

	<b>Specification</b>	<b>Peaking</b>
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Title:	Technical Specification for Drakensberg Pumped Storage Scheme <b>Bronze Wearing Parts</b>	Unique Identifier:	<b>31A/11111-P1-A</b>
		Alternative Reference Number:	<b>27265637, 27265823, 27265825 &amp; 27265826</b>
		Area of Applicability:	<b>Peaking Engineering</b>
		Documentation Type:	<b>Specification</b>
		Revision:	<b>2</b>
		Total Pages:	<b>10</b>
		Next Review Date:	<b>N/A</b>
		Disclosure Classification:	<b>Controlled Disclosure</b>

## 1. BACKGROUND

Drakensberg Pumped Storage Scheme consists of four pumped storage units. Each unit has a main unit shaft as one of the major components. The shaft rotates by means of water flowing through a runner of the turbine, which turns the rotor of the generator and generate electricity to the national grid of South Africa. The flow rate of the water is controlled with guide vanes in conjunction with a governor system.

The governor systems consist of various wearing components to allow the guide vane servomotors, operating ring and guide vanes to move. These wearing components are planned to be replaced during the upcoming Turbine Refurbishment outages planned for Drakensberg PSS. New wearing components are required to be procured to be able to perform the Turbine Refurbishment outages.

This Technical Specification outlines the required specification for each of the required wearing components as well as what will be expected from the *Supplier* supplying the *goods* for the duration of the supply.

## 2. DESCRIPTION OF THE GOODS

### 2.1 Employer's objectives

The *Employer's* objective is to have spare bronze wearing components available for the execution of Drakensberg Turbine Refurbishment outages, currently scheduled to start in August 2025 (DRP U3), October 2025 (DRP U4), March 2027 (DRP U2) and April 2027 (DRP U1). Take note that these dates might change.

### 2.2 Brief description of the goods

The scope of work includes the following:

- a) The *Supplier* manufactures, inspects, supplies and delivers the following components to the *Employer's* site (Eskom Drakensberg Pumped Storage Scheme):

**Table 1: Goods to be supplied**

Item	Qty.	Item Description	Reference Drawing*
1	84	Bush - Bottom Guide Vane Journal	18.48/5899
2	84	Bush - Middle Guide Vane Journal	18.48/5898
3	84	Bush - Top Guide Vane Journal	18.48/5894
4	168	Thrust Collar Wear Strip – Guide Vane	18.48/5911
5	1000	Twist-off Bolt – Guide Vane Thrust Collar Insert	18.48/6235
6	168	Bush – Guide Vane Link Straight & Eccentric Pins	18.48/5902
7	26	Horizontal Wear Plate – Operating Ring	18.48/5900
8	26	Vertical Wear Plate – Operating Ring	18.48/5901
9	20	Bush – Governor Servomotor Link Straight & Eccentric Pins	18.48/5903
10	10	Bush – Governor Servomotor Piston	18.48/6338

\*Refer to the latest revision of these drawings

- b) The *Supplier* repairs all defects.

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### 3. WORK TO BE PERFORMED BY THE *SUPPLIER* FOR THE SUPPLY OF THE *GOODS*

#### 3.1 Specifications

The *Supplier* adheres to the following in providing the *goods*:

- a) The *Employer's* safety rules
- b) The *Employer's* codes of practice
- c) All the documents stated in this document.

#### 3.2 Scope of work

The *goods* include the following:

- a) The *Supplier* manufactures, inspects, supplies and delivers the goods as described in Table 1 to the *Employer's* site (Eskom Drakensberg Pumped Storage Scheme).
- b) All parts are manufactured from CuSn11P as per BS EN 1982:2024 [either Ingot CuSn11P-B (CB481K) or Casting CuSn11P-C (CC481K) to be used]. The *Supplier* provides BS EN 10204 Type 3.1 Material Certificates for all materials used. Chemical Composition % by weight is shown in the table below

**Table 2: Bronze Wearing Part Chemical Composition Specification**

Element	Percentage (Ingots – CB)	Percentage (Castings – CC)
Cu - Copper	87.0 – 89.3%	87.0 – 89.5%
Sn - Tin	10.2 – 11.5%	10.0 – 11.5%
P - Phosphorus	0.6 – 1.0%	0.5 – 1.0%
Al - Aluminium	0.01% max	0.01% max
Fe - Iron	0.10% max	0.10% max
Mn - Manganese	0.05% max	0.05% max
Ni - Nickel	0.10% max	0.10% max
Pb - Lead	0.25% max	0.25% max
S - Sulphur	0.05% max	0.05% max
Sb - Antimony	0.05% max	0.05% max
Si - Silicone	0.01% max	0.01% max
Zn - Zinc	0.05% max	0.05% max

- c) Castings conform to BS EN 1982:2024 (Copper and copper alloys – Ingots and castings).
- d) The *Supplier* machines all items as per Table 1 to the tolerances as specified in the drawings.
- e) The *Supplier* machines all items as per Table 1 to within the concentricity, taper and surface roughness specification as specified in the drawings.
- f) The *Supplier* removes all burrs and sharp edges after final machining as specified in the drawings.
- g) For quality and traceability purposes, the *Supplier* hard stamps all items as per Table 1 with a unique identifying number on a non-working surface as specified in the drawings.
- h) The *Supplier* repairs all defects.

#### 3.3 *Supplier's* design

The *Supplier* designs and provides all equipment and jigs necessary to manufacture the items as per Table 1.

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## 4. WORK TO BE PERFORMED BY THE *EMPLOYER* FOR THE *GOODS*

### 4.1 Inspection

The *Employer* has the right to perform various inspection, witness and hold points during the manufacturing and quality checks of the *goods* at the premises of the *Supplier*.

The *Employer* performs visual inspection on delivery of the *goods* at the *Employer's* site (Drakensberg Pumped Storage Scheme).

### 4.2 Disassembly of current bronze wearing components

The *Employer* removes the currently installed bronze wearing components when required.

### 4.3 Installation of the new bronze wearing components

The *Employer* installs the new bronze wearing components when required.

### 4.4 Storage of the new bronze wearing components

The *Employer* stores the new bronze wearing components (as per the list of items in Table 1) in a safe area on the *Employer's* premises (Drakensberg Pumped Storage Scheme) after delivery of *goods* by the *Supplier*.

## 5. *EMPLOYER'S* PHILOSOPHY

### 5.1 Engineering philosophy

Fully operational capability of the Pump/Turbine unit, improved reliability and maintainability of the Turbine system at Drakensberg PSS.

### 5.2 Maintenance philosophy

New bronze wearing components will ensure that proper maintenance can be executed during the Turbine Refurbishment outages.

## 6. DRAWINGS

The following drawings are supplied to the *Supplier* for manufacturing purposes.

**Table 3: Drawings**

Drawing Number:	Title:
18.48/5899	Bush - Bottom Guide Vane Journal
18.48/5898	Bush - Middle Guide Vane Journal
18.48/5894	Bush - Top Guide Vane Journal
18.48/5911	Thrust Collar Wear Strip – Guide Vane
18.48/6235	Twist-off Bolt – Guide Vane Thrust Collar Insert
18.48/5902	Bush – Guide Vane Link Straight & Eccentric Pins
18.48/5900	Horizontal Wear Plate – Operating Ring
18.48/5901	Vertical Wear Plate – Operating Ring
18.48/5903	Bush – Governor Servomotor Link Straight & Eccentric Pins
18.48/6338	Bush – Governor Servomotor Piston

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## 7. SPECIFICATIONS

The *Supplier* adheres to the following in providing the items to be supplied:

**Table 4: Standards**

Reference Number	Title	Date or revision
240-53665024	Engineering Quality Manual	1
ASTM E310-21	Standard Ref Radiographs for Tin Bronze Castings	
BS EN 1371-1	Founding – Liquid penetrant testing – Part 1: Sand, gravity die and low pressure die castings	2011
BS EN 1371-2	Founding – Liquid penetrant testing – Part 2: Investment casting	2015
BS EN 1982	Copper and copper alloys – Ingots and castings	2024
BS EN 12681-1	Radiographic testing (Part 1: Film techniques)	2017
OHSA No. 85 of 1993	Occupational Health and Safety Act.	1993 as amended
ISO 9001	Requirements for Quality management systems.	2015

## 8. CONSTRAINTS ON HOW THE *SUPPLIER* PROVIDES THE GOODS

### 8.1 Factory testing

The *Supplier* performs factory testing. The *Supplier* submits copies of all tests performed by the *Supplier*, indicating the results of all tests performed to the *Employer* for acceptance within ten (10) days of being performed.

#### 8.1.1 Test Certificates

The *Supplier* submits copies of all test and calibration certificates of all tests performed by the *Supplier*, indicating the result of all types of tests performed, to the *Employer* for acceptance within ten (10) days of being performed.

#### 8.1.2 Chemical Composition of Ingots/Castings

The *Supplier* ensures the composition of ingots and castings to conform to the requirements for the material as specified in Table 2. Refer to BS EN 1982:2024 for the requirement in analysis of the chemical composition of ingots or castings. Refer to the retesting requirements in BS EN 1982:2024 when required.

The *Supplier* provide a BS EN 10204 Type 3.1 Material Certificate for each material tested to the *Employer* for their review and possible acceptance.

#### 8.1.3 Mechanical Tests of Ingots/Castings

Refer to BS EN 1982:2024 for the requirement for mechanical testing of ingots or castings. Refer to the retesting requirements in BS EN 1982:2024 when required.

The *Supplier* provide a BS EN 10204 Type 3.1 Material Certificate for each material tested to the *Employer* for their review and possible acceptance.

#### 8.1.4 Manufacturing Tests

Component materials and parts are routinely tested in accordance with the *Supplier's* QCP and as required by BS EN 1982:2024.

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### 8.1.5 Casting Inspections

- a) Castings are inspected in the manner stated below.
- b) Inspections are performed by Level 2 or better NDE technician from a third-party AIA.

#### 8.1.5.1 Visual inspections

- a) The surface of the castings must be smooth, free from hitting marks, blisters, porosity, cracks, flaws, non-metallic or foreign inclusions.
- b) The manufactured components must be straight and undeformed.
- c) Castings with defects exceeding the restrictions shall be rejected.
- d) Blowholes and cavities not exceeding 2 mm depth shall be smoothed out by blending as described in 8.1.4.
- e) In the case of blowholes occurring opposite each other, the combined depth is to be considered.
- f) Castings shall, after inspection, be ground smooth.
- g) Small and repaired blowholes shall be ground level and smooth. All surfaces are free from irregularities which may interfere with the performance of the examinations. The surface of the castings is examined visually and must be free of adhering sand, scale, cracks and hot tears.

#### 8.1.5.2 Radiographic testing

- a) Radiography is to be carried out in compliance with BS EN 12681-1:2017 (Radiographic testing – Part 1: Film techniques) on all castings. All sub-surface imperfections are to be identified for subsequent assessment in accordance with the acceptance standards. Also refer to ASTM E310-21 (Standard Reference Radiographs for Tin Bronze Castings).
- b) The *Supplier* provides radiographic test reports to the *Employer* for acceptance for each radiographic test performed containing the details as required by BS EN 12681-1:2017 (Radiographic testing – Part 1: Film techniques).
- c) The table below gives the maximum severity allowed for the castings (as per severity level 2).

**Table 5: Copper Alloy Casting Acceptance Criteria (Radiography)**

Code	Discontinuity type	Maximum Permissible Discontinuity
A	Gas porosity	2
B	Sand and slag inclusions	1
Ca	Shrinkage, linear	1
Cd	Shrinkage, feathery or spongy	1
Da	Hot tear	Not permitted
Eb	Inserts, chaplets	Not permitted

- d) Castings with defects having a max linear dimension exceeding 3 mm in size shall be rejected.

#### 8.1.5.3 Penetrant testing

- a) Penetrant testing acceptance criteria = Severity level SP 1, CP 1, LP 1 and AP01 as per BS EN 1371-1:2011 (Standard Founding – Liquid penetrant testing Part 1) and/or Severity level SP 2, CP 2, LP 2 and AP 2 as per BS EN 1371-2:2015 (Standard Founding – Liquid penetrant testing Part 2).
- b) The *Supplier* provides penetrant test reports to the *Employer* for acceptance for each penetrant test performed referring to the results and acceptance criteria as described in Section 8.1.5.3 a).
- c) Each casting is inspected after machining with dye-penetrant testing by a Level 2 or better NDE technician to ensure that there are no discernible cracks or other defects in the casting.

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- d) Indications of cracks, hot tears or chain-like porosity and surface oxide inclusions in linear formations are not acceptable.
- e) Indications arising from porosity and surface oxide inclusions in non-linear formations are to be assessed as follows:
  - Isolated pinpoint porosity (diameter smaller than 0.5 mm) is acceptable except on working surfaces.
  - Clustered pinpoint porosity (diameter smaller than 0.5 mm) and other defects are acceptable except on working surfaces, provided that the maximum size of any indication is not to exceed 2 mm diameter bleed out, and the sum of the diameters of all indications in an area of 70 x 70mm is not to exceed 24mm.
- f) The indications identified in (e)) are acceptable providing that the immediate area of the casting is acceptable when examined for sub-surface defects.

#### **8.1.6 Rectification of Defects**

- a) No welding or filling with any other metallic or non-metallic material is allowed on any casting.
- b) Unacceptable surface defects may be excavated by an approved process, providing the resulting depression does not reduce the section thickness by more than 3 mm. The excavation is to be smooth, and all sharp edges are to be removed.
- c) The depression sides and ends are to be smoothly blended out by a minimum radius of three times the maximum depth of blending and the edge formed with the surface is also to be faired smooth. The remaining section thickness in way of the depression is to be free from sub-surface defects as revealed by radiography. The total area subjected to blending, including the area affected by the fairing, is not to exceed 10%.
- d) In the case of blowholes occurring opposite each other, the combined depth shall be taken into account.
- e) Blowholes and cavities not exceeding 2 mm depth shall be smoothed out by grinding.
- f) Castings shall, after inspection, be ground smooth.

#### **8.1.7 Final inspections**

- a) The finished components as listed in Table 1 are inspected after final machining with a calibrated micrometer gauge. All diameters to be measured in the x-axis and y-axis in three positions along the z-axis (top, middle and bottom). Therefore 6 dimensions per diameter for each component as per items 1, 2, 3, 6, 9 and 10 as per Table 1. The Supplier must submit all dimensions in a hard-copy and soft-copy format. The soft-copy format must be on Microsoft Excel.
- b) The surface finish of the parts after final machining are tested with a calibrated instrument on two working surfaces on all components as listed in Table 1. All measurements are recorded and can be witnessed by the Employer.
- c) Any casting is rejected for defects discovered during subsequent machining notwithstanding that the casting had been passed previously as conforming to the testing standards.
- d) All recorded measurements are submitted to the Employer within ten (10) days of being taken for acceptance.

#### **8.2 Labelling**

The *Supplier* adds numbering by hard stamping the non-working surfaces with unique numbers identifying each item as per Table 1 separately. These numbers must be used for traceability between the manufactured products, material certificates, dimensional check sheets, radiographic reports and penetrant testing reports.



### 8.3 Dispatch, delivery and offloading

- a) The *Supplier* delivers the *goods* safely to the *Employer's* site (Eskom Drakensberg Pumped Storage Scheme, Jagersrust, Kwa-Zulu Natal, South Africa) without any damage.
- b) The *Supplier* ensures that all material and equipment is packaged, transported and delivered in such a way that the parts are not damaged by minor knocks.
- c) Each part is individually wrapped in protective coating and packaged in crates.
- d) The contents of each crate are clearly marked.
- e) The *Supplier* repairs all damaged or defective components.

### 8.4 Quality management

- a) The *Supplier* submits a quality control plan (QCP) to the *Employer* for acceptance as part of the tender returnable documents. This QCP include inspection, hold and witness points. Refer to Section 0.
- b) The *Employer* reserves the right to revise the Quality Control Plan after purchase order placement.
- c) The *Supplier* submits the final QCP to the *Employer* for acceptance within one week after purchase order placement. Refer to Section 0.

### 8.5 Safety management

- a) The *Supplier* complies with the Occupational Health and Safety Act. (OHSA No. 85 of 1993)
- b) The *Supplier* takes every precaution to ensure safety and to protect the *goods* and temporary *goods*.
- c) The *Supplier* is responsible for the safety and security of his personnel, materials on site and the *goods* at all times during manufacturing and delivery of the *goods*.
- d) The *Supplier* adheres to the safety regulations pertaining to the *Employer's* Power Station (Drakensberg Pumped Storage Scheme).
- e) The *Supplier* provides all the required safety and personal protective equipment to his staff for the duration of the contract.

### 8.6 Environmental management

- a) The *Employer's* Power Station (Drakensberg Pumped Storage Scheme) is situated in an environmentally sensitive area.
- b) The *Supplier* acquaints himself with all statutory and local environment regulations and adheres to these without exception.
- c) The *Supplier* complies with the Hazardous Chemical Regulations when using any hazardous chemicals, as well as complying with the requirements of the National Environmental Management Act of 1988.

### 8.7 Installation

#### 8.7.1 Security

General access to the *Employer's* Power Station (Drakensberg Pumped Storage Scheme) is controlled and it is mandatory that the *Supplier* adhere to all security regulations in force during the period of the contract.

#### 8.7.2 Other construction activities

The *Supplier* notes that there may be other work taking place during the period when he/she is providing the *goods* to the *Employer's* Site and liaises with the other *Suppliers* in this regard.

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## 8.8 Title to site materials

The *Supplier* has no title to plant and/or materials resulting from him/her supplying the *goods*.

## 8.9 Documentation

### 8.9.1 Pre-implementation documentation

The *Supplier* submits the following to the *Employer* for acceptance (within one week of purchase order placement):

- a) Approved detailed quality control plan
- b) Check sheet templates

The *Supplier* notes the following:

- a) Metric sizes, as specified by the International Standards Organization and agreed to by the South African Metrication Boards, are used.
- b) SI units are used on drawings, pamphlets, calculations and documents.

### 8.9.2 Post-implementation documentation

The *Supplier* submits one hardcopy and one electronic version of all documentation described below on delivery of the *goods* to the *Employer* for acceptance within five (5) calendar days of being performed.

- a) All BS EN 10204 Type 3.1 Material Certificates as described in Section 8.1.2 and 8.1.3.
- b) All radiographic test reports as described in Section 8.1.5.2.
- c) All penetrant test reports as described in Section 8.1.5.3.
- d) Calibration certificates.
- e) A drawing and dimensional check sheet indicating all relevant final machined dimensions of the components listed in Table 1. This must include check sheets.
- f) A completed and signed-off quality control plan certificate.
- g) All test certificates of the tests performed on the manufactured components.

## 8.10 Completion

Completion is when the following has been done by completion date:

- a) The *Supplier* has done everything required to provide the *goods*.
- b) The *Supplier* has delivered the *goods*, and the *goods* are accepted by the *Employer*.
- c) The *Supplier* has provided all as-built documentation described in Section 8.9.2 and is accepted by the *Employer*.
- d) The *Supplier* submitted all other docs as required to the *Employer* for acceptance.

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## 9. REQUIREMENTS FOR THE PROGRAM

- a) The *Supplier* submits a quality control plan (which may include a Gantt chart) detailing how the goods are manufactured with a timeline included to the *Employer* for acceptance as part of the tender returnable documents.
- b) The *Supplier* submits the finalized program and quality control plan within one week after purchase order placement.
- c) The program and quality control plan indicates the start date, completion date and duration of each activity.
- d) The *Supplier* indicates the following on his program and quality control plan submitted to the *Employer* for acceptance:
  - The time required from notification of work (contract award) to obtaining material.
  - Manufacturing of the *goods*.
  - Final inspection of the *goods*.
  - Delivery to the *Employer's* Site (Eskom Drakensberg Pumped Storage Scheme, Jagersrust, Kwa-Zulu Natal, South Africa)
  - Statutory and other non-working days included in the contract period and occurring just after the contract period.

## 10. SERVICES AND OTHER THINGS PROVIDED BY THE *EMPLOYER*

The *Employer* provides the following to the *Supplier*.

### 10.1 Crane

A crane is available in the *Employer's* power station machine hall. The *Supplier* ensures that all necessary arrangements and preparations are made for the use of this crane in terms of letting the *Employer* know when to expect delivery.

### 10.2 Area for site establishment and storage

The *Employer* indicates a storage yard to the *Supplier*.

**Note:** All other services and things needed to provide the *goods*, is supplied by the *Supplier*.

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