	SCOPE OF WORK (SOW)	TURBO GEN SERVICES (TGS)
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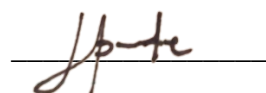
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# 1 Objectives

As part of routine maintenance on some components blast cleaning is necessary to remove scale, rust, oxide deposits, adherent contaminants and paints. Eskom Rotek Industries therefore needs to grit blast various components. Often this task is contracted to an external company. However, irrespective of department or company responsible for grit blasting Safety, Health, Environmental, Quality (SHEQ) and technical requirements have to be uniformly outlined & to set SHEQ and Technical requirements for the preparation of grit blasting areas and the blast cleaning of components under the control of ERI.

This document is drafted to select & place a contract with external service providers who are able to execute Grit Blasting on Turbine component & In situ Steam Chest during Eskom Turbine Outage, IR & Breakdowns as per Rotek **E-138** Grit Blasting Procedure.

## 2 General Requirements

### 2.1 Selecting a suitable blast cleaning material (Ref: E-138 Grit Blasting Procedure)

The only blast cleaning medium to be used on turbine components should be Aluminium Oxide, Glass Beads or a mixture thereof.

The use of Silica Sand was investigated and found unacceptable for blast cleaning turbine components. Silica Sand constitutes a health hazard because of its free silica and cyanide content. Contamination with minerals and other particulars and the wide range of grain shapes and sizes, often result in poor and damaged surface finishes. A comparison between Silica Sand, Glass Beads and Aluminium Oxide showed that Silica Sand has a target metal Mass Rate Removal (MRR) (MMR: 4.3 g/min; stand-off distance of 90mm at 6 bars air pressure) double that of Glass Beads (2 g/min) and Aluminium Oxide (2.8 g/min).

Recycled Mediums contain contaminants and should not be used on turbine rotors, rotor blades and diaphragm vanes.

### 2.2 Blasting Medium

#### Aluminium Oxide

Aluminium Oxide is widely accepted as a blast cleaning medium for turbines and related components.

Grain Size:

Medium Grain Sizes	
Component	µm
HP Rotor Vanes and Blades	70 - 120
IP/LP Vanes and Blades	70 - 120
Last Stages and Shafting	70 - 120
Turbine Casings, Gland Carries etc	70 - 150

The individual medium grain shall be angular in shape.

The iron content of the medium shall be less than 0.2%.

Water soluble salts should be kept to a minimum, as they will accelerate rusting of the blasted surface.

Mediums should be chemically inert.

The medium shall be non-hygroscopic. The moisture content for the medium supplied shall not exceed 0.5%.

The medium grains should be non-magnetic and non-metallic.

The medium hardness shall not exceed 9 Moh

### **Glass Beads**

Glass beads are a good choice as blasting medium. Limited target material is removed during blast cleaning. Glass beads cause peening and special care must be taken to prevent damage on soft fragile parts, such as diaphragm vane trailing edges and labyrinth sealing strips.

Medium Grain Sizes	
Component	µm
HP Rotor Vanes and Blades	70 - 160
IP/LP Vanes and Blades	70 - 160
Last Stages and Shafting	70 - 160
Turbine Casings, Gland Carries etc	200 - 400

The individual medium grain shall be angular in shape.

The iron content of the medium shall be less than 0.1%.

Water soluble salts should be kept to a minimum, as they will accelerate rusting of the blasted surface.

Mediums should be chemically inert.

The medium shall be non-hygroscopic. The moisture content for the medium supplied shall not exceed 0.5%.

The medium grains should be non-magnetic and non-metallic.

The medium hardness shall not exceed 9 Moh.

### **Aluminium Oxide and Glass Beads Mix**

A mixture of Aluminium Oxide and Glass Beads may also be used. The good cleaning properties of Aluminium Oxide, combined with the polishing effect of the Glass Beads, give outstanding surface finishes. A mix of 1:1 has been used and is recommended or as per the client's specifications.

### **Blasting Medium for Bearings, Rotor Discs**

Blasting medium GH25 for use at Bearing Services

Shotpeening shot medium (usually used to shotpeen Hendrina LP rotor discs)

Equipment

Blasting nozzle angle 90° and 135° (usually for blasting underneath rotor shrouds) ▪ Blasting medium GH25 for use at Bearing Services

Shotpeening shot medium (usually used to shotpeen Hendrina LP rotor discs)

Equipment

Blasting nozzle angle 90° and 135° (usually for blasting underneath rotor shrouds)

## 2.3 Surface Quality

The quality of the blast cleaned surface is defined in terms of (i) roughness and (ii) cleanliness.

The surface roughness is controlled through the choice of blast cleaning procedures and the type and grade of medium. The surface finish attainable depends largely on the condition of the component before cleaning. The correct selection of mediums is extremely important in obtaining the required surface roughness specifications.

The surface cleanliness is the appearance of the surface. A uniform matt finish should be achieved.

### Surface Roughness

HP Vanes and Blades	IP/LP Vanes and Blades	Last Stages and Shafting	Turbine Casings
$R\gamma \leq 10\mu\text{m}$ $CLA \leq 4$ N3	$R\gamma \leq 20\mu\text{m}$ $CLA < 8$ N4	$R\gamma \leq 30\mu\text{m}$ $CLA < 12$ N4 – N5	$R\gamma \leq 50\mu\text{m}$

### Surface Cleanliness

The surface area after blasting should be free of scale and contamination. Turbine rotors, blades and vanes should be cleaned in those areas identified by the responsible person. Care must be taken not to over blast the surface area.

Blasting should be done in a uniform nature to avoid uneven light/dark patches being left on the surface.

The blast cleaned components should be inspected by the Supervisor (Service Provider) for cleanliness

### Component Protection

All blast cleaned components should be protected from oxidation, contamination and damage.

Turbine components to be transported or stored should be protected using a protective sealed enclosure or OEM/CRAC approved temporary corrosion preventative coating. A drying unit shall be used when an airtight enclosure or protective coating is not possible.

### Component transport

Preplacement meeting for service is to be held with supplier to determine the scope of responsibility of the supply of transport and the review of client supplied facilities. The service provider is to supply sufficient capacity Tractor and lowbed Trailer, covering for rainy weather conditions for each shift to capacitate approximate 30 tons (Rotors, Casings and other), this may differ from site to site where the customer can supply the transport for such services. The service provider is responsible for the provision of personnel to operate the supplied transport equipment (ERI or Service Provider supplied transport), as well as 2 x flagmen during the transport process. Where the transport is off site for Aux Plant, ERI is responsible the transport the equipment to the relevant site with the blasting facilities.

## 2.4 Process Quality Plan For Sand Blasting The Components

The Responsible Service provider Technician should compile the process quality plan for blast cleaning the turbine components and Turbine Auxiliary Components before blast cleaning commences. Hold and witness points should be identified.

The process quality plan is authorised by the customer (ERI) before the grit blasting commences

Grit blasting activities should be incorporated into the main PQP by ERI as per scope of work.

The blast cleaning operators should be familiar with the process quality plan.

Service Provider to assign a responsible Supervisor for the blast clean area.

The process quality plan should include the items as listed in the attached process quality plan

A check sheet for Grit blasting should be developed and at least cover the following:

Plant	Turbine and Related Plant	Operation	Sand Blasting
Task			
1	Assign responsible supervisor for blasting area		
2	Evaluate blaster		
3	Inspect blasting equipment		
4	Inspect blasting nozzle		
5	Ensure correct blasting grits		
6	Check air pressure gauge calibration		
7	Check lighting in blasting area		
8	Check ventilation		
9	Blast clean target plate at selected distance		
10	Protected areas not to be blasted		
11	Rotors not resting on journal areas		
12	Identify area to be blasted and in testify		
13	Evaluate blasted areas		

## Blast Cleaning Services

The following are services expected from the blast cleaning service provider:

- On-site blast cleaning using Eskom or own facility, (provide a compressor if facilities do not have air connections)
- Blast cleaning at Rosherville using ERI facilities, (provide a compressor if facilities do not have air connections)
- Blast cleaning at Rosherville using own temporary facility, (provide a compressor if facilities do not have air connections)
- Blast cleaning at Supplier's own facility

- ERI to arrange transportation requirements for all components to be blast cleaned at the supplier's site/facility
- The supplier will be required to supply own blasting medium and take responsibility for disposal of the used medium.

### **3 Scope of Work (SOW)**

The generic SOW includes but not limited to the following:

#### **HP Turbine**

HP outer casing Top half  
 HP outer casing fasteners  
 HP inner casing Top and Bottom half  
 HP diaphragms Top and Bottoms  
 HP gland boxes Top and Bottoms  
 HP Rotor

#### **IP Turbine**

IP outer casing Top half  
 IP outer casing fasteners  
 IP inner casing Top and Bottom half  
 IP diaphragms Top and Bottoms  
 IP gland boxes Top and Bottoms  
 IPRotor

#### **LP Turbine.**

LP inner casing Top and Bottom half  
 LP inner casing fasteners  
 LP diaphragms Top and Bottoms  
 LP gland boxes Top and Bottoms  
 IP Rotor

#### **BFPT Turbine**

BFPT inner casing Top and Bottom half  
 BFPT diaphragms Top and Bottoms  
 BFPT gland boxes Top and Bottoms  
 BFPT Rotor

#### **Turbine Steam admission valves.**

HP steam valve modules and spares Modules  
 HP steam valve bonnet studs and nuts  
 IP steam valve modules and spares Modules  
 IP steam valve bonnet studs and nuts  
 LP bypass valve Modules and spares  
 HP and IP Strainers (strainer basket and chests)

### **Turbine Aux Plant.**

All Auxiliary plant that is included in the maintenance SOW with Eskom, Lp Heater drain pumps, Air Ejector pumps, CW Pumps, stud nuts, pipes ect.

**Waste Management.** For all site and off-site sand blasting the supplier is responsible for the blasting medium removal, In the event that sandblasting is to be performed on the plant the Service provider is to supply and erect sufficient screening with ventilation to prevent dust transmission to other areas of plant. The removal and disposal of sandblast mediums is the responsibility of the service provider.

**Foreign Material Exclusion (FME – In-Situ Sandblasting):** The contractor is responsible for providing FME covers for in-situ blasting. Inspections to be conducted with the Site team to ensure that the all areas that need FME covers are catered for before commencing with Sandblasting.

## **ERI Works Sandblasting Scope of Work (SOW) with details of the components**

The scope of work includes but not limited to the following:

- Blast cleaning of all required components without causing any damage
- Cleaning of extraction filters if and when required (applies only to use of Eskom or ERI plants)
- Shot blasting of bearings without causing any damage
- Repair hose or pot if and when required
- Changing of nozzles if and when required
- Inspection of components for damages prior to blast cleaning
- Inspection of components for completion and damage prior to leaving plant
- Cleaning of components
- Filling pots with the medium
- Shift work when required

### **1.1 MAN (Matla, Lethabo and Matimba)**

The following are the components that are to be blast cleaned.

- HP Rotors
  - Length of up 6.143m
  - Diameters of up to 1.248m
  - Weighs up to 26 000kg
- IP Rotors
  - Length of up 6.178m



- Diameters of up to 2.170m
  - Weighs up to 28 000kg
- LP Rotors
  - Length of up 8.440m
  - Diameters of up to 3.464m
  - Weighs up to 52 000kg
- HP Casing
- IP Casing
  - Weighs up to 4 800kg
- LP Casing
- HP diaphragms
- IP diaphragms
- IP Blade carriers
- LP diaphragms
- HP Nozzle boxes
- IP Nozzle boxes
- LP Nozzle boxes
- HP / IP / LP / Generator / Exciter Bearings
  - Diameters up to 726mm
- HP / IP / LP Gland boxes
- ESV valves
- Control valves
- BFPT Rotor
- BFPT Casing
- BFPT Diaphragms
- BFPT Bearings
- BFPT Gland boxes

- Gland box and diaphragm segments

## **1.2 GEC (Tutuka, Majuba and Duvha)**

The following are the components that are to be blast cleaned.

- HP Rotors
  - Length of up 5.2m
  - Diameters of up to 1.290m
  - Weighs up to 16 000kg
- IP Rotors
  - Length of up 5.851m
  - Diameters of up to 1.891m
  - Weighs up to 31 500kg
- LP Rotors
  - Length of up 7.3m
  - Diameters of up to 3.578m
  - Weighs up to 57 920kg
- HP Casing
- IP Casing
  - Weighs up to 4 800kg
- LP Casing
- HP diaphragms
- IP diaphragms
- IP Blade carriers
- LP diaphragms
- HP Nozzle boxes
- IP Nozzle boxes
- LP Nozzle boxes
- HP / IP / LP / Generator / Exciter Bearings

- HP / IP / LP Gland boxes
- ESV valves
- Control valves
- BFPT Rotor
- BFPT Casing
- BFPT Diaphragms
- BFPT Bearings
- BFPT Gland boxes
- Gland box and diaphragm segments

### **1.3 Siemens (Camden, Hendrina and Kendal)**

The following are the components that are to be blast cleaned.

- HP Rotors
  - Length of up 7.00m
  - Diameters of up to 2.00m
  - Weighs up to 18 000kg
- IP Rotors
  - Length of up 8.80m
  - Diameters of up to 2.20m
  - Weighs up to 34 000kg
- LP Rotors
  - Length of up 7.322m
  - Diameters of up to 3.8m
  - Weighs up to 57 000kg
- HP Casing
  - Weighs 7 550kg
  - Height of 3.5m
  - Width of 3.3m

- Length of 4.5m
- IP Casing
- LP Casing
  - Weighs up to 18 000kg
  - Length of up to 3.4m
  - Width of up to 2m
  - Height of up to 2.3m
- HP diaphragms
- IP diaphragms
- IP Blade carriers
- LP diaphragms
- HP Nozzle boxes
- IP Nozzle boxes
- LP Nozzle boxes
- HP / IP / LP / Generator / Exciter Bearings
- HP / IP / LP Gland boxes
- ESV valves
- Control valves
- BFPT Rotor
- BFPT Casing
- BFPT Diaphragms
- BFPT Bearings
- BFPT Gland boxes
- Gland box and diaphragm segments

#### **1.4 Medupi, Arnot and Kriel**

The following are the components that are to be blast cleaned.

- HP Rotors

- Length of up 7.05m
  - Diameters of up to 1.034m
  - Weighs up to 14 200kg
- IP Rotors
  - Length of up 7.410m
  - Diameters of up to 1.60m
  - Weighs up to 29 300kg
- LP Rotors
  - Length of up 10.120m
  - Diameters of up to 3.160m
  - Weighs up to 64 500kg
- HP Casing
  - Weighs approximately 18 000kg
  - Length of approximately 3.40m
  - Width of approximately 2.00m
  - Height of approximately 2.30m
- IP Casing
- LP Casing
  - Weighs up to 17 000kg
- HP diaphragms
- IP diaphragms
- IP Blade carriers
- LP diaphragms
- HP Nozzle boxes
- IP Nozzle boxes
- LP Nozzle boxes
- HP / IP / LP / Generator / Exciter Bearings

- HP / IP / LP Gland boxes
- ESV valves
- Control valves
- BFPT Rotor
- BFPT Casing
- BFPT Diaphragms
- BFPT Bearings
- BFPT Gland boxes
- Gland box and diaphragm segments

### **1.5 Koeberg**

The following are the components that are to be blast cleaned.

- HP Rotors
- IP Rotors
- HP diaphragms
- IP diaphragms
- IP Blade carriers
- HP / IP / LP / Generator / Exciter Bearings
- ESV valves
- Control valves
- Gland box and diaphragm segments

## **4 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.

## 5 Key Performance Indicators

Objective	Key Performance Indicator	Measure	Unit of Measure	Source of Evidence
Safety Sustainability	LTI Free days	LTI Free days	Days	To be provided by supplier
Turnaround Time	Available within 24 hours	Number of queries responded to	Nr	To be provided by supplier
Due Date Performance	Due Date Performance	Average contracted outage days	Days	To be provided by supplier
Reduce the Number of Rework Incidents	No of Rework Incidents	Number of Rework Incidents	Nr	To be provided by supplier
Reduce the Rework Duration	Rework Duration (Days additional to planned outage duration)	Number of Days Rework Duration Impacts Outage Due Date	Days	To be provided by supplier
No of Legal & Environmental Contraventions	No of Legal & Environmental Contraventions	Number of contraventions	Nr	To be provided by supplier
Zero Fatalities Excl 3rd party at fault	Zero Fatalities Excl 3rd party at fault	Number of fatalities	Nr	To be provided by supplier