
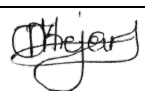
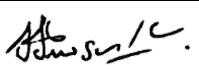
	<b>Condition Monitoring Contract Scope of work</b>	Doc. no.
		Rev. 1
		Total pages      1 of 13
Lethabo Power Station		Reference Document:
<p>Unit:      1   <input checked="" type="checkbox"/>   2   <input checked="" type="checkbox"/>   3   <input checked="" type="checkbox"/>   4   <input checked="" type="checkbox"/>   5   <input checked="" type="checkbox"/>   6   <input checked="" type="checkbox"/>   O/P   <input checked="" type="checkbox"/></p> <p>Outage      IR   <input checked="" type="checkbox"/>   GO   <input checked="" type="checkbox"/>   OTHER   <input type="checkbox"/></p> <p>Contract Date      <input type="text" value="July 2022"/></p> <p>Function      <input type="text" value="PERFORMANCE AND TESTING"/></p>		
	Condition Monitoring Service	Signature
Contract Manager	Khutso Ledwaba	
Performance and Testing Manager	Onicca Nkejane	
Engineering Manager	Harry Sewsunker	

# CONDITION MONITORING SCOPE

## 1. DESCRIPTION OF THE SERVICES

The aim or purpose of the required services will be to provide PRO-ACTIVE and CONTINUOUS evaluation of PLANT components throughout its serviceable life.

Required condition monitoring services to Lethabo Power Station which entails; Vibration Analysis, Infrared Thermography and Tribology as per TASK Schedule section and Scope - Deliverables.

Note of the Standards reference documents as indicated in the Contract document of which adherence are required to.

## 2. INTERPRETATION AND TERMINOLOGY

Detailed terminologies and definitions within the scope of work will be as per:  
Eskom Standard for vibration-based Condition Monitoring of Rotating Auxiliary Plant machinery **GST 36 -1095 rev 0**,  
Eskom Guideline Eskom Infrared Thermography Standard **GST 36-511 rev 0**.

The following abbreviations most commonly referred to as used in the Scope:

Abbreviation	Meaning given to the abbreviation
ASTM	American Standard test method
CPP	Condensate Polishing Plant
CM	Condition Monitoring
FRF	Fire Resistant Fluid
EFP	Electric Feed Pump
FD	Forced Draft
ID	Induced Draft
ICP	Inductively Coupled Plasma Spectrometric Method
LAN	Local Area Network
LH	Left-hand
RH	Right-hand
ODS	Operating deflection shape
PA	Primary Air
SSC	Submersible Scraper Conveyor
SOW	Scope of Work
ISO	International Standard Organisation

**Vibration Analysis:**

Equipment to be monitored as per work breakdown on Vibration Analysis list. Changes on work breakdown on vibration analysis list to be made as and when required and per agreement between the Contract Manager and the Contractor.

The Contractor to perform Vibration Tests on rebuild fixed etc. electric motors on initial installation at Lethabo Power Station.

Service to be delivered as per Generation standard, Vibration-based Condition Monitoring of Rotating Auxiliary Plant machinery **240- 129001353**. (Personnel requirement for Condition Monitoring on site is one ISO CAT 3 Analyst with two ISO CAT 2 Analyst) (two ISO CAT 1)

**Thermography:**

Plant to be scanned as per Thermography list, parts A and B including special requests for once of scanning. Service to be delivered in line with Generation Infrared Thermography Standard **240-129001393**. (One Level 2 Analyst to do Reporting or approve reports done by other Personnel before distributing)

**AD-HOC requests above the normal routine SOW:**

Monthly: Twenty (20) Valve Scans, Ten (10) LV Motor Scans.

Ad-hoc thermo scanning on plant not stipulated on the SOW.

Yearly: Five Ad-hoc scans of Mills (24), Draught Group (36) and EFP (18) Electric Motors to be performed when required by Electrical Engineering.

**Note:** Anything over this will be treated per the Compensation Event Notification process.

**Ash and Coal Plant Pulley Bearings:**

Vibration Monitoring the preferred option where possible. (Vibration the 1<sup>st</sup> indication before temperature will increase.

All Coal and Ash outside plant pulley bearings must be scanned as per INFRARED THERMOGRAPHY

- Scan the pulley bearings and submit results that can be worked on, with all problematic areas identified.
- Areas that are inaccessible or posing a challenge when scanning throughout the plant, must be identified and reported to the related plant engineers to take action.

**ODS:**

ODS is an additional requirement lead by a Certified & Qualified person as where indicated in the SOW Schedule, and need to be included in the contractual price, and will not be considered as compensation events when notified about.

**Video Amplification:**

Video amplification services on an ad hoc basis and to be used in conjunction with ODS as per SOW Schedule, and need to be included in the contractual price, and will not be considered as compensation events when notified about.

**Motor Circuit Analysis:**

Motor circuit analysis to be performed on all Unit Motors during Major Outages.

Outside Plant/Conveyor Drives – 2 Yearly

All motors in store on a six monthly basis and Motors returning from overhaul.

Acceptance testing of motors at rewinders (on request).

**Prognostic Reporting:**

Preparation of a proposal for a prognostic reporting function. (Additional funds to be proposed after a suitable solution has been found)

**Turbine Run-up & Run-down Monitoring:**

The Contractor must be fully aware that the monthly price in the Task schedule includes the service delivered and the analysis reporting, whenever required, irrespective if it may be required in normal or abnormal working hours.

**Note:** Corporate Directive denote major and interim outage transient monitoring by ROTTEK TSS.

Ad-hock transient monitoring will still be required with opportunity outages (Week-end Outages, Repair outages planned by Productions).

**Failure Analysis:**

The Contractor must conduct an in depth analysis to all failures of plant that is included in the scope of work and a detailed report to be compiled.

**Routine Condition Monitoring:**

Continuous assessment and improvement of CM program, measurement techniques, analysis of data, reports etc. Capture and trending of information on problematic plant.

Reports on results to be submitted within 5 working days from data collection.

Reports on analysis done to be categorised as:

PRIORITY	DESCRIPTION	MEANING
Serious	Very High	Emergency – should be done immediately
Alarm	High	High Priority – should be done within 48 hours
Monitoring	Medium	Medium Priority – Monitoring
Acceptable	Low	Low Priority – should be done when the opportunity present itself

Report serious plant problems within 24 hours to Engineering, Maintenance and Operating Departments.

**NOTE:**

Emailed reports require to be indicating the System and Sub-Systems within Subject heading and the message included.

With reference to reports in section 1 ADDITIONAL REQUIREMENTS TO THE STANDARD SCOPE OF WORK within this Contract.

Provide Maintenance and Engineering solutions and recommendations.

Establish root causes of failure trends.

Provide a monthly report on all the plant areas (i.e. Turbine plant, Boiler, Mills, Draught group, Coal plant, Ash plant, outside plant, etc.). The report should show trends and overall condition of the system.

Provide thermography reports within two weeks after scans have been made.

Attend Lethabo meetings where needed.

Do follow up tests on maintained plant.  
Discuss reports and recommendations with clients.  
Provide monthly management report.

**Non Routine Condition Monitoring:**

Attend to special requests and investigation from Engineering and Maintenance departments: inclusive of Vibration, and Thermography etc. Compile detailed reports on the above.

**Charges:**

All routine and non-routine service charges performed during normal working hours will be done at the monthly rate on the price list.

Call-outs and any other work performed outside of those hours will be charged to the Employer at a rate as detailed in the price list.

**Equipment:**

The Contractor will supply personal computers which will be used for data input required. These computers must also be maintained and upgraded by the Contractor. The Contractor will be responsible to pay all applicable software license fees.

The Contractor will be responsible for the supply and maintenance of all portable condition monitoring equipment required in supplying the services. Test equipment to be calibrated and calibration certificates to be available on request.

**Labour:**

Permanent personnel must be based on site, available at Office hours times, however they may be utilised elsewhere. Personnel must be available for afterhours Call-outs, and need to be on site within 30 minutes after being called out. The Contract Manager must be given first preference for the use of these people. Any personnel changes must be agreed with the Contract Manager before any changes are done.

**Services and Standards:**

The Contractor shall perform all services necessary to ensure that the plant is monitored in accordance with the agreed **standards and procedures** as been indicated in this document. The integrity of plant data shall continuously be checked and confirmed against history and any applicable standards.

**Accountability and Responsibility:**

The Contract Manager shall remain accountable for the ultimate health of the plant. The Contractor is responsible for the accuracy of all monitoring, integrity and data, data trending, timeous reporting and accuracy of predictions and/or recommendations.

**Co-operation and access to information:**

The Contractor will provide the Contract Manager all the relevant technical information and reports as described in the scope of work. The Contractor will allow full access to their facilities and their information as reasonably requested by the Contract Manager on the Power Station site.

**3. WORK BREAKDOWN**

To provide Condition Monitoring services i.e. Vibration analysis, Infra-Red Thermography etc to Lethabo Power Station as detailed below.

**VIBRATION ANALYSIS/ INFRARED ROUTINES****CONDITION MONITORING SCOPE OF WORK -Annexure AM**

_Plant Description	Equipment	Machines	Points	Vibration	Temp Monitoring	Frequency	Infrared Frequency
Tube Mills Unit 1-6	Motor/gearbox/pinion	36	1548	yes	yes	monthly	If and when required-
Seal Air Fans U 1-6	Motor/Fan	36	576	yes	yes	monthly	If and when required--
So3 Plant	Blower/motor/cooling fan	12	108	yes	yes	monthly	If and when required--
Secondary Air heaters	Motor/ Gearbox/ Lub Oil Pumps	36	576	yes	yes	monthly	If and when required
Oil rooms Bfpt & Main	Pumps & Motors	120	1320	yes	yes	monthly	If and when required
AC & DC Seal Oils	Pumps and Motors	12	108	yes	yes	monthly	If and when required
Draught Group 1-6	Motor/Fan/ Oil pump	36	576	yes	yes	monthly	If and when required
Turbine Auxiliary Plant	Motor/Pump	216	2586	yes	yes	monthly	If and when required--
Coal conveyors U1-6	Motor/gearbox/pulleys	42	1169	yes	yes	monthly	If and when required--
_Incoming Coal Conveyors T1-T6	Motor/gearbox/pulleys	14	353	yes	yes	monthly	If and when required--
T7 Coal conveyors	Motor/Hydraulic Drives/ Planetary g/box	18	144	yes	yes	monthly	If and when required--
Electric Feed Pumps	Booster pump/ motor/gearbox/main pump	12	360	yes	-yes	Monthly	If and when required--
Main CW Pumps	Motor/pump	12	120	yes	yes	monthly	If and when required--
HP Fuel Pumps	Motor / pump	12	156	yes	yes	monthly	If and when required--
Ingersoll Rand Centac Compressors	Motor/Compressors	8	218	yes	yes	monthly	If and when required--
Fire Protection	Motor / Pump	6	76	yes	yes	monthly	If and when required--
Hydrogen Ext Fans	Motor / Fan	6	36	yes	-yes	monthly	If and when required--
Lp Fuel Oil Pumps	Motor/Pump	6	78	yes	-yes	monthly	If and when required--
Sulphur Circulating pumps	Motor/Pump	2	18	yes	-yes	monthly	If and when required--

Turbine/Gen Pedestals	Turbine/Generator/ Exciter	6	182	yes	-yes	monthly	If and when required--
_Boiler Steam Feed Pump	Booster Pump / Turbine/Main/Pump	6	162	yes	-yes	monthly	If and when required--
Water Treatment Plant	Motor / Pumps/ Blowers/G-box/Fans	120	1650	yes	yes	monthly	If and when required--
Ash Plant	Motor/gearbox/pulleys	66	1607	yes	yes	monthly	If and when required--
Dust Plant	Motor/gearbox/pulleys	162	1910	yes	yes	monthly	If and when required--
_Ash Water Return Pumps	Motor/Pump	18	180	When available to test	yes-	monthly	If and when required--
_Ash & Dust Plant Pulleys	Plumber Blocks	856	856	yes	yes	monthly	If and when required
Coal Conveyor Pulleys	Plumber Blocks	464	464	yes	yes	monthly	If and when required
High Voltage Motors	HV Motors	100	100	-	yes	-	If and when required
_TOTAL MACHINES		2440	17219	-	-		-
_TOTAL PLUMBER BLOCKS		1320	1320	-	-	-	-
_Standby duties all plant		If and when required at the agreed rates					
_Condition Monitoring related call out charges		Per hour at the agreed rates					
Travelling on Call Out		Per KM at the agreed rates (Limited to a 50 km radius)					
Other CMON related emergencies		Per hour at the agreed rates					
Ahoc requests not part of scope / Additional Tests		Per Machine at the agreed rates					
ODS or Video Amplification Surveys		Per Machine if and when required at the agreed rates					
Motor Current Analysis Tests (MCA)		If and when required at the agreed rates					
Eddie Current X & Y Probes Removal and installation during outages (Approx. 34 probes 3 x per year)		If and when required at the agreed rates / per month/per year					
Defect Monitoring		Per Month at the agreed rates					
Remote Monitoring on Critical Plant		Trending of Temperature / Vibrations if and when required and identified at the agreed rates					

**Anything not covered under the scope or exceeding the agreed total will be treated as compensation events.**

### Milling Plant

#### Note:

- : 1. Vibration Survey After every Mill Services, IR and GO
2. White metal bearings, inspect breather filters.
3. Couplings
4. Gearbox
5. Pinion bearings temperature also to be measured when measuring tooth flank temps and ambient.
6. Units 1 to 6, Mill Visual Inspection (Stroboscopic) and Photographic Images.
7. Check Grease Spray Patterns on mill pinion Gear.

## General Plant

### Note:

To monitor only running pump, do not switch pumps (Operating assistance should be requested to switch pumps)

Emergency vibration conditions must be reported to the unit controller that in turn must contact the relevant system engineer.

## ON LINE MONITORING WHEN REQUIRED

### Infrared Monitoring

#### NOTES:

Although thermography presents a better solution for pulley bearing condition monitoring a few problems were identified which may affect the quality of data that is to be gathered such as:

Dirty pulley bearings due to the spillage or the material that conveyors are carrying (Coal or Ash) the bearings are usually piled up with coal or ash and that affect the emissivity of the material thereby compromising the reading. (there have to be a way to make sure that there are no piles of Ash or coal on the line of bearing that will be inspected/monitored)

Some bearings such as the take up and some drive and boom cannot be easily reached and that only allows for temperature to be taken without imaging.

S1 tail pulley is on the other side of the yard (mine) making it uneasy to do thermograph on it.

Since thermograph can be done from a distant all pulleys can be scanned and only that can also be scanned for images will then have such results.

### ADDITIONAL REQUIREMENTS TO THE STANDARD SCOPE OF WORK:

1. Installation and removal of X/Y probes on Turbines, generators, Bfp etc
2. Turbine run downs and run ups when the unit goes on outage and when back from outage.  
Note: Comment on Deliverables section, states as follows, "Corporate Directive denote major and interim outage transient monitoring by ROTEK. Ad-hock transient monitoring will still be required with opportunity outages".  
Note: Turbine Centre Line vibration ad-hock monitoring at increased frequency for when out-of normal conditions occurs, will be required.
3. All Turbine centreline vibration readings to be done before and after each outage.
4. The condition monitoring contractor to do QC on the balancing of the draught group fans (i.e. ID, FD & PA fans) done by the fan outage contractor. There are normally three planned outages per year, giving a total of 18 fans to be balanced per year.
5. The condition monitoring contractor to do QC (Vibration Measurements) on alignments done by Lethabo maintenance personnel.
6. Ad-Hoc ODS:



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Done on Diesel Fire Pump and Motor

Done as a complete system.

Expect two per year (If required).

7. Ad hoc thermo graphic scans as and when required, as per Deliverables section.

**8. Reports:**

8.1. The condition monitoring report to be on Adobe Acrobat file as per attached example.

8.2. The report/s to be sent to all stake holders as attachment via e-mail, not later than five days after measurements are taken. Serious cases to be reported within 24 hours to the relevant stakeholders.

8.3. Reports to refer to the full correct Functional location and asset serial number of plant that is monitored.

8.4. Point out in the report specific component causing vibration defect.

8.5. Report number and file name to be similar and uniquely numbered and indicated in all SAP workshop documentation, to be used for History purpose when closing of works Notification papers.

8.6. All reports to be saved to specific Condition Monitoring folder, on same LAN server but not in the folder of where the RBM Database is installed on.

**Note:** For back-up purpose it will be helpful to save reports in specific folders as per each year reporting period

8.7. All reports sent out to recipients must be backed up to G drive,

9. Data inputs and management thereof to be carried out by the contractor according to the requirements set by Lethabo Power station.

10. Ownership of the data and setup information remains the property of Lethabo Power Station.

**Reports to be issued:**

**Detail Vibration report (Out of norm only)**

1. Should contain basic requirements like

:

2. Pdf Document with unique number

3. Company Name

4. Plant area(Akz)

5. Survey Information (Test Equipment, Test Information, Priority Summary)

6. Iso and spike energy charts related to

7. Explanation and recommendation

8. Applicable plots

## Summary report for all machines

Summary report should be issued on all machines surveyed

Infrared scanning reports to be issued as per approved infrared templates

1. Pdf Document with unique number
2. Images with temperatures
3. Recommendations

## SITE SERVICES, HEALTH AND SAFETY, ENVIRONMENT AND TEMPORARY WORKS

### Site services provided by the Employer

The following services are provided by the Employer during the periods stated:

The Employer will provide a contractor on site for the duration of works.

- Electricity at no charge
- Potable water at no charge
- Toilet facilities at no charge
- Security

The provision of the above is related to the use of the present facilities.

Names and Identity numbers are required seven working days before the contract starts. Photo copies of Identity and qualification certificates and all training certificate related to the work to be executed documents are also required as per

GST 36-1095 training requirements document and GST 36-511 qualification of personnel document. This must be arranged with the Contract Manager.

Lost permits will be paid for by the Contractor to Protective Services at a cost of R 60-00 or as per current requirement per lost permit.

Only work vehicles with an approved permit will be allowed on site. These vehicles are to be in a serviceable condition and road worthy

### No private vehicles will be allowed onto site

Arrangements must be made with the Contract Manager well in advance to allow sub-contractors and visitors onto site. The transport of any equipment onto the site must be declared and documented at Protective Services in order to facilitate the future removal thereof.

### Use of Eskom's Tools and Equipment

For the purpose of expediting the Contract Works, the Employer may make facilities and services available to the Contractor as hereinafter provided at no cost to the Contractor. The Contractor will not receive any reimbursement or make any charge relative to the beneficial use of the facilities or services.

The Employer may allow the Contractor for the execution of the Contract Works the reasonable use of its workshops cranes tools and equipment provided that the Employer's own work and business are not interfered with in any manner by such use. The Contractor shall leave all workshops, cranes, tools and equipment in as good a condition as he found them, fair wear and tear excepted, and shall be liable for any damages by the

Employer as a result of any act of negligence by the Contractor, his employees or sub-contractor while using such workshop, cranes, tools and equipment.

The Employer may provide workshop and machining facilities to assist the Contractor with the execution of the Contract Works. The priority of work to be executed shall be determined by the Employer who shall also approve of the manner of execution of work which cannot be reasonably executed at the Site workshop.

At least one supervisor shall be authorized as responsible person to take out Permits to work on plant as per Eskom Plant Safety Regulations.

Eskom may at its discretion provide any spare parts, materials or equipment as may be required for the execution of the contract works.

#### **Site services provided by the Contractor**

All transport i.e.  
Tractors  
Trucks  
L.D.V's etc.

All health & safety equipment, as per OHS Act 85 of 1993, Lethabo Power Station safety policy and SHE - system requirements, which is obtainable from Risk services.

Accommodation is for the Contractor's own account. Should use be made of Eskom Accommodation, they are to be official occupants of the room.

All tools to be provided to complete the contract works.  
All workshop machinery to be provided to complete the contract works.

All office equipment.  
Telephone bills will be paid by the Contractor.

Working procedures for each activity to be issued to the Contract Manager at least 2 weeks prior to work commencing before work may proceed. This procedure will include Safe working procedures. If portable two-way radios are to be used, the type and make must be approved by the Contract Manager. Attendance at meetings as considered necessary by the Contract Manager.

Removal of redundant material to allocated sites. No scrap shall be stored in the Contractor's yard.  
Scrap is to be cleared from Site daily.  
The Contractor will provide with his tender a typical quality program in accordance with ISO 9002.

#### **Health and safety requirements**

Medical Station available on site during normal working hours. After hours the emergency telephone number 014 763 8311 can be used to obtain emergency assistance.

Fire protection and rescue available on site 24 hours per day.  
Compliance with Lethabo Power Station Health and Safety Standards as per Lethabo Power Station Health & Safety Specifications for Contractors.

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This procedure will be handed over during tender enquiry and will enable the successful tenderer to compile a Health & Safety plan that has to be approved by the Client (ESKOM) prior to commencement of work.  
PA/270/003

Compliance with Eskom & Lethabo Smoking Policy.  
Adherence to the OHS Act 85 of 1993.  
All staff will undergo Safety Induction training before site occupation.

### **SHE Documentation Required from the Contractor**

The following documents must be provided by the contractor in terms of Health, Safety and Environmental performance;

Letter of good standing with COID or any insurance body  
An Organogram indicating the names of all persons that will hold legal appointments on the project in terms of the Act.  
The expected role responsibilities and authority of those who are proposed to receive legal appointments.  
Provide an overview of the system / program that is utilized to manage Safety, Health and Environment.

### **Lethabo Environmental Requirement**

- The tenderer shall coordinate his activities in line with the requirements of ISO 14001: 2004 as Lethabo Power Station is ISO 14001 compliant.
- The tenderer shall ensure that in the execution of his/her activities, contamination or pollution of water (either surface or underground) is avoided.
- The tenderer shall ensure that his/her practices are in line with Eskom SHEQ Policy (32-727) and Lethabo Power Station SHEQ Policy.
- The tenderer shall prepare environmental aspects and impacts (environmental risk assessment) which are in line with the scope as per the tender document.
- The tenderer shall provide comprehensive method statement for all the testing to be done (this document shall detail a process for handling, storing and disposal of samples).
- The tenderer shall provide a waste management plan for all anticipated waste during the execution of the scope.
- The tenderer shall prior to start with execution of the scope, provide the environmental officer with Environmental File, the requirements for the environmental file shall be provided to the successful tenderer during awarding.

Rules are as following:

- Provide sufficient storage containers labelled depicting general or hazardous waste and store in a designated storage area.
- No hazardous waste may be stored for a period of more than 90 days on the Lethabo premises.
- Ensure that all hazardous waste is disposed of at a licensed class H disposal site. A copy of the hazardous waste disposal certificate must be submitted to the project manager.
- Ensure that all other general waste is disposed of at the local municipal waste dump.
- Ensure that your site does comply with the general good housekeeping practices.

The Principal contractor must ensure that his contractors (Subcontractors) also have a Health and Safety File and that it must be accepted by the Principal Contractor.

The Safety Officer employed by Lethabo Power Station will audit these Health and Safety Plans to ensure compliance with the provisions of the Act.

### Lethabo Permit to Work system

All Contractors will ensure that they are informed of all the requirements of Eskom's Plant Safety Regulations and ORHVS and that they at all times comply to the requirements of these Regulations.

All Supervisors of contracting companies who are directly involved with Eskom's Permit to Work System shall be trained and successful completion of Lethabo authorization / evaluation process may be authorized as Responsible Persons.

The Responsible Person shall ensure that:

- The conditions of permits and cautionary notices are strictly adhered to.
- The lockout procedures, mechanical as well as electrical are strictly adhered to and any deviations shall be corrected immediately.
- The safe work procedures as laid down by Lethabo Power Station and as determined by the Risk Assessment shall be followed.
- The workers register and cautionary notices are discussed daily with workers.

### Management meetings

Regular meetings of a general nature may be convened and chaired (1) by the Employer's Agent as follows:

Title and purpose	Approximate time & interval	Location	Attendance by:
Production presentation if requested – Plant routines feedback when required	Weekly on Mondays if requested	Production Conf Room or via Teams	Consultant Senior Analyst, Site HOF's, System Engineers
Cross Functional Meeting (UNITS)	Daily	Production Conf Room or via Teams	Consultant Senior Analyst,
Scope concerns – Manage risks	As per arranged meeting invites	As per arranged meeting invites	As per arranged meeting invites
BR Presentation	Monthly as per arranged Business Review invite	Conf Room or via Teams	Consultant Senior Analyst,