



SCOPE OF WORK
(SOW)

TURBO GEN SERVICES
(TGS)

Title: TGS – Supply of Oil Purification
Services

Unique Identifier: N/A

Alternative Reference No.: N/A

Area of Applicability: Eskom Rotek
Industries (ERI) SOC Ltd.

Document Type: Scope of Work (SOW)

Revision: 0

Total No. of Pages: 11

Next Review Date: N/A

Classification: **Controlled Disclosure**

Compiled by:

Anton Greyling Date: 29/07/2022
Senior Commissioning Engineer

Angelique Geldenhuys Date: 29/07/2022
Senior Commissioning Engineer

Functional Responsibility:

Accepted by:

Nhlakanipho Blose Date: 30/07/2022
Maintenance Services Manager

Rishan Moodley Date:
Projects Service Manager

Approved by:

Reinaldo Da Veiga Date: 5/8/2022
Engineering Manager

Table of Contents

- 1 Objectives..... 3
- 2 Scope of services 3
- 3 General Requirements 4
 - 3.1 Compliance 4
 - 3.2 Operation, Maintenance and Downtime/Breakdowns..... 4
 - 3.3 Types of Purification Equipment 4
 - 3.4 Minimum Criteria 5
 - 3.5 Where Services will be rendered 6
- 4 Scope of Work (SOW)..... 7
- 5 SHEQ REQUIREMENTS..... 9
- 6 KEY DELIVERABLES..... 10
- 7 Key Performance Indicators 10
- 8 Evaluation Returnables to Include 11

1 Objectives

As part of ERI TGS Maintenance, Projects and Works Services, it is required to make use of various Oil Purification Services and Supply for Eskom Turbine and Generator Oil Systems on Eskom plant and/or ERI premises, during outages; maintenance as well as onload. This includes provision of Mobile/Modular Bulk Oil Storage and Pumping stations; Oil systems cleaning and Flushing (Oil pipe work and oil storage tanks); Oil Condition monitoring; testing and reporting services.

The objective of this document is to outline the services that are required from approved and established Oil Purification services companies. It seeks to ensure that the proposed services required are executed in a planned and structured manner, and that all quality and safety requirements during activities are met.

2 Scope of services

The scope of responsibility includes the delivery, transport, maintenance and operation of the various Oil Purification; Pumping; Storage; Cleaning; Flushing; Oil Condition Monitoring Services and Supply to and from listed ERI work stations and Eskom Power Stations. The services will be utilised for specified periods at the listed ERI work stations and Eskom Power Stations, as agreed upon upfront. The supplier will provide the necessary trained and licensed personnel to operate and maintain the equipment as well as to interface with the Eskom Plant. All services will be rendered as wet services. **The scope of services will be rendered to ERI, as and when required, over a period of 5 years.**

3 General Requirements

3.1 Compliance

- It is the responsibility of the supplier to ensure that the Oil Purification services; machinery and vehicles comply to all aspects of the relevant South African Acts and Regulations, i.e. Occupational Health and Safety Act No. 85 of 1993, Road Safety Act, Driven Machinery Regulations and Traffic Safety Act.
- Further all personnel supplied to operate and maintain the machinery and vehicles must be competent and qualified to do so, with compliance to the aforementioned Acts and Regulations and procedures. Personnel must comply to the Eskom and ERI SHEQ requirements for site access and site safety, including the vehicle and machinery inspection requirements, where applicable.
- The Solvents and chemicals that will be used for tank cleaning, must be supplied with Material Safety Data Sheets (MSDS) and safely and securely stored on site. The solvents and chemicals must not cause any damage or degradation to the oil tanks, piping or valves and seals to be cleaned and must be removed from the system with no residues remaining; to not contaminate the oil when oil is returned to the systems.

3.2 Operation, Maintenance and Downtime/Breakdowns

- It is the responsibility of the supplier to ensure the services and equipment are insured and maintained, without impacting on ERI Maintenance, Project and/or Works Services project schedules.
- It is the responsibility of the supplier to ensure that the equipment operator is available on site 24/7 for the duration of the services required. The operator will be responsible to continuous operation, maintenance, sampling, testing and reporting, as required.
- It is the responsibility of the supplier to interface with the plant, having the correct Permit to Work to execute the tasks.
- It is the responsibility of the supplier to connect and disconnect to the plant and maintain the equipment. ERI will assist the supplier in identifying points of connection, be it connection flanges; hoses unions; electrical supplies, etc.
- Downtime and breakdowns must be minimal, with turnaround time to resolve downtime/breakdowns of maximum 4hours.
- All newly supplied and/or refurbished equipment used for these services must be fit for use, with no defects or anomalies.

3.3 Types of Purification Equipment

- The mobile purification equipment must be of reputable brand with local supply, maintenance, spares, consumable and operation support.
- The preferred purification technology will be vacuum dehydration units with inline filtration and heating capability. Units with vacuum pumps that require water for sealing purposes will not be considered.

3.4 Minimum Criteria

- Purifiers and oil sampling and testing must comply with Eskom's specified Fluid Cleanliness standards for Turbine and Feed Pump hydraulic and gear systems (As per Eskom Guideline GGL 36-53 - IN-SERVICE MONITORING OF LUBRICATING OILS AND HYDRAULIC FLUIDS).
- Maintain average moisture content below 100 ppm.
- Maintain an ISO 4406 particle count of 16/13 or lower
- Filter inserts should be rated at 3µm absolute or less and should have a Beta Ratio greater or equal to 1000.
- Purifiers should be able to handle a particle count of 28/27 and a moisture content of 45000 ppm
- The supplier must provide references and sources of evidence that the quoted purifier is able to reduce the moisture content in a 50 000 L oil tank from 10 000 ppm to <300 ppm within 66 hours and in a 10 000 L tank from 10 000 ppm to <300 ppm within 42 hours.
- Purifiers must be equipped with auto shut-off valves on the inlet and outlet of the purifier. Auto shut-off valves should trip closed in the event of a hose failure to eliminate the risk of an oil spillage (Alternative methods of oil spillage prevention in the event of hose failure can be suggested by the Supplier, and may include oil bunding with local audible alarms).
- Purifiers should be equipped with sample valves on the inlet and outlet of the purifier for performance verification via sampling.
- Purifiers should be equipped with a heater capable of heating the oil to 60°C. Heater should be able to control the oil temperature at a set temperature value (i.e. 60°C).
- Purifiers should be equipped with filter differential pressure indicators.
- Purifiers to be operated using 3-phase, 380 V power and should be supplied with a minimum 50m extension cable and a 5 pin plug.
- Purifiers should be supplied with flexible oil supply and return hoses. The oil supply and return hoses should each be minimum 20 meter in length and be compatible with the oil.
- The purifier/pumping should be able to be primed and commissioned and operated with a negative suction head, whilst maintaining the required recirculation flow rates. This applies to stations where it is required to fit the purifier/pumping on top of tanks due to limited access. A 3 to 6 meter negative suction head may be required. The affected stations include but are not limited to: Kendal Power Station; Arnot Power Station; Tutuka Power Station.
- Where purifiers/pumping are fitted on zero meter, ensure that there is sufficient discharge pressure to reach the Turbine oil tanks. The vertical head to reach the Turbine oil tanks is typically 16 to 20meters.
- The supplier must supply their own mating flanges and/or couplers if required on systems where flanges and/or couplers are provided for suction and return lines. This applies to mobile purifiers; mobile pumping stations and storage tanks. Note that adequate FME must be applied to restrict any foreign material from entering the oil systems.
- Not all sites are modified to utilise mobile purification/pumping connections, which may require suction and return hoses to be routed to inside the oil tanks. In this instance the hoses must be properly secured to ensure they do not move or fall out of the tanks to not cause an oil spillage. Adequate FME must be applied to restrict any foreign material from entering the tanks, while performing purification/pumping. Note though that every effort must be made to find means of connecting the mobile purifier/pumping stations to existing oil system pipework.

- Purifiers and pumping stations must be mobile to be moved and rigged between tanks and Units.
- Purifiers; pumping stations and storage tanks must be able to contain oil leaks and spillages in a drip tray or tank or bund, to be supplied.
- The Services should be delivered to site within 4 hours of placing the order.
- The Purifier should be operated/supervised 24 hours a day for the duration of the order by a trained operator who will report on the amount of water removed per shift and oil cleanliness improvement daily. Daily oil sampling, testing and reporting must be done as minimum. The frequency of sampling; testing and reporting will increase as required during recommissioning phases of the Turbine oil systems or when purification effectiveness needs to be verified.
- The Contractor should supply and replace the filter and/or cartridge elements as required to ensure the required particle count is achieved within the required timeframe. A minimum of three spare sets of new replacement filter and/or cartridge elements should be available on site at all time.
- The purifiers; pumping stations; storage; hoses and connections provided must be compatible with Turbine Grade Lubrication oil as well as FRF oil. Oils typically used on the Eskom Stations include:
 - Castrol Perfecto THZ 46
 - Castrol Perfecto THZ 32
 - Castrol Energol HLP 32
 - Regal R&O 46
 - Castrol Anvol PE 46XC
 - Engen Superturb 46
 - Gencirc 46
 - ISO VG 46
 - Shell Turbo 46
- Where oil condition monitoring services is provided by the supplier, as minimum the water content must be reported in PPM and the cleanliness reported as per ISO4406 particle count. The equipment used for sampling and testing must be certified calibrated and defect free for the duration of the services.
- The capacity of the mobile purifiers must be such that the full volume of the oil tanks are circulated minimum of 5 times in a 24hour period or unit recirculation rate must be 20% of oil tank capacity per hour. For example for a 50000L oil tank, a minimum purifier throughput of standard 10000L/hr is acceptable.

3.5 Where Services will be rendered

- It is the responsibility of the supplier to transport, operate and maintain the machinery and vehicles to and from where the services will be required.
- It is the responsibility of the supplier to assess the specific site oil systems set up and to provide a proposal and/or method statement for acceptance; for effective oil purification; mobile oil pumping and storage; oil systems cleaning and flushing as may be required for specific sites.
- The ERI work stations/premises for the services include:

- ERI Rosherville, Germiston
- ERI Homebase, Witbank
- The Eskom Power Station for the Services include:
 - Arnot Power Station
 - Camden Power Station
 - Duvha Power Station
 - Grootvlei Power Station
 - Hendrina Power Station
 - Kendal Power Station
 - Koeberg Power Station
 - Komati Power Station
 - Kriel Power Station
 - Kusile Power Station
 - Lethabo Power Station
 - Majuba Power Station
 - Matimba Power Station
 - Matla Power Station
 - Medupi Power Station
 - Tutuka Power Station
 - Eskom Peaking Power Stations

4 Scope of Work (SOW)

- The services to be provided, include:
 - Supply of Mobile Oil Purifiers. These may be once off to be supplied as New, as and when required and will be agreed upon up front.
 - Supply of Mobile Purification services, inclusive of oil condition monitoring, sampling, testing and reporting.
 - Supply of Mobile/Modular Oil Storage Tanks and Pump Station Services. These services will typically be utilised to drain; store; purify and transfer the Turbine and Generator and Bulk storage oil systems oil and include:
 - Supply Portable temporary storage tanks and bund area as required.
 - Supply the required purification equipment and staff to operate, maintain and test the oil being purified.
 - Supply the required pipe work, pumps and electrical cabling/plugs and/or power supply as necessary to facilitate the draining of the Turbine and Generator oil systems to the portable temporary storage tanks.
 - Do sampling and testing of all oils prior to purification to determine the cleanliness and record.

- Purify the oil to the required standard or better.
- Compile the required reports and quality documents prior to returning the oil to the relevant tank.
- Pump the oil back into the Turbine and Generator oil system tanks as required.
- Sample the oil and test to confirm the cleanliness in the tank.
- Remove all the equipment used and clean the area that was utilized for this activity
- Specific to the Bulk Storage tanks, the following additional will apply:
 - Pre-assessment of the tanks and pipework.
 - Draining of the tanks and transfer line pipework for the bulk storage tanks.
 - Cleaning of the Bulk storage tanks and transfer line pipework.
 - Inspect and close all the bulk storage tanks and transfer line pipework prior to putting the purified oil back in the tanks.
- Supply of Oil Condition monitoring, sampling, testing, reporting and tracking, as and when required.
- Turbine and Generator and Bulk Oil pipework cleaning and flushing
- Turbine and Generator and Bulk Oil Storage tank inspection and cleaning
- Supply of Spares and Consumables for the services, to operate and maintain the supplied equipment and services
- Performing Maintenance and Overhaul of ERI and Eskom owned Mobile and installed oil purifiers, as and when required, including provision of new spares and consumables.
- The services will be required on the Eskom Turbine and Generator Oil Systems, i.e:
 - Turbine Main Lubrication Oil System and Tanks, including associate auxiliaries and piping. Tank volumes range from 25000L to 80000L for the various sites.
 - Generator Seal oil system and Tanks and associate auxiliaries and piping. Tank volumes may range from 1000L to 20000L for the various sites.
 - Control Oil System and Tanks and associate auxiliaries and piping. Tank volumes may range from 5000L to 20000L for the various sites.
 - Turbine Bypass System and tanks and associate auxiliaries and piping. Tank volumes may range from 250L to 1000L for the various sites.
 - Turbine Bulk Oil Storage Tanks (New and Used Tanks, Clean and Dirty tanks) and associate auxiliaries and system piping. Tank volumes may range from 50000L to 250000L for the various sites.
 - Electric Feed Pump (EFP) Lube oil system and tanks and associate auxiliaries and piping. Tank volumes may range from 5000L to 20000L for the various sites.
 - Boiler Feed Pump Turbine (BFPT) Lube oil and Control oil system tanks and associate auxiliaries and piping. Tank volumes may range from 10000L to 25000L for the various sites.

- The duration and type of services will be agreed upon upfront, as and when required. Typical duration of the services will be for the duration of the outage, for example 40 to 60 days.

5 SHEQ REQUIREMENTS

All service providers are expected to comply with, but not limited to the following:

- Compliance with the Occupational Health and Safety Act 85 of 1993 is compulsory.
- Adherence to Quality Management System Policies, Procedures and related requirements of ISO 9001.
- Adherence to Occupational Health and Safety Policies, Procedures and related requirements of the OHSAS 18001.
- Adherence to environmental aspects, related impacts and legal requirements associated with work activities in accordance with ISO 14001.
- Adherence to Life Saving Rules.
- Compliance with the Eskom Plant Safety Regulations.
- Only authorised documents and processes are to be used in the execution of duties.
- Continuously seek methods for improvements from a process, quality and safety perspective.
- Obey all instructions.
- Familiarize with:
 - The applicable work instructions and procedures in place.
 - Safe working conditions and procedures.
 - All legal and contractual requirements.
 - Discipline and integrity.
- Compliance to all ERI Work Instructions, processes, procedures, and standards
- Adherence to ERI's disciplinary code or practice.
- Set example to co-workers and others.
- Participate in Risk Assessments.
- Responsible for own safety.
- Responsible for Personal Protective Equipment issued.
- Execute duties promptly and safely.
- Safeguard tools and safety equipment issued.
- Keep good relationship with all personnel.
- Compile a HIRA for each and every activity that needs to be performed.
- Ensure the activities are carried out following a Works Instructions and Procedure.
- Adhere to clean condition policy where required.
- All activities to be carried out as per the documented processes and comply with the requirements of ISO and OHSAS certification
- Service provider to comply to Eskom PPE (Personal Protective Equipment) Policy with regards to issuing of PPE to resources
- Proper use of PPE to be followed

- Ensure that tools and equipment are stored correctly in a safe place.

6 KEY DELIVERABLES

The following deliverables are to be met by the service provider:

- No customer complaints
- Compliance to all ERI Work Instructions, processes, procedures, and standards
- No SHEQ incidents
- Project Milestones are to be achieved on time, or earlier

7 Key Performance Indicators

The performance of the contractor will be evaluated on the KPIs in the table below:

| Objective | Key Performance Indicator | Measure | Unit of Measure | Source of Evidence |
|--|--|---|-----------------|----------------------------|
| Zero Defects | Zero Defects | Equipment delivered and operated defect free | Nr | To be provided by Employer |
| Zero Safety Incidents | Zero Safety Incidents | No safety related incidents for the duration of the services | Nr | To be provided by Employer |
| Due Date Performance – turnaround time | Due Date Performance | Actual delivery date versus supplier committed delivery date / Turnaround time to repair max 4hours | Hours | To be provided by supplier |
| Oil purification to specification criteria met | Purifier is able to reduce the moisture content in a 50 000 L oil tank from 10 000 ppm to <300 ppm within 66 hours and in a 10 000 L tank from 10 000 ppm to <300 ppm within 42 hours. | Time to purify | Hours | To be provided by supplier |
| Zero Oil Spillages | Zero Oil Spillages | No oil spillages for the | Nr | To be provided by |

| | | | | |
|--|--|--------------------------|--|----------|
| | | duration of the services | | Employer |
|--|--|--------------------------|--|----------|

8 Evaluation Returnables to Include

- Clearly state the type of purifiers; mobile storage and pumping stations to be used.
- Provide 4 verifiable references and sources of evidence that the quoted purifier has been successfully utilised at an Eskom site within last 5 years. The listing shall include contact details for the listed reference projects.
- The minimum acceptable purifier throughput is 10 000 L/hr, for 50000L tanks.
- Proof that has inlet and outlet sample points. The proof can be in the form of a drawing or photo.
- Proof that the heater can heat the oil to a temperature of 60 degrees Celsius. Proof can be in the form of heater data sheet, nameplate or photo.
- Purifiers/tanks/pumping station should be able to contain oil leaks and spillages in a drip tray or tank or bund. Drawing or photo as proof will be acceptable.
- The Contractor will provide verifiable references and sources of evidence that the quoted purifier is able to reduce the moisture content in a 50 000 L oil tank from 10 000 ppm to <300 ppm within 66 hours and in a 10 000 L tank from 10 000 ppm to 300 ppm within 42 hours.
- Commitment letter stating that the Purifier/Pumping station/Mobile storage and associate services will be supervised and operated 24 hours a day.
- Proof that the purifier is equipped with auto shut-off valves on the inlet and outlet. Proof can be in the form of a photo or data sheet.
- In the event of exclusions or deviations from the scope of work, the exclusions or deviations should be stipulated and explained in detail.