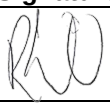
Document Type	User Requirement Specification
Scope of Activity	User Requirement Specification for Kendal in-situ valve seat machining/grinding.
Purpose	Valve seats need to be machined/ground in-situ due to welded construction in plant and seat wear.

Compiled		
Name/Designation	**Signature**	**Date**
J. Visagie – Design Engineer		2022/01/21

Authorised		
Name/Designation	**Signature**	**Date**
R. da Veiga Engineering Manager		25/7/2022

Revision Details		
Date	**Revision**	**Area**

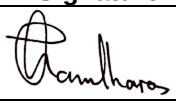
Accepted		
Name/Designation	**Signature**	**Date**
A. Rambharos – Snr Design Engineer		21/01/2022
Jai Singh – Snr Works Engineer		24/01/2022
Njabulo Mpanza – On site machining		07/02/2022

TABLE OF CONTENT

1. INTRODUCTION / SCOPE

Kendal High Pressure (HP) Governor Valve (GV) seat was damaged, and refurbishment is required to bring it back to Original Equipment Manufacturer (OEM) specification. In-situ machining of the valve seat in the valve body is required. A tool needs to be designed, manufactured and qualified, which could either be used at Eskom Rotek Industries (ERI) workshop in Rosherville or on site at Kendal Power Station.

2. ASSIGNMENT OF RESPONSIBILITIES

2.1 Services for which the owner (ERI) is responsible

1) Clear interfaces of the valve need to be provided or any other interfaces required by the awarded contract company.
2) Material specification of the valve and stellite seat.

2.2 Services to be performed by the owner's (ERI) designee

1) Each phase needs to be signed off by the owner's designee and the end user who will perform the work before progressing to the next phase.

2.3 Boundaries of Jurisdiction

1) ERI is not responsible for Professional Engineer approval and responsibility of design.

3. REFERENCES

3.1 Standard Codes and Specifications

Occupational Health and Safety Act

ISO 9001:2008 Quality management systems - Requirements

SANS 13849-1:2013 Safety of machinery - Safety-related parts of control systems Part 1: General principles for design

SANS 61010 Safety requirements for electrical equipment for measurement, control, and laboratory use Part 1: General requirements

SANS 61326-1: 2007 Electrical equipment for measurement, control and laboratory use - EMC requirements Part 1: General requirements

3.2 Design Input Documents

None.

3.3 Design Input Models

Only basic CAD models and sketches of the valve spindles and valve seats will be made available to the chosen contractor.

4. COMPONENT DESCRIPTION

4.1 Overview

A tool is required to be able to do in-situ machining or grinding of Kendal steam valves. The tool needs to be able to fit various different valves, depths of machining and different seat profiles. The operation that is required for the tool is as follows:

1. Removing of the stellite section in the valve seat, up to the butter layer. The detail of the stellite size and location is shown in section 4.2.1. (Note, dimensions shown in this document are for information and quotation only).
2. Welding of new stellite (not part of this scope to be performed, but need to take note of the action due to possible second site establishment and setup of equipment). Various removal and setup of the equipment might be required to clean inter pass welding layers.
3. Reintroduce or machine the seat profile as shown in section 4.2.1.

The general assembly of the seat within the valve body, together with valve body geometry is shown in section 4.2.2. For more specific information on each valve, see Table 1.

During the execution of the work the following must be considered:

- Both the emergency stop valve and control valve is located in the same valve chest, 90 degrees apart. For both Figure 9 and Figure 10 the control valve is vertically located the stop valve is horizontally located.
- PCD of the bolt holes on the valve body which could be used to secure the machine.
- The seat location in the valve from the top of the valve body
- While setting up machine the following geometric tolerance need to be adhered to:
    - Runout to inlet of valve and seat location within 0.03mm
    - Concentric from inlet of valve to seat location within 0.05mm
    - Perpendicular to inlet of valve to seat landing within 0.5 degrees

4.2 Valve details

4.2.1 Stelite seat interface

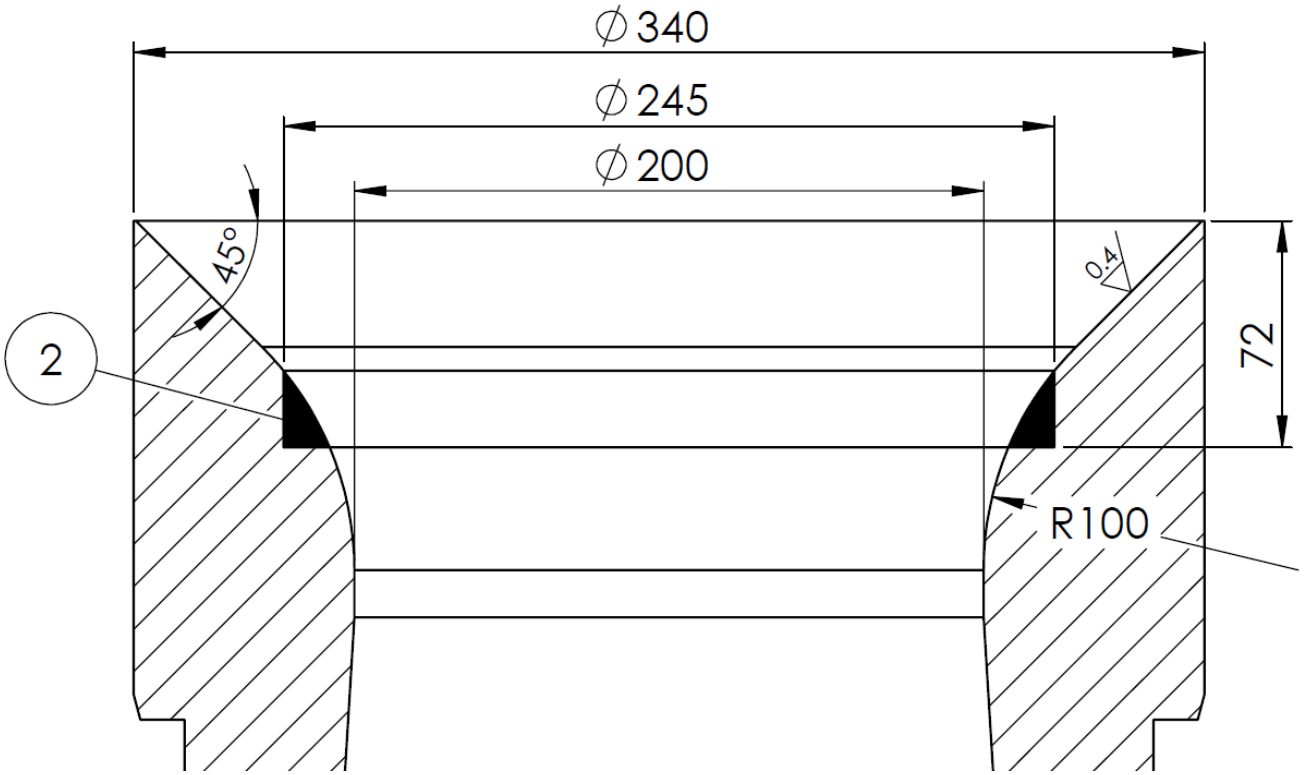


Figure 1: Stellite section (item 2) of HP control valve seat

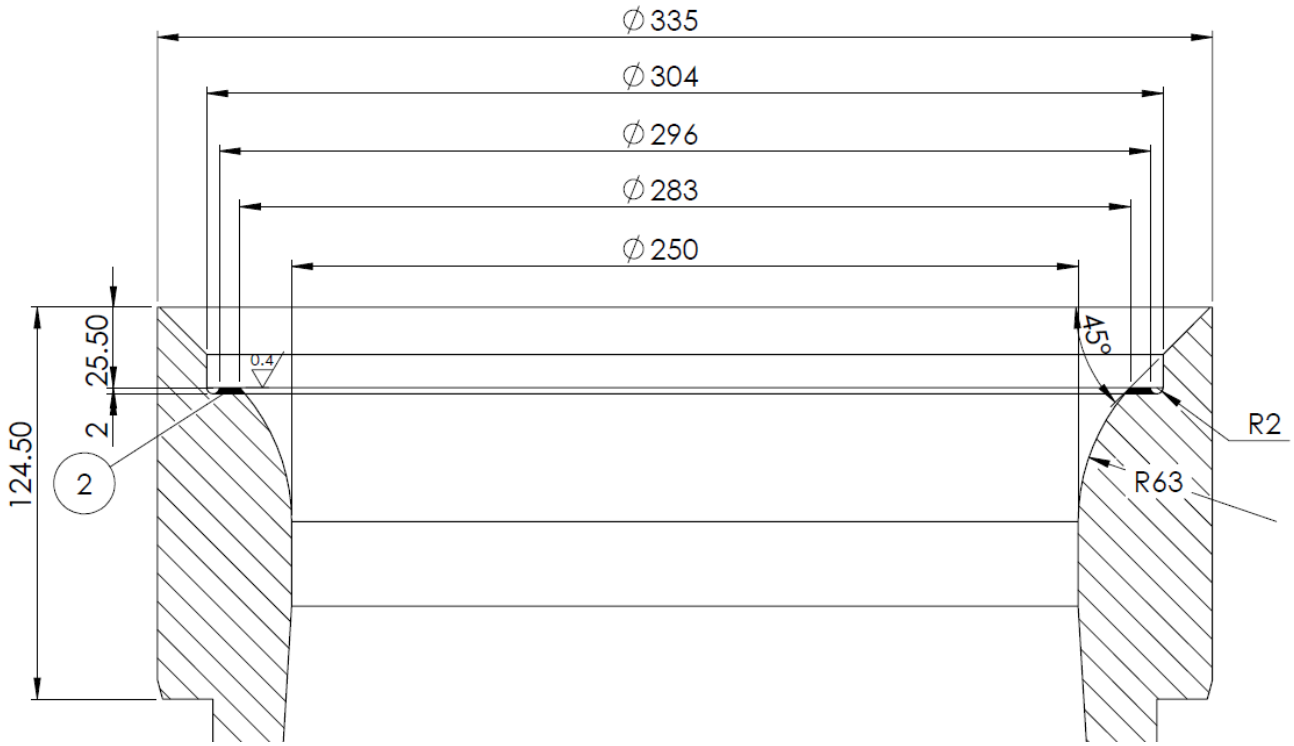


Figure 2: Stellite section (item 2) of HP emergency stop valve seat

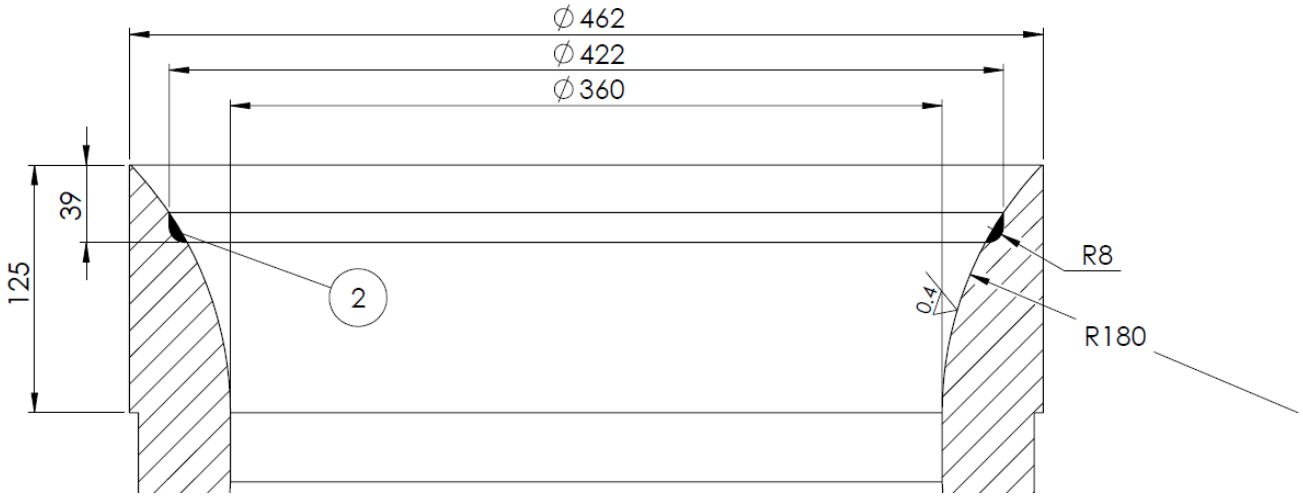


Figure 3: Stellite section (item 2) of IP control valve seat

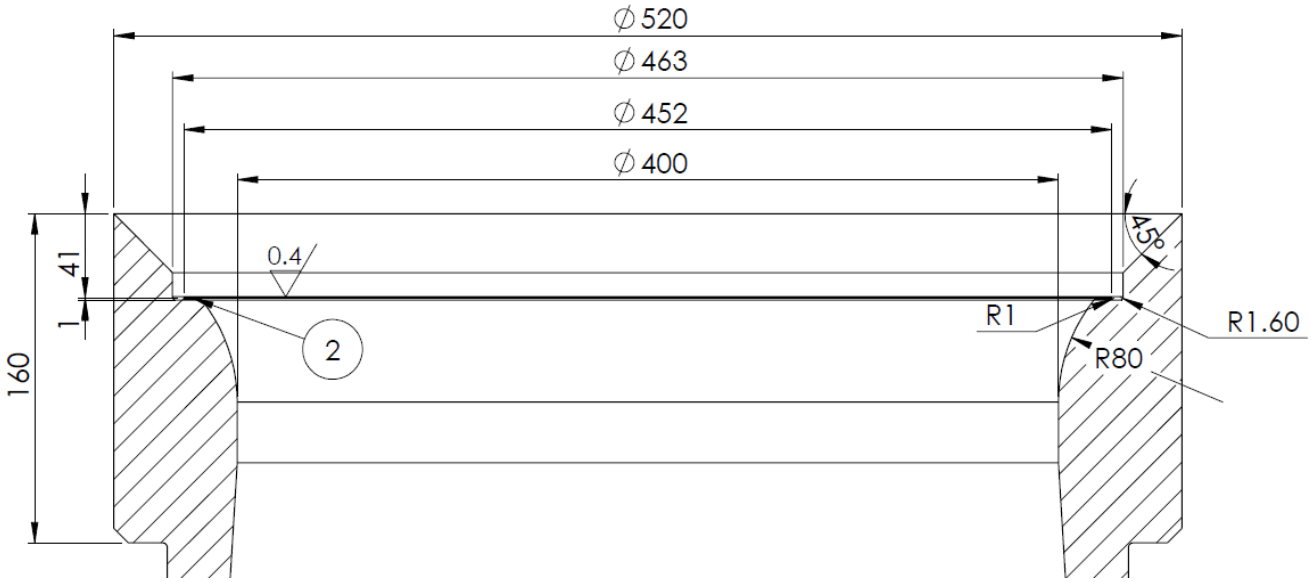


Figure 4: Stellite section (item 2) of IP emergency stop valve seat

4.2.2 General assembly of valve

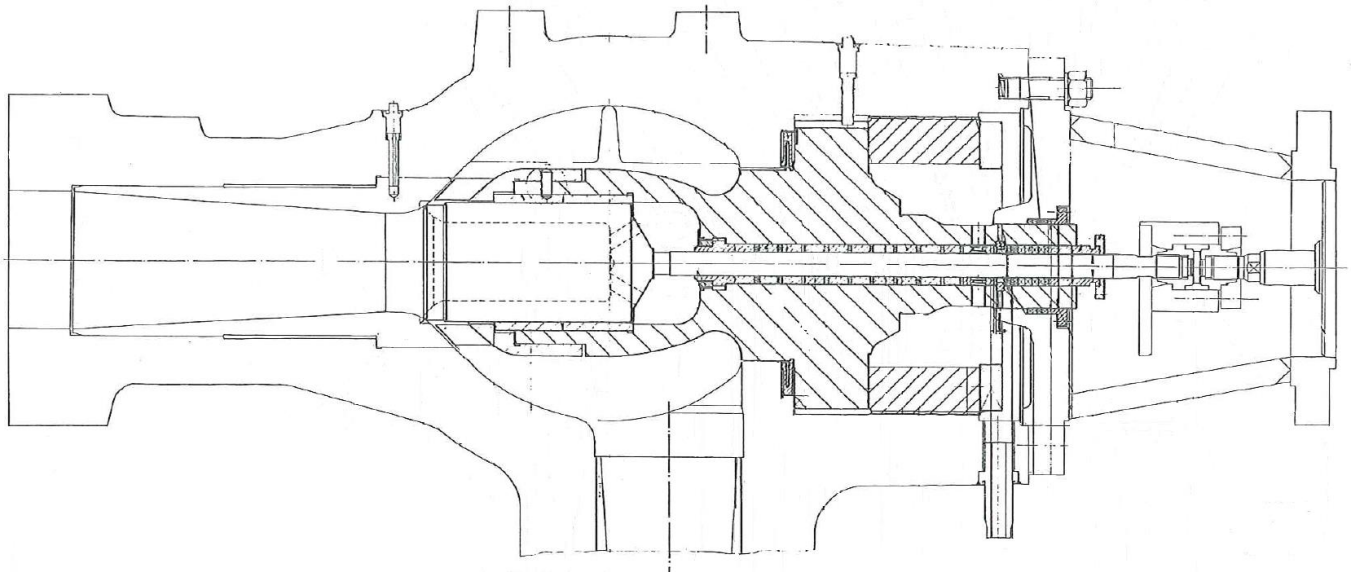


Figure 5: General assembly of HP Control valve

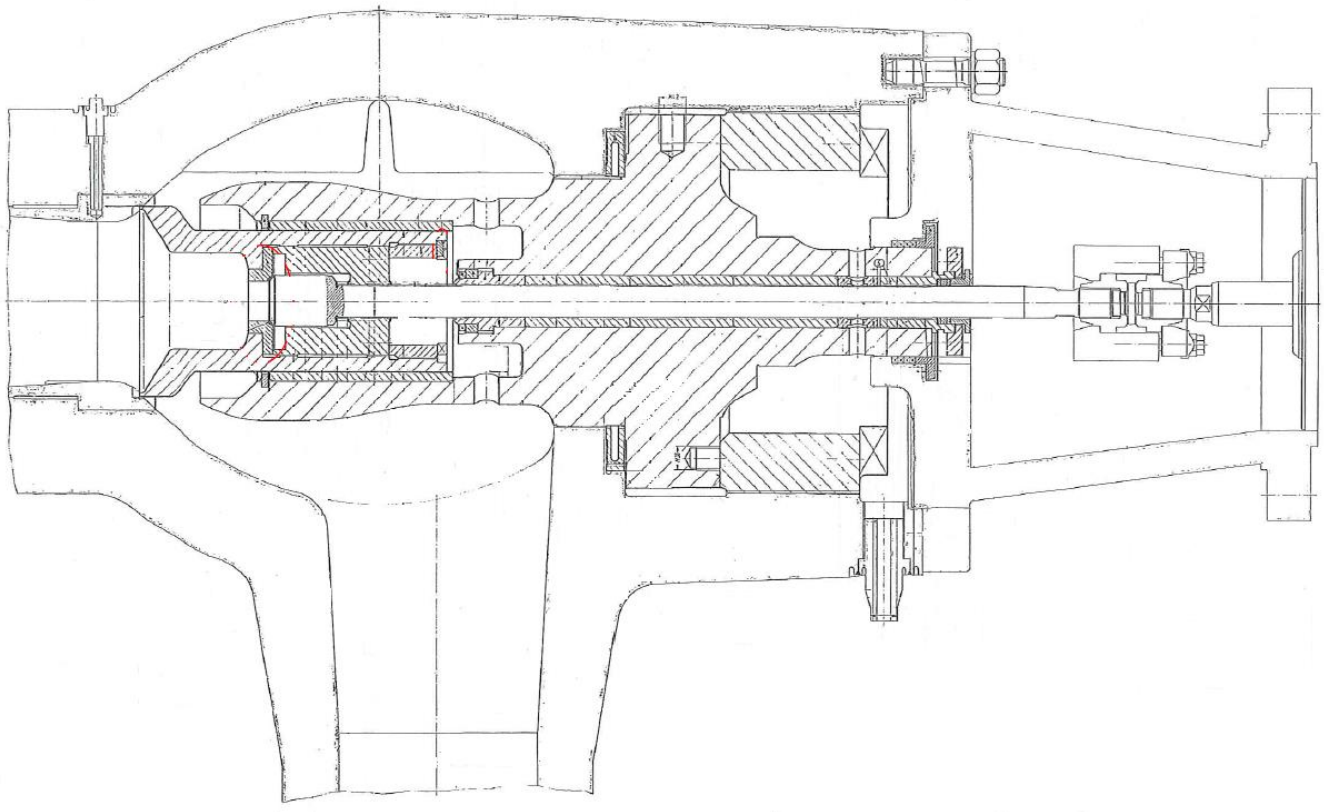


Figure 6: General assembly of HP emergency stop valve

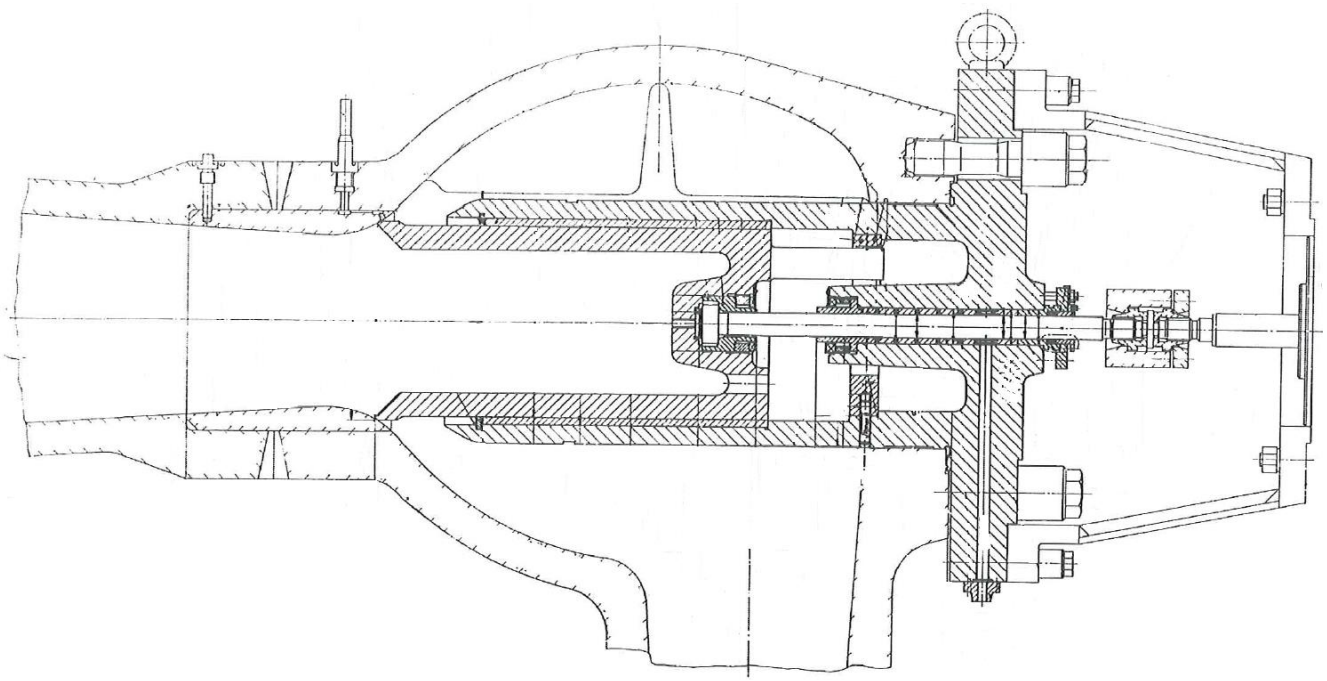


Figure 7: General assembly of IP Control valve

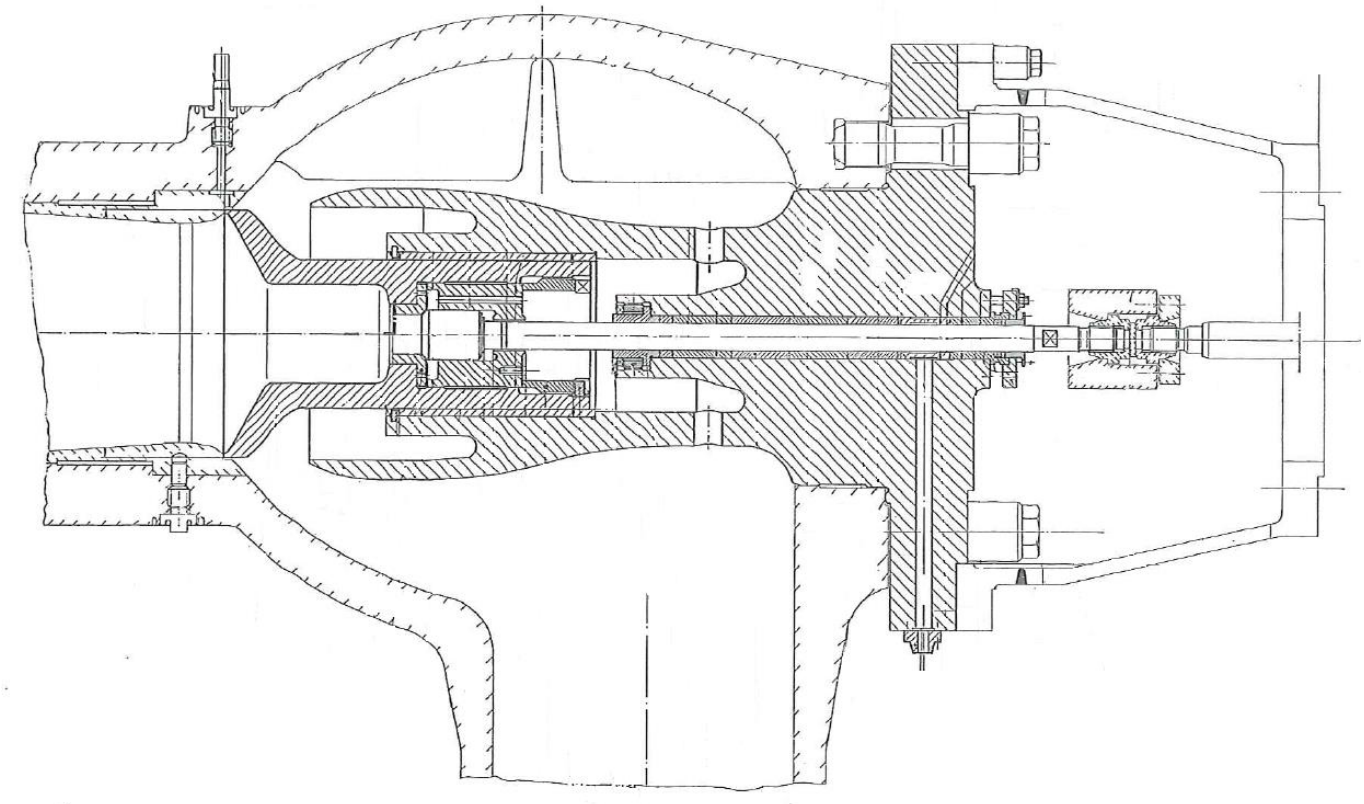


Figure 8: General assembly of IP emergency stop valve

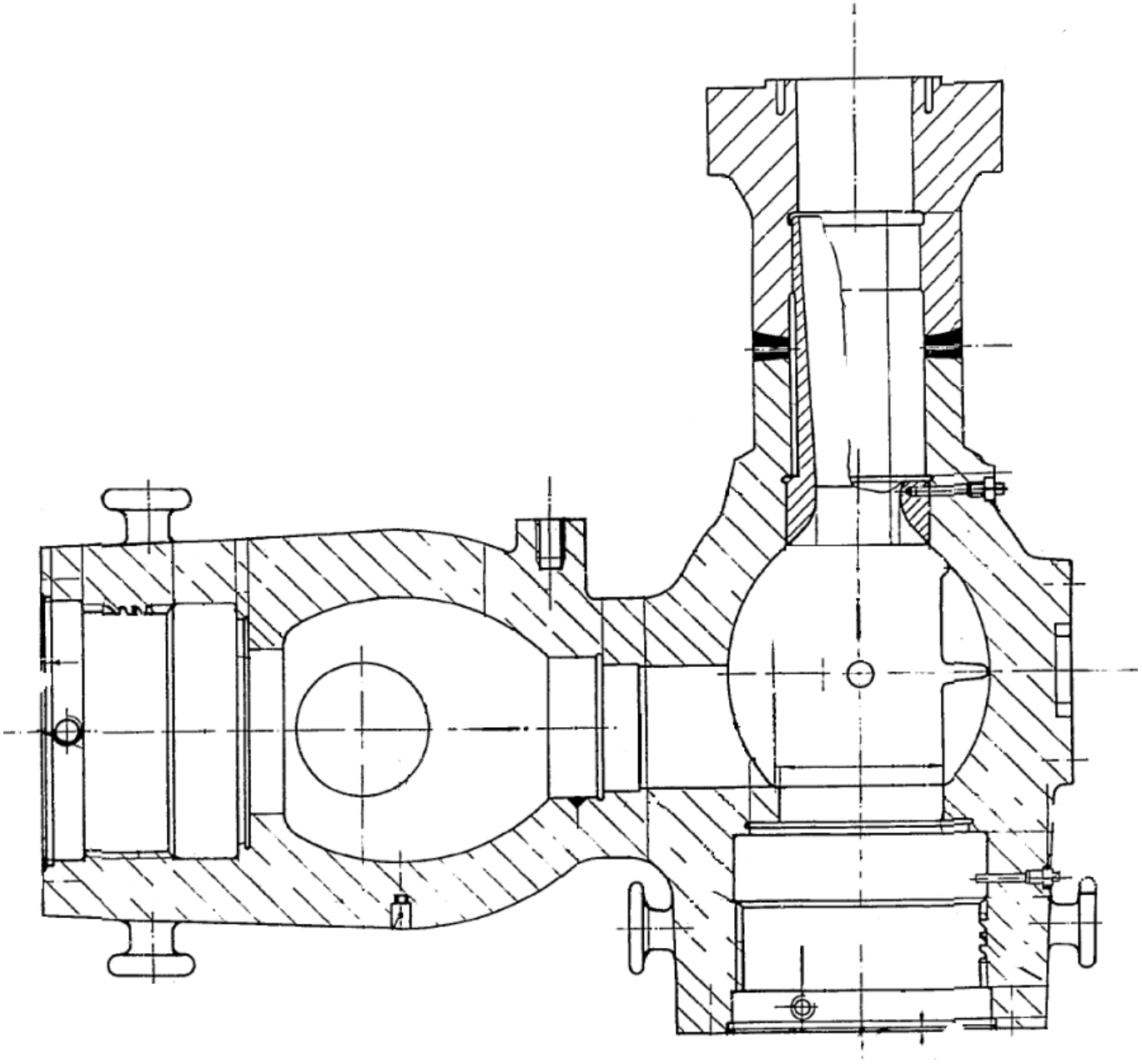


Figure 9: HP valve chest

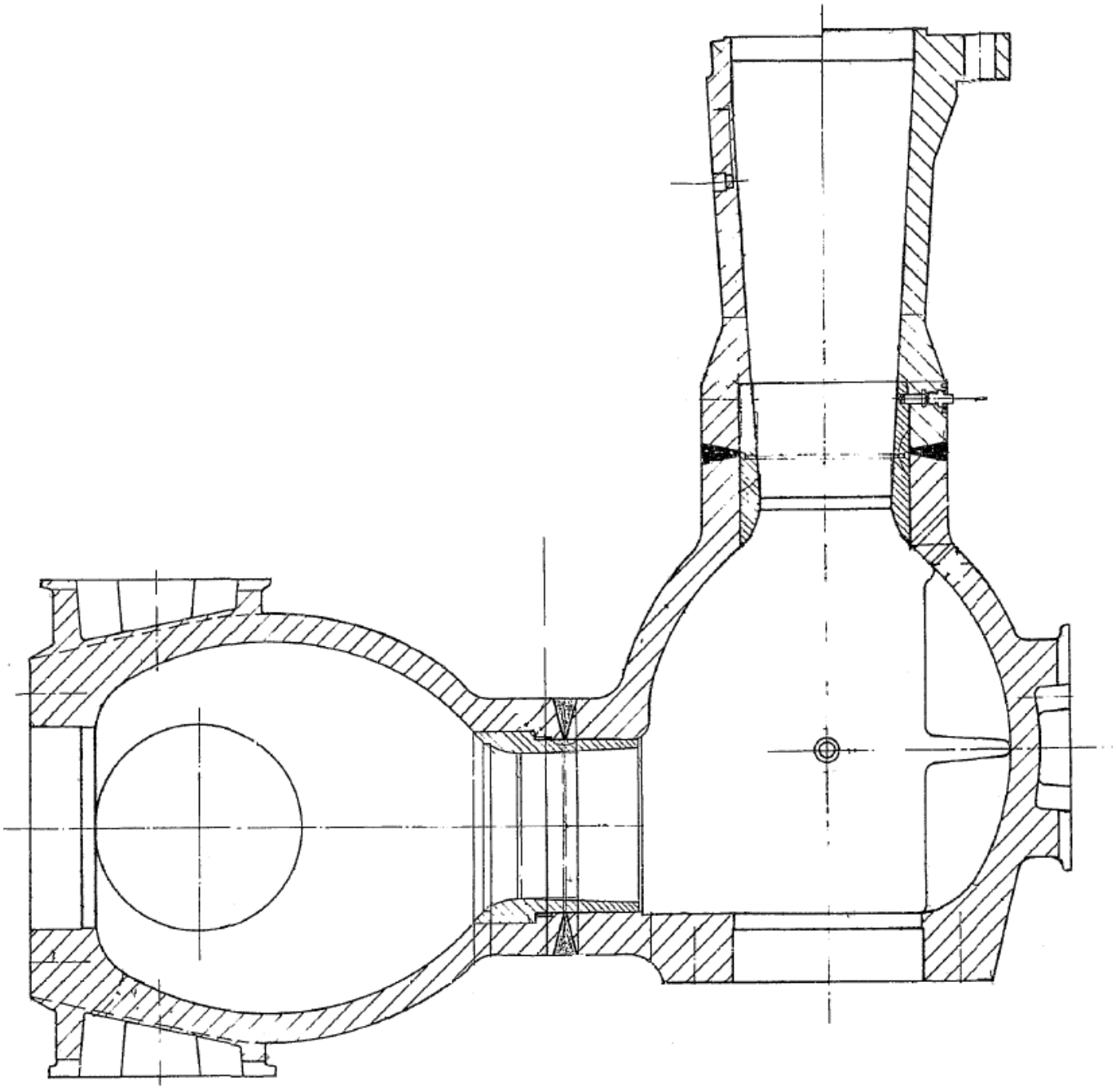


Figure 10: IP Valve chest

Table 1: Valve specifications

	HP control valve		IP control valve	HP stop valve	IP stop valve
Bolt details of valve body	16x M42 equi-spaced on 790 PCD	16x M80x6 equi-spaced on 790 PCD	16x M42 equi-spaced on 790 PCD	16x M80x6 equi-spaced on 790 PCD	
Approximate length from top of valve body to seat [mm]	1225	1240	1242	1242	
Throat diameter [mm]	200	360	250	400	

5. REQUIREMENTS

5.1 Functional Requirements

5.1.1 Classification

TEE-L-833-1 The equipment shall be designed in accordance with all the relevant requirements of the Occupational Health and Safety Act.

5.1.2 Control Requirement

TEE-L-833-2 The implemented control system shall be capable of manual and semi-automatic operation.

TEE-L-833-3 Semi-automatic can be seen that after machine is setup and checks have been done to ensure that axis is concentric; the equipment may take various cuts to ensure input parameters is met.

TEE-L-833-4 The equipment shall be capable of centralizing the cutting axis centre to the valve within a diameter of 0.05 mm.

TEE-L-833-5 The equipment shall be capable of centralizing the cutting axis perpendicular to the valve seat within 0.5 degrees.

TEE-L-833-6 The equipment shall be capable of moving axially in the valve to cut any of the reference surfaces as mentioned in section 4.2, within the required tolerances.

TEE-L-833-7 The surface roughness to be achieved need to be Ra of 0.4 µm on the seat.

TEE-L-833-8 Any values or limits indicated in this specification that are considered unattainable/unsuitable/unrealistic, shall be brought to the attention of the Design Engineer or representative of ERI for discussion.

TEE-L-833-9 Any requirements not specified in this document but deemed necessary/useful by the supplier shall be added as an optional extra in the final quotation.

5.1.3 User Interface Requirements

TEE-L-833-10 The equipment needs to able to be adjusted on micron level increments and have clear visual indication / feedback to the user of the amount that the tool is moving.

TEE-L-833-11 The control system shall have a physical user interface. The user interface shall have a clear indication, that is easily readable of where the tool is and give feedback to the operator. This may even include capability of displaying CAD data, preloaded into software.

5.1.4 Safety

TEE-L-833-12 The equipment shall have no unsafe features. Special consideration shall be given to the following aspects:

- Where applicable, it shall not be possible for any of the rigging gear such as slings, chain blocks, etc. to become detached during a lifting operation.
- All parts of the equipment weighing more than 20kg will have lifting points which can be used for installation and assembly with a crane or jib crane.
- There shall be no sharp edges or corners on any component that can come into contact with personnel during a lifting operation.
- Pinch points shall be avoided where possible. Where unavoidable, clear signage shall indicate any hazards.

TEE-L-833-13 Any potential hazards that can be caused by misuse shall be identified and, where possible, mitigated. The lockout/tagout procedures specified by the Occupational Health and Safety Act shall be incorporated in the design of the system.

TEE-L-833-14 Operators shall be trained in the appropriate handling, loading, lifting, transportation, assembly and operating procedures. Training manuals shall be provided.

TEE-L-833-15 All electrical components shall be listed, approved or registered with a recognised testing laboratory to ensure that the components meet suitable standards that will prevent catastrophic failure.

TEE-L-833-16 The system shall be provided with manual “Emergency Stop” buttons which disconnects all power to the machinery, equipment and process in a safe manner.

TEE-L-833-17 Accidental powering of outputs shall be prevented. This shall be achieved through the use of external devices, independent of the electrical controlling devices to provide protection for any part of the

mechanical/hydraulic system that may cause personal injury or damage.

TEE-L-833-18 An orderly system shutdown shall be included in the design. This must ensure that, if a fault is detected or the Emergency Stop is actuated, the system will return to a fail-safe position and the equipment/process stopped, in a safe manner. Any loss of feedback signal shall result in a system shutdown to a fail-safe state.

TEE-L-833-19 Good electrical grounding principles shall be incorporated in the design, construction an installation process. Protective devises shall be incorporated to minimise any fire risk. Electrical noise shall be kept at a minimum to prevent interference with the measurement equipment.

TEE-L-833-20 All enclosures and cabinets that have energized circuits shall be secured to prevent unauthorized access.

TEE-L-833-21 Where possible, equipment shall not be sensitive to high current, or high frequency noise or magnetism. Any sensitive equipment shall be adequately shielded to prevent reading inaccuracies.

TEE-L-833-22 Safety requirements and guidance on the principles for the design and integration of safety-related parts of control systems shall adhere to the requirements of SANS 13849-1:2013, SANS 61010 (latest) and SANS 61326-1: 2007, or equivalent standards.

5.2 Performance Requirements

TEE-L-833-23 Lifting test to be performed on all lifting points with certificates supplied

TEE-L-833-24 100% NDT to be done on all lifting points with reports supplied.

TEE-L-833-25 If welding is required on the equipment NDT need to be done to ensure that weld is safe.

5.3 Physical Requirements

TEE-L-833-26 Adequate approved and safe lifting equipment shall be used, where applicable, in the lifting, transporting and positioning of the equipment.

TEE-L-833-27 The size of the equipment should be considered for handling, and light enough to be carry by one person (less than or equal to 20 kg), if required to be carried by a person.

TEE-L-833-28 Ergonomics must be considered for operation of equipment.

5.3.1 Working Conditions

a) Position

TEE-L-833-29 Equipment should be able to be operated at any angle of the valve. Valves can be positioned horizontally or vertically in the plant.

b) Temperature

TEE-L-833-30 The material allowable temperature limit is typically 600°C for the valve body and about 500°C for the stelite seat section. General operation of the equipment shall not exceed this temperature limit.

c) Humidity

TEE-L-833-31 The equipment must be designed and manufactured to be used anywhere in South Africa and not be affected by humidity changes.

d) Shock Loading / Vibration levels

TEE-L-833-32 The equipment must be able to handle normal transportation and working conditions without losing accuracy or calibration. Proper transportation boxes must be supplied with the machine. These boxes must have designed and certified lifting points as well as anchor points for transportation.

e) Noise Levels

TEE-L-833-33 Normal ear plugs must be adequate to protect the user and other employees in the vicinity of the machine when being used.

f) Corrosion and Protective Coating

TEE-L-833-34 Storage and preservation instructions for the machine must be supplied. All painting to comply to Eskom paint specification 240-106365693, condition CPS 03 and machine cream colour code.

5.4 Quality Assurance

TEE-L-833-35 The suppliers of all components/systems quality management system shall provide proof of adherence to ISO 9001:2008 or equivalent standard.

TEE-L-833-36 Each data pack shall be approved by ERI.

TEE-L-833-37 Hold and witness points during the manufacturing phase shall be identified before the phase is started. .

TEE-L-833-38 A proof-of-concept demonstration needs to be carried out with the equipment before final acceptance and sign-off of the order or phase.

5.5 General Requirements

5.5.1 General

TEE-L-833-39 The equipment shall be designed, certified, tested and assembled/manufactured for the safe operation of valve seat machining or grinding.

5.5.2 Input Devices

TEE-L-833-40 The system shall incorporate at least 2 RTD thermocouples with a minimum temperature range of 0-100°C ± 0.5 °C. The thermocouples shall measure the ambient temperature as well as component temperature. This information must be used for accuracy compensation when machining/grinding is done, and the temperature is not at 22 °C.

TEE-L-833-41 The system shall incorporate RVDTs or similar equipment to measure the angular displacement. This should be used to check the perpendicular constrained to ensure that the tool is operated in the valve axis within 0.5 degrees.

TEE-L-833-42 The equipment should be powered from a standard single / three phase socket and then distributed to other equipment via a distribution board.

TEE-L-833-43 All input devices shall be suitable for the required application in terms of specified operating voltage, sensing distance, force applied to actuator, current requirements, ambient and operating temperatures, humidity range and all pertinent environmental considerations.

5.5.3 Material

TEE-L-833-44 Appropriate material for the design application shall be selected and recorded in the design report. All material certificates are to be included in the data pack.

5.5.4 Inspection and Testing

TEE-L-833-45 An inspection and test plan shall be prepared prior to commissioning of the equipment. This test plan shall include a calibration check with the required calibration pieces (supplied), which will be used every time before the machine is used.

6. SPECIFIC DESIGN REQUIREMENT

6.1 Deformation Limit

TEE-L-833-46 The equipment shall not deform/deflect more than the required specifications that the cut that needs to be achieved for the valves. Accuracy as requested above must be achieved under all operating conditions.

6.2 Other limits

TEE-L-833-47 The equipment shall have a minimum design life of 40 years.

TEE-L-833-48 Hardware and software if applicable need to be considered and should be accessible for the design for the duration of the design life.

TEE-L-833-49 The duty cycle for the equipment will be 3 outages per year, refurbishing 4 valves per outage and 8-10 cycles of installation and setup of the machine per valve.

6.3 Design Report

TEE-L-833-50 A design report shall be compiled by the supplier. The report shall detail the design philosophy followed, state the standard with which the design complies and include any calculations, design load or analyses that were performed.

TEE-L-833-51 The design report and drawings shall be done before manufacturing may commence and ERI Engineer need to review and agree with content. Once agreed the report and drawings shall be signed as acceptable and returned to the supplier.

TEE-L-833-52 All manuals and plans shall be subject to a similar review and approval process before final payment is made.

TEE-L-833-53 Detail drawings and CAD files shall be supplied. Ownership of design with ERI.

7. FABRICATION

7.1 Tolerances

TEE-L-833-54 The tool should be designed such that it meets the manufacture tolerances as specified in section 4.1.

8. HANDLING AND TRANSPORT

8.1 Handling Tools

TEE-L-833-55 All special tools required for the assembly use and calibration of the tool must be supplied with the machine,

8.2 Transport Requirements

TEE-L-833-56 Proper transportation boxes must be supplied with the machine. These boxes must have designed and certified lifting points as well as anchor points for transportation.

8.3 Storage instruction

TEE-L-833-57 Provision shall be made for the equipment to be able to be stored for long periods while not in use. Storage instructions to be supplied.

9. INSTALLATION REQUIREMENTS

TEE-L-833-58 Any special calibration requirements need to be stipulated and recorded. Special calibration tools to be supplied.

10. MAINTENANCE AND SUPPORT REQUIREMENTS

10.1 Maintenance

TEE-L-833-59 A maintenance plan/procedure shall be prepared and certified. This should include maintenance intervals.

TEE-L-833-60 Any special tools required for maintenance of the equipment shall be supplied.

10.2 In-service Inspection

10.3 Manuals

TEE-L-833-61 A user manual/operating procedure shall be prepared and certified.

TEE-L-833-62 All documentation should be supplied with at least one hardcopy as well as electronically, for backup purposes.

11. COMMERCIAL REQUIREMENTS

The project will be done in phases and the prospective suppliers must quote for each phase. At the end of each phase, verification of completeness will be evaluated by ERI and the supplier will be able to invoice ERI for the phase before the next phase may be started.

The phases will be as follows:

1) **Concept and design phase**

ERI Engineers and technical personnel need to be part of the development phase of the tool.

2) **Development and Manufacturing**

3) **Training and Manuals**

Once off training of personnel, who will operate the equipment will be required as well as relevant manuals. Manuals must include maintenance requirements for the machine.

4) **Implementation and Handover**

During implementation phase, an actual valve will be machined to prove the design and to aid with a practical use of the machine. After handover the machine will be ERI property.

A detail quote is required for the full scope of work.

This quote should indicate timelines as well as cost for the different phases for the development of such a tool if none is available.

Provisional time limits for the different phases should be as follow:

1) Concept and design phase – 3 months
2) Development and Manufacturing – 2 months
3) Training and Manuals – 2 weeks
4) Implementation and Handover – 2 weeks

12. APPENDIXES

12.1 Tender Evaluation

A technical evaluation will be performed on all tenders to ensure that they meet the minimum criteria and thresholds. The criteria are shown in Table 2. Please ensure that proof of items below are submitted with the tender.

Table 2: Technical criteria

Eskom Rotek Industries

TECHNICAL EVALUATION CRITERIA

Kendal in-situ valve seat machining tool

Description:
A tool is required to be able to machine Kendal valves in-sito on site or in the workshop

Requirements	**Weighting Criteria [%]**	**Evaluation criteria [points]**
References of previous machine design projects to demonstrate capability in profile cutting / grinding within tolerance of 0.025mm (at least 2)	10%	Provided 2 = 10 Provided 1 = 5 Provided none = 0
References of previous manufacturing projects with high tolerance parts to demonstrate capability to excecute manufacturing (at least 2)	10%	Provided 2 = 10 Provided 1 = 5 Provided none = 0
Provide referances of previous work where work was done on sterlite material (at least 2)	10%	Provided 2 = 10 Provided 1 = 5 Provided none = 0
Provide methode statement of how tool will be installed, setup and operated, based on scope of work provided.	20%	Provided and accepateble = 25 Provided and not acceptable = 0 Not provided = 0
Provide statement on how design will be conducted and basic elements which will be used for the machine / tool. For example tooltip and holder, read outs, adjustment tools to achieve fine adjsutment required	20%	Provided and accepateble = 25 Provided and not acceptable = 0 Not provided = 0
Provide at least: 1x Mechanical Engineer CV with Profesional Engineering registration with ECSA 1x Electrical Engineer CV with Profesional Engineering registration with ECSA.	20%	Provided and accepateble = 20 Provided and not acceptable = 5 Not provided = 0
Timelines for project phases.	10%	Within time limits = 10 15% over time limits = 5 More than 15% over or not provided = 0
Total Score (MINIMUM THRESHOLD 75%)	**100%**	

Comments:

Compiled by: Johan Visagie **Date:** 2022/01/13

Checked by: Akash Rambharos **Date:** 2022/01/21