



UNIVERSITY OF THE  
WITWATERSRAND,  
JOHANNESBURG

# Annexure A

## Maintenance of Generator Farms

### Scope of Work

## 1 BACKGROUND AND PURPOSE

The electricity supply from the national grid is not always available, which may be due to load shedding, equipment failure or vandalism of equipment upstream belonging to the supply authority. The University of Witwatersrand, Johannesburg ("the University") is not immune to these problems and as such acquired a fleet of diesel generator units to support its teaching and learning objectives in the event of power outages.

It is essential that these units are maintained regularly to extend their lifespan and to maintain a reliable power supply in the event of power outages that will allow teaching and learning functions of the University to continue with the least possible interruption.

For this reason, it is important for the University to procure the services of accredited and experienced Service Provider (i.e. a tenderer who is awarded the contract ) to perform preventative and corrective maintenance of the generator farm assets as required.

## 2 DEFINITIONS

Some key terms and their definitions are considered in this section, as follows.

"Breakdowns" i refers to any equipment part, system failure, or malfunction that results Downtime and impacts on the University's activities.

"Components" The individual items, which collectively make up the equipment.

"Downtime" The period the equipment is not in operation due to equipment failure, breakdowns, unplanned repairs and periodic re-commissioning/re-adjusting of the equipment systems. This includes the response and repair time.

"Generator Farm" A generator setup with 2 or more generators that operate in synchrony implemented via controls, accompanied by bulk diesel storage that is centrally controlled.

"Safety" The operational requirements with regards to the Occupational Health and Safety Act 85 of 1993, current relevant regulations, codes and standards"

"Site Visits" The scheduled visits to the Precincts to verify the equipment and space has been used and maintained in accordance with the Agreement.

## 3 ABBREVIATIONS

The works typically make use of abbreviations as in Table 1.

*Table 1 Abbreviations Relevant to the Scope of Work*

Term / Acronym	Definition
AC	Alternating Current
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
BS	British Specification
CMMS	Computerised Maintenance Management System
DC	Direct Current
IEC	International Electrotechnical Commission
IP	Ingress Protection
ISO	International Organization for Standardization
kVA	Kilo Volt Ampere

kPA	Kilo Pascal
OEM	Original Equipment Manufacturer
SANS	South African National Standards
SOW	Scope of Work
W	Watt

## 4 STANDARDS AND REGULATIONS

The Services provided by the Service Provider must comply with inter alia:

- Occupational Health and Safety Act 85 (1993) along with its regulations.
- SANS 10142-1: The Wiring of Premises, low-voltage installations.
- IEC 60034-1: Rotating electrical machines - Rating and performance.
- Municipal by-laws.
- All manufacture specific service requirements as documented in the various product manuals.
- Any other local or international standard that may not be listed above but is applicable to the respective components and maintenance work.

## 5 REQUIRED SERVICES

The Service Provider must provide the following Services including the services incidental, ancillary, or complementary thereto:

1. Carry out initial inspections and testing and provide written feedback in the form of a report.
2. Carry out servicing, preventative maintenance and corrective maintenance or repairs of generators as described in Section 7 and Section 8.
3. Supply and installation of all mechanical and electrical spare parts for generators as and when recommended by the Service Provider during the periodic reviews as defined in Section 8 or for emergencies. The management of the stock inventory will be negotiated during the tender award.
4. The required service also includes a 24-hour, Monday to Sunday emergency service as and when required by the University.
5. It is also a requirement the health and safety protocols are observed to prevent injury to personnel and workers.

## 6 CONTRACTUAL MATTERS

### 6.1 Contract Duration

The contract duration will be for 5 years.

### 6.2 Maintenance Reporting

The Service Provider shall submit two types of documents to the University on an ongoing basis, namely:

- A service log, after every service or inspection.
- A monthly report.

The service logs must highlight:

- Date and time of service.
- The equipment model and serial number being serviced.
- The maintenance tasks performed such as inspections, repairs, or replacements, etc. This will include readings, test results and checklists.
- Issues that were encountered during the service and the actions taken to resolve them.
- Recommendations for future maintenance.
- Materials used, including quantity and cost.
- Record of the personnel involved in the maintenance activities.
- Faults found and their priority.

The service log must be submitted to the University, and the subsequent maintenance activities must factor in previous outcomes where required.

Monthly reports will be required by the University which document all maintenance activities and incidents for that period. The reports are to be succinct and compiled with care. The reports referred to here are separate to the service logs but can be deemed to communicate a summary of events for the month. The report and service log template will be finalized upon tender award with successful Service Provider.

### **6.3 House Keeping**

All rubbish and waste arising from the work must be removed and the site and buildings left in a clean and tidy condition. Any spillages as a result of the work done by the Service Provider will be cleaned by the Service Provider at no cost to the University.

As part of this submission the bidder is to provide an environmental management plan, that addresses aspects such as but not limited to: noise control measures, leakage control and protection, bulk diesel spillage and waste management.

### **6.4 Response Times**

The required response time for call outs and other events is as follows:

- Priority 1 (Emergencies) – within 1 hour. The requirement is that the contractor is on site within 1 of an emergency condition to provide support. This would typically entail a scenario where a machine won't start, or a condition which is life threatening.
- Priority 2 (Urgent) – within 3 hours. This condition would typically be associated with a situation where a machine signals a particular alarm condition.
- Priority 3 (General) – within 6 hours.

Any work / event requiring extended repair time shall be discussed and agreed between the University and the Service Provider.

### **6.5 Payment**

The University does not allow upfront payments. All payments will be made within 30 (thirty) days of submitting an invoice. However, where an EME as per the B-BBEE Codes has been appointed as a successful service provider, shorter payments may be considered as part of supplier development, subject to prior approval by the University.

The rates indicated in the bill of quantities must be adhered to when preparing the invoice. Works involving ad hoc replacement of parts shall be in line with the tendered rates, have sufficient detail provided, and pre-approved by the University.

### **6.6 Sub-Contracting**

The University prefers to contract directly with all service providers and the Service Provider must not sub-contract any of its responsibilities or obligations.

### **6.7 Workmanship**

Works with poor workmanship and unauthorized spares will not be accepted. Acceptance of the maintenance work shall be by means of review and approval of the submitted and fully completed service log by the University. The University may, from time to time, elect to witness any of the tests or inspections relating to the maintenance activities or request a retest to satisfy the University personnel of satisfactory function of the equipment.

The University reserves the right to withhold payments until the quality of the Services is acceptable. The Service Provider must have quality management system such as ISO9001:2015 or similar in place, and proof of such is to be provided with the bid. The quality management system must encompass, but not be limited to:

- Structured record keeping and retrieval.
- Record keeping for an established duration. The
- Issuance of reviewed service logs by authorised personnel.

In addition to the services being fit for purpose, they should also meet the manufacturer's performance standards.

### **6.8 Health and Safety**

The Service Provider must submit to the University's authorized representative and maintain a health and safety file every year for the duration of the contract.

The Service Provider must ensure that:

- A second person present during maintenance activities in the event of an accident, to ensure the emergency will be detected and help will take place.
- Its personnel wear personal protective clothing and safety equipment.
- Suitably trained personnel perform the Services.

### **6.9 Qualified Personnel**

The Service Provider must ensure that its personnel performing and overseeing Services are suitably qualified and accredited in the specific trade, as listed below. The required key personnel for this work are as follows:

Professional Engineer or Technologist:

- Pr Eng or Pr Tech (electrical).
- Minimum 5 years' relevant experience post registration.
- Qualification and CV to be submitted.

Diesel Mechanic:

- Minimum 5 years' experience post qualification.
- Bidder to submit Trade test information and CV.

**Installation Electrician:**

- Minimum 5 years' experience post registration.
- Copy of the wireman's license and CV to be submitted.

The Service Provider should be in position of adding more staff when required to assist on the ground.

## **7 CORRECTIVE MAINTENANCE**

Corrective maintenance is service performed after the problem has been identified. It can also include emergency repair or the replacement of components to correct errors or malfunctions, including parts and labour.

The corrective maintenance addresses problems identified through preventive maintenance or during operation. The Service Provider must submit a written quotation describing the services, equipment, pricing, and how the University's requirements will be met. The University will evaluate and approve the quotation prior to the work commencing. The callout, labour rates and rates for parts (markup) must be as per the tendered rates.

## **8 PREVENTATIVE MAINTENANCE ACTIVITIES**

The maintenance activities in this section serve as a guide for the requirements at each interval described in this section. The Service Provider will be required to establish a checklist for each service interval in line with this guide and any other manufacturer specific requirements as well as industry best practice.

The University will verify and accept the service sheet and report.

### **8.1 Weekly**

The weekly services can be summarized as follows. Please note that, these services are will also coincide with the monthly, quarterly, and annual activities.

- Checking of the plantroom/container condition and attending to anomalies.
- Check the oil levels and replenish it as required.
- Check the radiator water/coolant levels.
- Visual inspection of the air inlet and air filter.
- Check the oil filter.
- Checking the fuel filter.
- Checking the water heater.
- Check and record the battery voltage.
- Perform a 30-minute no load test run.
- Check for coupling noises.
- Check that the plant selector is on "Auto".
- Check the voltage level per phase and record it.
- Check and record the frequency.
- Check and record the hour meter.
- Check and record the oil pressure.
- Check and record the fuel pressure.
- Check and record the engine temperature.

- Inspect for oil leaks.
- Inspect for fuel leaks.
- Inspect fuel hoses.
- Visually inspect the radiator.
- Inspect jacket water heater hoses.
- Inspect pipeline and filters for diesel leaks.
- Inspect for water leaks.
- Check and record information regarding the cool down cycle and generator stop.
- Check and record that all systems are running normally and no alarm conditions.
- Ensure the circuit breakers are on.
- Check and ensure the controller is on auto.
- Check and record the generator fuel level.
- Inspect the synchronization panel and equipment for cleanliness.
- Monitor, record and attend to any alarms.

## **8.2 Monthly**

Additional to the weekly activities, the monthly activities are as follows:

- Check filters for water and drains where applicable.
- Check the fan belt tension and condition.
- Check the fan drive pulley & the fan.
- Check the water pump condition.
- Check the turbo charger condition.
- Check the crankcase breather.
- Check and record the battery electrolyte level.
- Simulate start attempts.
- Check and record battery voltage during cranking.
- Check the charging alternator.
- Check and record change over timing.
- Check on load run period.
- Check if load reading is displayed on all control units.
- Check if voltage readings are displayed on all control units.
- Check delay unit shut down.
- Check and record the maximum demand in amperes per phase.
- Check and record the power measured (kW).

These activities are also applicable to quarterly and annual activities.

## **8.3 Quarterly**

Additional to the weekly and monthly activities, the quarterly activities are as follows:

- Simulate low oil pressure
- Simulate high engine temperature
- Simulate low water level
- Simulate low fuel level
- Simulate over frequency and record the response.
- Simulate under frequency and record the response.

- Simulate over voltage and record the response.
- Simulate under voltage and record the response.
- Simulate start attempts.
- Check the governor's function.
- Test and calibrate the synchronization equipment.
- Perform full load 120-minute test run
- Diesel sampling

These activities are also applicable to annual activities.

#### 8.4 Annually or at every 250-hour interval

Additional to the weekly, monthly and quarterly activities, the annual activities are as below:

- Replace filter cartridge
- Replace engine oil
- Replace air filters
- Replace oil filters
- Replace fuel filters
- Oil sampling
- Radiator fin cleaning
- Bulk and day diesel fuel tank desludging/cleaning

A summary of all the activities above is presented in Table 2.

*Table 2 Preventative Maintenance Activities for the Generator Farms*

Generator sets	Activities that are to be undertaken						
	Weekly	Monthly	Quarterly	Yearly*	Check <sup>1</sup>	Record <sup>2</sup>	Action <sup>3</sup>
Plantroom/Container Condition	✓	✓	✓	✓	✓	•	✓
Oil Level	✓	✓	✓	✓	✓	•	✓
Radiator water/coolant level	✓	✓	✓	✓	✓	•	•
Air inlet inspection	✓	✓	✓	✓	✓	•	•
Air Filter	✓	✓	✓	✓	✓	•	•
Oil Filter	✓	✓	✓	✓	✓	•	•
Fuel Filter – Primary	✓	✓	✓	✓	✓	•	•
Fuel Filter – Secondary	✓	✓	✓	✓	✓	•	•
Jacket Water Heater “HOT”	✓	✓	✓	✓	✓	•	•
Battery Voltage	✓	✓	✓	✓	✓	✓	•
No load 30minute test run	✓	✓	✓	✓	•	•	✓
Check Coupling Noises	✓	✓	✓	✓	✓	•	•
Check Plant Selector (Auto)	✓	✓	✓	✓	✓	•	•
Voltage RED $V_{L/N}$	✓	✓	✓	✓	✓	✓	•
Voltage WHITE $V_{L/N}$	✓	✓	✓	✓	✓	✓	•
Voltage BLUE $V_{L/N}$	✓	✓	✓	✓	✓	✓	•
Frequency	✓	✓	✓	✓	✓	✓	•



Generator sets	Activities that are to be undertaken						
	Weekly	Monthly	Quarterly	Yearly*	Check <sup>1</sup>	Record <sup>2</sup>	Action <sup>3</sup>
Hour Meter	✓	✓	✓	✓	✓	✓	•
Oil Pressure	✓	✓	✓	✓	✓	✓	•
Fuel Pressure	✓	✓	✓	✓	✓	✓	•
Engine Temperature	✓	✓	✓	✓	✓	✓	•
Oil Leak	✓	✓	✓	✓	✓	•	•
Fuel Leak	✓	✓	✓	✓	✓	•	•
Fuel Hoses	✓	✓	✓	✓	✓	•	•
Radiator	✓	✓	✓	✓	✓	•	•
Jacket Water Heater hoses	✓	✓	✓	✓	✓	•	•
Diesel leaks pipelines and filters	✓	✓	✓	✓	✓	•	•
Water leaks	✓	✓	✓	✓	✓	•	•
Cool down cycle and gens stop	✓	✓	✓	✓	✓	✓	•
All systems normal and no alarms	✓	✓	✓	✓	✓	✓	•
Station DB CB's on	✓	✓	✓	✓	✓	•	•
Make sure controller is on auto	✓	✓	✓	✓	✓	•	•
Fuel Level	✓	✓	✓	✓	✓	✓	•
Synchronization panel cleanliness	✓	✓	✓	✓	✓	✓	
Synchronization panel alarms	✓	✓	✓	✓	✓	✓	
Drain Donaldson filters for water	•	✓	✓	✓	✓	•	✓
Fan Belt Tension/Condition	•	✓	✓	✓	✓	•	•
Fan Drive Pulley & Fan	•	✓	✓	✓	✓	•	•
Water Pump Condition	•	✓	✓	✓	✓	•	•
Turbo Charger Condition	•	✓	✓	✓	✓	•	•
Crankcase Breather	•	✓	✓	✓	✓	•	•
Battery Electrolyte Level	•	✓	✓	✓	✓	✓	•
Simulate Start Attempts	•	✓	✓	✓	✓	•	•
Battery Voltage during cranking	•	✓	✓	✓	✓	✓	•
Check Charging Alternator	•	✓	✓	✓	✓	•	•
Full load 60minute test run	•	✓	✓	✓	✓	•	•
Check Change Over Timing	•	✓	✓	✓	✓	✓	•
Check on Load Run Period	•	✓	✓	✓	✓	✓	•
Load reading displayed all control units	•	✓	✓	✓	✓	•	•
Voltage readings displayed all control units	•	✓	✓	✓	✓	•	•
Check Delay Unit Shut Down	•	✓	✓	✓	✓	•	•
Max Demand RED Amp	•	✓	✓	✓	✓	✓	•
Max Demand WHITE Amp	•	✓	✓	✓	✓	✓	•
Max Demand BLUE Amp	•	✓	✓	✓	✓	✓	•

Generator sets	Activities that are to be undertaken						
	Weekly	Monthly	Quarterly	Yearly*	Check <sup>1</sup>	Record <sup>2</sup>	Action <sup>3</sup>
Power Measured (kW)	•	✓	✓	✓	✓	✓	•
Simulate Low Oil Pressure	•	•	✓	✓	✓	•	•
Simulate High Engine Temperature	•	•	✓	✓	✓	•	•
Simulate Low Water Level	•	•	✓	✓	✓	•	•
Simulate Low Fuel Level	•	•	✓	✓	✓	•	•
Simulate Over Frequency	•	•	✓	✓	✓	✓	•
Simulate Under Frequency	•	•	✓	✓	✓	✓	•
Simulate Over Voltage	•	•	✓	✓	✓	✓	•
Simulate Under Voltage	•	•	✓	✓	✓	✓	•
Simulate Start Attempts	•	•	✓	✓	✓	•	•
Check Governor Function	•	•	✓	✓	✓	•	•
Test and calibrate the synchronization equipment			✓	✓	✓	✓	
Diesel sampling			✓	✓	✓	✓	
Replace filter cartridge	•	•	•	✓	•	•	✓
Replace engine oil	•	•	•	✓	•	•	✓
Replace Air filters	•	•	•	✓	•	•	✓
Replace Oil filters	•	•	•	✓	•	•	✓
Diesel fuel tank desludging				✓	•	•	✓
Fuel Filter – Primary replace	•	•	•	✓	•	•	✓
Fuel Filter – Secondary replace	•	•	•	✓	•	•	✓
Radiator fin cleaning				✓	✓	•	✓
Oil sampling				✓	✓	✓	
Fuel Filter – Primary replace	•	•	•	✓	•	•	✓
Fuel Filter – Secondary replace	•	•	•	✓	•	•	✓

\*Yearly or every 250 hours running time as indicated on the controller, whichever comes first

1 **Check** means to visually verify/examine a specific item/modality

2 **Record** means to visually inspect an item, collect the data and document this for future references.

3 **Action** means physically conduct an organized activity to accomplish an objective.

## 9 LOCATION OF THE GENERATOR FARMS

The University infrastructure currently consists of 5 (five) generator farms:

### Braamfontein Campuses:

- 1 farm with 3 generators
- 1 farm with 2 generators

### Parktown campuses:

- 3 farms, each with 2 generators

The University currently operates 11 generators across its Braamfontein and Parktown campuses.

An additional generator farm with 2 generators will be established during the course of the contract and this will increase the total number of generators to 13.

## 10 EQUIPMENT CURRENTLY IN USE

The University has procured several units over time and has gensets from various Original Equipment Manufacturers (OEMs).

The manufacturers of the engines currently in use are as follows:

- MTU
- Caterpillar
- Kohler
- Kirloskar

More information on the individual units is captured in the bill of quantities.

## 11 WARRANTY

The Service Provider must provide, at least a twelve (12) month OEM warranty on the equipment after installation. Equipment that fails and is found to be defective in workmanship or materials shall be replaced by the supplier at its own cost with equipment carrying the same guarantee as the original offer. All workmanship shall be required to carry a twelve-month warranty.

## 12 CHANGE MANAGEMENT

Any changes to the maintenance schedule or adjustments to the tasks being performed must be communicated to the University 30 days in advance. This process ensures that the necessary review and approval by the University can take place, allowing for a smooth operation and minimal disruption to the University's activities.

## 13 TIMEFRAMES AND DELIVERABLES

The key goal is to have equipment/plant which is available 24/7 for backup power in the event of an outage. Additionally, evidence to support this outcome will be reporting as indicated in

Table 3 along with the associated time frames.

*Table 3 Time frames and deliverables*

#	Services / Deliverables	Deliverable Due Date	Acceptance Criteria
1	Once-off inspection	Upon contract commencement.	Report
2	Compliance with Health and Safety Requirements	Upon contract commencement and annually.	Report
3	Preventative maintenance logs	Every week over a 5-year period	Service Log
4	Monthly report	Monthly over a 5-year period	Service Report