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Compiled by



SINQOBILE NENE

Plant Maintenance Manager

Supported by



SISA PANTSHWA

Mechanical Engineer

Supported by



VUSI SIBEKO

Mechanical Services Manager

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Date: 15.09.2020

Functional Responsibility



SINQOBILE NENE

Plant Maintenance Manager

Approved by



NHLAKANIPHO BLOSE

Maintenance Service Manager

Date: 14.09.2020

Date: 16/09/2020

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1. INTRODUCTION

The Manage Maintenance base is based on best practices identified from the Equipment Reliability Process, existing within Eskom best practices and operational experience, with inputs from a number of industry subject matter experts (SME) and Original Equipment Manufacturers (OEM). This generic process provides standard capabilities that are utilised during operating and maintenance engineering phases of the assets lifecycle.

Effective maintenance entails a process whereby maintenance strategies are developed. These strategies include the maintenance and/or inspection execution process and their frequencies. The maintenance strategies further identifies and categorizes the maintenance to be conducted according to their criticality. Original Equipment Manufacturers (OEM's) develops the minimum inspection and maintenance requirement to ensure that the equipment operates within the design specifications and thus ensuring the expected life cycle of the equipment.

The Rosherville Workshop located at Rosherville, located at approximately 10km South-East of the Johannesburg CBD in Gauteng and the Matla Workshop located at Matla Power Station which is approximately 20 km from the Kriel Town of Mpumalanga, have a number of air compressors and pressure vessels that require maintenance and service in pre-determined intervals. The air compressors vary in type and size. Each air compressor or pressure vessel requires specific maintenance strategies.

This scope makes provision for the development of a maintenance and service contract for all the Turbo Gen Services (TGS) Rosherville Works and TGS Matla Works Air Compressors and Pressure Vessels as per the requirement of their respective Maintenance Strategies. The contract will be for a period of 3 years from the date of acceptance by all parties.

2. SUPPORTING CLAUSES

2.1 SCOPE

This document covers the maintenance and services requirement for the TGS Rosherville and TGS Matla Works Air Compressors and Pressure Vessels as per their respective maintenance strategies. The scope also covers the minimum requirements

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to be met by the Service Provider, which will ensure that the said equipment is inspected and maintained according to the highest standard and effectiveness required by the Client (ERI).

The processes identified on this document are a guide to the process to be followed but is not definite. The OEM's requirements are the minimum standards to be met by the maintenance and/or service to be rendered.

2.1.1 Purpose

The aim of this document is to define the scope of work for the maintenance and service provision of the TGS Air Compressors and Pressure Vessels.

2.1.2 Applicability

This document shall apply throughout Eskom Rotek Industries SOC LTD TGS Air Compressors and Pressure Vessels Maintenance and Services processes.

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

Parties using this document shall apply the most recent edition of the standards for best practices and in line with Eskom specifications that are indicated in this document.

- [1] SANS 1973-1 - Low-voltage switchgear and control gear ASSEMBLIES Part 1: Type-tested ASSEMBLIES with stated deviations and a rated short-circuit withstand strength above 10 kA
- [2] SANS 1973-3 - Low-voltage switchgear and control gear ASSEMBLIES Part 3: Safety of ASSEMBLIES with a rated prospective short-circuit current of up to and including 10 kA
- [3] SANS 10142-1 - The wiring of premises Part 1: Low-voltage installations
- [4] SANS 10142-2 - The wiring of premises Part 2: Medium-voltage installations above 1 kV a.c. not exceeding 22kV A.C. and up to and including 3 MVA installed capacity.

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- [5] SANS 12100 – Safety of Machinery
- [6] SANS 347:2012 – Categorization and conformity assessment criteria for all pressure equipment.

2.2.2 Informative

Parties using this document shall apply and have knowledge of the most recent edition of the standards as listed below.

- [7] ISO 9001 - Quality Management Systems.
- [8] ISO 14001 – Effective Environmental Management System.
- [9] OHSAS 18001 – Occupational Health and Safety Standards.
- [10] OHS Act 85 of 1993, *specifically*: General Machinery Regulation (GMR), Electrical Installation Regulations (EIR), Electrical Machinery Regulations (EMR) and Driven Machinery Regulations (DMR).

2.3 DEFINITIONS

| Definition | Description |
|-------------------|---|
| ERI | Eskom Rotek Industries SOC LTD, the Client |
| TGS | Turbo Gen Service , an ERI Business Unit |
| Works | A TGS Department responsible or production |
| Plant Maintenance | A TGS Department responsible for maintenance effectiveness and control. |

2.3.1 Disclosure Classification

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

2.4 ABBREVIATIONS

The following are abbreviations and their descriptions are specific to this document.

| Abbreviation | Description |
|--------------|--------------------------------|
| RPM | Revolutions Per Minute (speed) |
| PM | Preventative Maintenance |
| CM | Corrective Maintenance |

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| Abbreviation | Description |
|---------------------|--|
| PdM | Predictive Maintenance |
| CMMS | Computerized Maintenance Management System |

2.5 ROLES AND RESPONSIBILITIES

| Roles | Responsibilities |
|---------------------------|--|
| Scope Compiler | Compilation of the scope of work |
| Functional Responsibility | Reviewing and acceptance of the scope |
| Support Personnel | End-user support and acceptance of the scope |
| Approval Authority | Approving the scope for tendering purposes |
| Authorising Personnel | Reviewing and authorising the scope |
| Service Provider | Execution of the approved scope |

2.6 PROCESS FOR MONITORING

| Requirements | Monitoring Process |
|---------------------------------------|--------------------------------------|
| Computerised Management Process (SAP) | Monitoring of the execution progress |

2.7 RELATED/SUPPORTING DOCUMENTS

- TBC

3. SCOPE OF WORK

3.1 BACKGROUND

The TGS Air Compressor and Pressure Vessels (pressure equipment – PE) are assets used for ensuring on-time and effective delivery of the works executed within the works department at both Rosherville Works and Matla Works. The maintenance of these PE is critical to the operation of the works, thus the service delivery to the TGS clients. The maintenance of these PE is required to be conducted at an interval as specified by the maintenance strategies. The maintenance and service executed in these PE are both planned and unplanned work as the requirement may be. A well-structured

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maintenance and service programme is essential for any manufacturing operation. In having numerous different PE that require regular services and maintenance, an adoption of an effective maintenance plan will ensure that:

- PE down time resulting from breakdown are limited,
- The quality of production will be improved,
- The life of the PE will be improved, and,
- The unplanned costs of repairs and maintenance will be reduced.

As part of a full maintenance proposal, the scope of work should be divided into a well-structured on-going maintenance program as well as a breakdown service. The maintenance program must be tailored for each PE to specifically address the needs of each piece of equipment. This must include regular inspections of the equipment as well as the servicing of such equipment at the required intervals. The equipment reliability and availability promotes and supports the daily production schedules and plans.

3.2 SITE INFORMATION

The scope entails works to be executed at two different sites; i.e.; the Rosherville Works in Johannesburg, Gauteng and the Matla Works at Matla Power Station, Kriel Town, Mpumalanga.

3.3 PLANT DESCRIPTION

The plant description of the PE to be maintained and/or serviced is tabulated on the tables below. The Matla Works has a total of 3 (three) main pressure equipment while the Rosherville Works has 5 (Five) main pressure equipment. The pressure equipment includes a combination of air compressors and pressure vessels.

Table 1: Rosherville Located Equipment

| Asset Number | Full Description |
|---------------------|--|
| TBC | 380V 150L Air Compressor |
| 34E585004999 | CP01 Atlas Copco GA160 Air Compressor #1 |
| 34E585005100 | CP02 Atlas Copco GA160 Air Compressor #2 |

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| | |
|--------------|---|
| TBC | CP03 Ingersol Rand R160 Air Compressor #3 |
| TBC | CP04 Ingersol Rand R160 Air Compressor #4 |
| 99E585001986 | CT01 Cooling Tower |
| 99E585001862 | PV01 Pressure Vessel #8 |
| 99E585001863 | PV02 Pressure Vessel #9 |
| 34E585010406 | PV03 Pressure Vessel #3 |

Table 2: Matla Works Located Equipment

| Equipment Number | Description |
|-------------------------|--|
| 10906080 | T-60 Detroit Titan Screw Air Compressor 45kW, 380V, Working Pressure = 0.8MPa, Exhaust Volume = 7.0m ³ /min |
| 110905742 | CSC 60/10 Ceccato Aria Compressa SPA 45kW, 400V, Working Pressure = 10Bar |

3.4 DETAILS OF THE WORKS

The specific tasks to be conducted are detailed below. The detailed tasks are the bare minimum and binding as the minimum contractual agreement between the Client and the Service Provider. OEM requirements that may, or may not, be different from the details scope will be considered as and when it may arise. Upon any realization of such, the Service Provider and the Client's Plant Maintenance Manager will agree on the most effect, feasible and cost effect manner to proceed. The details of the works is divided according to the machine location, machine type and duration requirement.

Prior to commencement of the work, the Service provider must make available all load testing and calibration certificates of all tools and tackles, apparatus, special instruments, measurement equipment as and when required.

3.4.1 SPECIFIC TASKS FOR EACH EQUIPMENT

The work shall entail but is not limited to inspection, servicing and repair on the following part of the PE:

- Compressor Motor

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- Compressor Air End Unit
- Air Cooling System
- Air Receiver
- Oil Separator
- Unloader Valve
- Air Filters
- Oil Cooler
- Compressor Cooling Pump
- Compressor Cooling Motor
- Colling Tower System
- Pressure Vessels and their Auxiliaries
- Compressor Control System

The scope shall entail but is not limited to the following tasks:

Mechanical Details (*Specific to the Detroit 60A M764 Air Compressor*)

- Dismantle all machine covers from machine.
- Drain oil from Machine.
- Replace oil filter (KLG-P553771 Oil Filter for (60A-Detroit M764)
- Replace Separator Filter (OZE-05V21020 OSC20B SEPERATOR ELEMENT for (60A-Detroit) M764)
- Clean sight glass.
- Replace Air Filter (KLG-PA3848FN Air Filter)
- Replace V-Belts (4 x BELTRSXPA 1482)
- Check for oil leaks.
- Check all pipes and connections for wear. Replace damaged pipes and fittings if required.
- Test machine for correct operation.
- Fill all oils on machine including lubrications system with new oil as per specification from OEM (KLG-OZENMAXPOW 800HR OZEN LUBRICANT). (Wet service)
- Removal of all old Lubricants from site after completion of the work on each machine

Electrical Details (*Specific to the Detroit 60A M764 Air Compressor*)

- Test all limit switches for correct operation.

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- Test all control panel switches, all motors and contactors.
- Clean out electrical panel.
- Check panel for hot connections.
- Check emergency stops for correct operation.
- Check counter and readout system on machine for correct operation.
- Check all interlocks and safety devices on machine for correct operation.
- Test and Check Lights on machine and repair, install if required.

Similar but not limited to the above, is a typical example of a scope of work to be carried out for all other Air compressor units between Matla Works and Rosherville Works. The Service Provider will be required to compile a detailed scope of work to cover, inspection, servicing and repair for each machine.

3.4.2 SERVICE INTERVALS

The maintenance intervals for the air compressor is guided by the OEM requirements and the maintenance strategies developed. Due the duty cycle of the Air Compressors, the maintenance scheduled as follows:

3.4.2.1 Three (3) monthly minor service or OEM stipulated utilisation hours (whichever comes first).

3.4.2.2 Six (6) monthly major service or OEM stipulated utilisation hours (whichever comes first)

3.5 DELIVERABLES

The service provider shall ensure that the reports and documentation pertaining the service and maintenance of the pressure equipment are submitted to the Client's Plant Maintenance Manager. Below is a table that entails the minimum details to be contained in the report. The agreed template will be provided to the Service Provider upon finalization of the contract and prior to the initial rendering of the services.

Table 3: Report Minimum Required Information

| System | Report Content |
|---------------|--|
| Housekeeping | The initial housekeeping prior to the execution of the task and the resulting housekeeping condition after the |

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| | |
|---|---|
| | execution of the task |
| Machine condition | The condition of the machines prior to starting the task and the condition of the machine after the task has been completed |
| Lock-out facility | The condition of the lockout system to ensure the safety of both the Service Provider and the Client's personnel |
| Out-of-Normal Condition | The identification of any out of normal condition on the machine, both prior and post servicing and maintenance execution |
| Electrical System | The condition of the electrical system of the machine |
| Environmental Condition | Identification of any environmental contravention, <i>if any</i> , in relation to, <i>but not limited</i> , the drip tray conditions, oil or grease leaks, etc. |
| Cooperation Between Service Provider and the Client | Ease of access to the machine and cooperation by the Client's personnel for the execution of the task. |
| Parts and Consumables | Details of all parts and consumables used |
| Duration | The duration of the task from start to finish |
| Machine Specification | The details of the machine maintained which shall include the name, serial number, asset number, design specs and data of the machine. |
| Recommendations | Any recommendations outside of the contractual agreement of the execution contract of this scope of work. |
| Service Report | Detailed service report of all work done and list off all replacement parts used |

3.6 ASSESSMENT CRITERIA

3.6.1 Upon completion of the task, the Service Provider shall ensure that a Client's Plant Maintenance representation, to be identified as and when required, inspects and signs of the work executed prior to the acceptance of the work as complete in accordance to the contract by the Client's Plant Maintenance Manager or representative.

3.6.2 The Service Provider shall ensure that records are kept for the duration of the contract while the Client's Plant Maintenance Manager shall ensure that records are kept safe for duration as stipulated in the maintenance philosophy.

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3.7 WARRANTY

The work performed is warranted to be free from defects in material and workmanship from date of completion to the following periods. The warranty shall cover:

3.7.1 New electrical and Mechanical parts as stipulated by OEM.

3.7.2 Workmanship for 6 Months after acceptance of work by the Client

3.7.3 The product must be used in accordance with manufacturer's recommendations and must not have been subject to abuse, lack of maintenance, misuse, negligence, or unauthorized repairs or alterations. Should any defect in material or workmanship occur during the above time period in any product, as determined by supplier inspection of the product, the Service Provider, agrees, at its discretion either to replace (not including installation) or repair the part or product free of charge.

3.8 ELIGIBILITY EVALUATION CRITERIA

The Service Provider intending to tender for this work shall ensure they are and/or employ qualified and competent personnel in the field of Maintenance, specifically, Air Compressors and their auxiliaries. Notwithstanding other requirements that may arise during the tender process, the following are the minimum requirements.

3.6.1 Qualified Trade Tested Artisans

3.6.2 Proof on Knowledge of Machinery and Pressure Equipment Safety

3.6.3 Proof of Knowledge of the OHS Act requirements

3.6.4 Must have worked on similar equipment before, e.g. air compressors, pressure vessels, etc.

3.6.5 Be capable of undertaking the magnitude of the work as per the contract

3.6.6 Be mobile and readily available for breakdowns in Rosherville and Matla Works.

3.9 GENERAL CONSTRAINTS

The following are the general constraints that are to be considered:

3.7.1 Working in an operational environment where machines and equipment are being handled.

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3.7.2 Negotiating with Production Managers to arrange planned shutdowns specific within the contractual interval requirements

3.7.3 Minimizing down periods as production will still be taking place in and round the vicinity of the working area.

3.7.4 Working in areas where there are vehicle and pedestrian traffic.

3.7.5 Accuracy of existing information may be outdated and need to be verified on site prior to proceeding with any work.

3.10 TERMS AND CONDITIONS

The successful Service Provider will be expected to adhere to the following minimum conditions:

- a. Adherence and compliance to the health and standards set out by the Client.
- b. Provide adequate PPE to its employees.
- c. Provide its own working fully functional tools
- d. Fully sign and complete the PM Orders.
- e. Issue the service report for the work done and fully signed by the responsible Technician or Supervisor.
- f. Respond to the call out within 4 hours after receiving a call out.
- g. Hand over the replacement (parts removed from the machine) parts to the Client.

4. AUTHORISATION

| Name & Surname | Designation |
|---------------------------|-----------------------------|
| Singobile Nene | Plant Maintenance Manager |
| Sisa Pantshwa | Works Engineer |
| Vusi Sibeko | Mechanical Services Manager |
| Nhlakanipho Blose | Maintenance Service Manager |
| | |

5. REVISIONS

| Date | Rev. | Compiler | Remarks |
|-------------|-------------|-----------------|-----------------------|
| September | 1 | S Nene | Scope of Work for the |

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| Date | Rev. | Compiler | Remarks |
|------|------|----------|---|
| 2020 | | | Maintenance and Servicing of the Workshop Air Compressors and Pressure Vessels and their Auxiliaries Contract |
| | | | |

6. DEVELOPMENT TEAM

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

- Sinqobile Nene
- Sisa Pantshwa
- Vusi Sibeko
- Nhlakanipho Blose

7. ACKNOWLEDGEMENTS

- Plant Maintenance Team
- Works Team

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