings, test certificates etc. to the Project Manager for acceptance. These include, but are not limited to:

- Document List;
- Instruction for Work/ Purchase Order;
- Approved and signed off ITP's, QCP's;
- Certificate of Compliance
- Notifications;
- Modifications;
- Concessions;
- Survey reports
- Technical Queries, Engineering Responses and communications with Project Manager/ Employer
- Non-conformance reports;
- As-built data and marked up drawings of the completed *works* upon handover.

5. AUTHORISATION

This document has been seen and accepted by:

Name & Surname	Designation
L[redacted]	Section Manager: Auxiliary Maintenance
T[redacted]	Senior Supervisor: Civil Maintenance

6. REVISIONS

Date	Rev.	Compiler	Remarks
August 2022	0	Chirwa V	Draft Document
February 2024	0.1	Chirwa V	Revised for Contract placement
February 2024	1	Chirwa V	Final Document

7. DEVELOPMENT TEAM

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