

	<b>Scope of Work</b>	<b>Generation: Kriel Power Station</b>
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Title: **Scope of Work to Conduct Safety Valve Refurbishment on the Feed Heating Plant at Kriel Power Station**

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**System Engineer:  
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## **1. INTRODUCTION**

Kriel Power Station feed heating system makes use of four Low-Pressure Heaters, and two banks of High-Pressure Heaters (two High Pressure heaters per bank), and two deaerator storage tanks on each of its six units.

The Low-Pressure heaters (single-shell type) are used to heat the main condensate stream flowing from the condenser to the deaerator storage tank, to improve the efficiency of the turbine cycle. The condensate is heated by means of bled steam extracted from the turbine.

Two deaerators (A&B) are utilised to deaerate and heat the feedwater. They are mounted on the two feedwater storage tanks from which the water flow throughout the whole plant is controlled.

The High-Pressure Heaters assist in heating the feedwater flowing from the deaerator storage tanks to the economiser (boiler). The feedwater is heated by IP bled steam (HP Heater 6) and from the Cold Reheat (HP Heater 7).

The feed heating system consists of safety valves on the steam and water supply systems. The purpose of this document is to provide technical information that will outline the requirements for a safety valve refurbishment contract for the feed heating system at Kriel Power Station, for a period of 5 years.

## **2. SUPPORTING CLAUSES**

### **2.1 SCOPE**

The document outlines requirements for a safety valve refurbishment contract for the feed heating system at Kriel Power Station, for a period of 5 years.

#### **2.1.1 Purpose**

The purpose of the document is to define the technical requirements for Contractors to tender for a contract with a duration of 5 years.

#### **2.1.2 Applicability**

This document shall apply to Kriel Power Station's Feed Heating System.

### **2.2 NORMATIVE / INFORMATIVE REFERENCES**

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

#### **2.2.1 Normative**

[1] OHS Act 85 of 1993: Occupational Health and Safety Act, 85 of 1993.

[2] Pressure Equipment Regulations

[3] SANS 347: South African National Standard 347 (SANS)

[4] PD 5500: Specification for unfired fusion welded vessels

[5] EN13480: Metallic Industrial Piping

[6] 240-105658000: Supplier Quality Management: Specification.

[7] OPR 3305: Plant Safety Regulations.

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[8] SANS ISO 9000: SANS Quality Standards.

[9] 32-136: Contractor Health and Safety Requirements.

[10] ISO 3834: Quality Requirements for Welding

### **2.2.2 Eskom Standards**

[11] 240-154283718: Pressure Equipment Regulations Compliance Manual

[12] 240-75426899: Feedheating Health Care Standard

[13] 240-69258336: Pressure Relieving Safety Devices Standard

[14] 240-166574085: Safety Valve Inspection Refurbishment Testing Procedure

[15] 240-84979413: Maintenance and Repair of High Temperature and High Pressure Valves and Fittings

### **2.2.3 Informative**

[1] BBC Main Turbine manual AF.

[2] Valves for Steinmuller-Benson-Boiler.

## **2.3 DEFINITIONS**

<b>Definition</b>	<b>Description</b>
<b>Design Pressure</b>	The gauge pressure used in the design formulae to determine the dimensions of the component parts of the pressure equipment.
<b>Design Temperature</b>	The temperature used in the design formulae to determine the dimensions of the component parts of the pressure equipment.
<b>Maintenance</b>	Repair and replacement of components to endure the reliable operation of the plant and conformance to statutory legislation
<b>Outage</b>	Planned down-time for a specific power station Unit. An outage is a maintenance opportunity, during which outage scope of work is executed.
<b>Pressure Accessory</b>	Devices with an operational function having pressure-bearing housing.
<b>Pressure Equipment</b>	A steam generator, pressure vessel, piping, pressure accessory and safety accessory, transportable gas container, and fire extinguisher and includes, but is not limited to an accumulator, a hot-water geyser and hyperbaric chambers.
<b>Pressure Relieve Valve</b>	Is a spring operated valve that operates by means of static upstream pressure against a spring. The opening travel is in proportion to the pressure increase to operating pressure. The Relief Valves are designed to relieve excessive pressure in systems containing incompressible fluids.
<b>Pressure Vessel</b>	Is a housing designed and manufactured to contain a fluid/gas under a design pressure equal to or greater than 50 kPa.
<b>Safety accessory</b>	Is a device designed to protect pressure equipment
<b>Safety Relief Valve (PRV)</b>	Is a spring operated pressure relief valve that can be used either as relief valve or safety valve depending on application.

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<b>Safety Valve</b>	Is a spring operated valve that operates by means of static upstream pressure against a spring. The opening is characterised by rapid action or “popping” and mostly used for compressive fluids. The valves are designed to provide immediate relief of over-pressure for any fluid (compressible fluids like: air, gasses, steam) which could cause an explosion if over-pressurised.
<b>Set Pressure</b>	Pressure at which the safety valve / accessories / pressure relief devices is set to lift, protecting the pressure equipment on which it is installed against exceeding its design pressure.
<b>Trevi-Test / Hydro setting</b>	Is a method (online verification and setting) of functionally testing mechanically operated safety valves to protect pressure equipment from over-pressurization.
<b>Valve Parts / Components</b>	Valve internal components/parts exclude the body and bonnet. The valve internal components/parts are generally the spindle, disk, nozzle, springs, bushes, flow guides, adjusting rings lock nuts and spring end plates/steps to name a few.

### 2.3.1 Disclosure Classification

**Controlled Disclosure:** Controlled Disclosure to external parties (either enforced by law, or discretionary).

### 2.4 ABBREVIATIONS

<b>Abbreviation</b>	<b>Description</b>
AIA	Approved Inspection Authority
DA	Deaerator Vessel
HP HEATER	High Pressure Heater
LP HEATER	Low Pressure Heater
NDE	Non-Destructive Examination
PER	Pressure Equipment Regulation
PRV	Pressure Relief Valve
QA	Quality assurance
QCP	Quality control plan
SANS	South African National Standard
SOW	Scope of work

## 3. TECHNICAL REQUIREMENTS

### 3.1 SYSTEM LIMITS

This scope of work is limited to the safety valves listed in the table below:

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**Table 1: Applicable Safety Valves**

Valve No	Valve Description	Size	Manufacturer	Set Pressure (MPa)	Temp (Degrees Celsius)
RL71S401	HP HTR A BNK SAFETY RELIEF FW V/V A	25 MM	Sempell	25	230
RL72S401	HP HTR B BNK SAFETY RELIEF FW V/V A	25 MM	Sempell	25	230
RL71S402	HP HTR A BNK SAFETY RELIEF FW V/V B	40 MM	Sempell	25	260
RL72S402	HP HTR B BNK SAFETY RELIEF FW V/V B	40 MM	Sempell	25	260
RF62S406	HP HTR 6B SHELL RELIEF V/V	100-150 MM	Sempell	2.5	430
RF71S406	HP HTR 7A SHELL RELIEF V/V	65-100 MM	Sempell	5.0	410
RF72S406	HP HTR 7B SHELL RELIEF V/V	65-100 MM	Sempell	5.0	410
RF71S406	HP HTR 6A SHELL RELIEF V/V	100-150 MM	Sempell	2.5	430
BSV 415	LPH 3 STM SIDE RELIEF V/V	50-75 MM	Sempell	0.58	163
BSV 420	LPH 4 STM SIDE RELIEF V/V	50-75 MM	Sempell	0.58	252
CV 408	LPH 1 WATER SIDE RELIEF V/V	50-75 MM	Sempell	3.65	80
CV 410	LPH 2 WATER SIDE RELIEF V/V	50-75 MM	Sempell	3.65	88
CV 414	LPH 3 WATER SIDE RELIEF V/V	50-75 MM	Sempell	3.65	117
CV 419	LPH 4 WATER SIDE RELIEF V/V	50-75 MM	Sempell	3.65	146
BSV 424 A/B	DEAERATOR SAFETY VALVE	300-350 MM	Sempell	1.13	180
BSV 425 A/B	DEAERATOR SAFETY VALVE	300-350 MM	Sempell	1.13	180
BSV 426 A/B	DEAERATOR SAFETY VALVE	125-200 MM	Sempell	1.13	180

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### 3.2 REFURBISHMENT REQUIREMENTS

#	Requirement
1	Conduct an inspection on the safety valves. This inspection should be conducted by the Contractor, Turbine Engineer and Turbine maintenance personnel. The intention of this is to agree on the defects and the corrective actions. Scope to be then issued by Turbine Engineer.
2	Transport valve/s to the <i>Contractor's</i> workshop from the prearranged location at Kriel Power Station. The valves must be transported using "gagging" devices (locks the valve spindle in place, preventing seat vibration, and this device must be supplied by the contractor) and strapped down on soft dampening material to ensure they are not damaged during transportation.
3	Disassemble valve/s. The contractor is accountable for the valve parts, any missing or lost valve parts will be replaced at the contractor's cost. Every safety valve (components) must be stored in an individual disassembly bin/container, in which all the parts can be stored safely.
4	Clean valve body and all components
5	Conduct a visual inspection of the valve body and trim components, inspect for damage and wear. Findings must be photographed (visual damage) and sent to Kriel Turbine Engineering for written approval to repair.
6	Compile a quality control plan (QCP) for each valve that contains the required activities as per the scope. Additional work requirements may be included if the contractor deems it necessary, pending written approval from Kriel Turbine Engineering.
7	Each valve must have a service book, containing all reports, valve lift pressure setting certificate and graphs, hydraulic pressure test bench gauge certificate, spare part documentation and the QCP as a minimum. A copy of this service book must be submitted to Kriel Turbine Engineering in hardcopy and digital format, once the valve refurbishment is completed.
8	Using a spring stiffness test bench, record the spring stiffness for each spring in the valve, compare the recorded spring stiffness values to that of the OEM, and include this report in the service book. The contractor may use their own spring stiffness test bench or outsource the spring stiffness testing (SANAS approved calibration certificates will be required).
9	<p>Execute the valve specific scope as per Turbine Engineering issued scope and preapproved additional work. The activities performed at this point include but is not limited to:</p> <ul style="list-style-type: none"><li>– Lap, Blue and grey the valve disks and nozzles seats.</li><li>– Valve spring stiffness test</li><li>– Non-destructive testing (MPI and DPI) on valves operating above 400°C.</li><li>– Soft spares replacement: gasket and seal element (O-rings, preform gaskets, packing etc.) replacement (soft spares are supplied by the contractor, the specification of all soft spares used must be approved by Eskom for each valve type and application).</li><li>– Record the valve seat ID, venturi nozzle vena contracta ID, plug diameter and plug length as a minimum.</li><li>– Valve component replacement – OEM spare parts only, Eskom approval required on all new spares.</li><li>– Valve component refurbishment – Turbine Engineering pre-approval required</li></ul>

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	(this includes machining of valve components, welding-general, welding -hard facing seal faces). Any welding work will be executed by an entity with ISO 3834 certification.  – Serial number stamping on exhaust flange and bonnet flange (this is done if the valve does not have a serial number, or if the existing serial number is unclear)
10	Assemble the valves
11	Using a certified hydraulic pressure test bench set the valve lift pressure as specified in Table 1. The Kriel Turbine Engineer, Quality representative and on-site authorized inspection authority (AIA) must be present during the valve lift pressure setting.
12	Install a tamper-proof lead seal and a valve lift pressure setting plate, the plate must contain the name of the company that did the pressure lift setting, the date at which the setting was done, the set pressure and valve serial / KKS number. The lift pressure setting plate must be stamped by the Kriel on-site AIA.
13	Install dust covers on the inlet and outlet flanges of the valve
14	Transport valve to the prearranged location at Kriel power station. The valves must be transported using “gagging” devices (locks the valve spindle in place, preventing seat hammering, and this device must be supplied by the contractor) and strapped down on soft dampening material to ensure they are not damaged during transportation.

#### 4. AUTHORISATION

This document has been seen and accepted by:

Name	Designation
[REDACTED]	Senior Technician – Turbine Maintenance
[REDACTED]	Senior Advisor – Turbine Plant Technical Support
[REDACTED]	Kriel Engineering Manager
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#### 5. REVISIONS

Date	Rev.	Compiler	Remarks
April 2023	0	[REDACTED]	First Issue
June 2023	1	[REDACTED]	Document finalised and issued

#### 6. DEVELOPMENT TEAM

The following people were involved in the development of this document:

- A Rudman
- M Amir

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## **7. ACKNOWLEDGEMENTS**

- A Rudman
- M Amir

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