Eskom	Scope of Work	Camden Power Station

Title: **Turbine Welding and Maintenance Service Contract - 5 Years**

Scope of Work

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Area of Applicability:	**Turbine Plant**
Functional Area:	**Engineering** **Maintenance and Outage**
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Content

1. INTRODUCTION

This document serves the purpose of defining the technical scope of work associated with the initiation of a **Turbine Welding and Maintenance Service Contract** for the Camden Power Station. The contract, spanning a duration of **5 years**, aims to establish comprehensive maintenance and welding services to ensure the optimal functioning of the power station's turbine plant during both routine maintenance and outage periods.

1.1 SCOPE

This document establishes the prerequisites for a contractor that will be stationed at Camden Power Station, to be deployed on an as-needed basis for Maintenance and Outage-related tasks, with a primary focus on welding and mechanical activities pertaining to the turbine plant. The overarching objective is for the contractor to furnish the essential Maintenance and Outage resources and equipment throughout the contract's duration at Camden Power Station, deploying these resources as needed.

1.1.1 Purpose

The aim of this scope of work is to define a comprehensive set of requirements, providing a qualitative specification for contractors to bid on. Contractors are invited to tender if they meet the stipulated requirements outlined throughout this document.

1.1.2 Applicability

This document is compiled for the purpose of an open tender, but its application is restricted solely to Camden Power Station.

1.2 NORMATIVE/INFORMATIVE REFERENCES

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

1.2.1 Normative

[1] OHS-Act	Occupational Health and Safety Act 85 of 1993 (OHS-Act)
[2] PER	Pressure Equipment Regulation (PER)
[3] SANS 347	South African National Standard 347 (SANS)
[4] PD 5500	Specification for unfired fusion welded vessels
[5] EN 13445	Unfired Pressure Vessels
[6] EN13480	Metallic Industrial Piping
[7] AD-2000	Technical rules for pressure vessels (TRB) / AD-Merkblatter
[8] ISO 3834	Quality requirements for Welding
[9] ISO 9001	Quality Management System

[10]	ASME Section I	Rules for construction of power boilers
[11]	ASME Section VII	Recommended guidelines for the care of power boilers
[12]	ASME Section VIII	Rules for construction of pressure vessels (divisions 1-3)
[13]	ASME Piping Codes	B31.1 – Power Piping, B31.3 – Process Piping
[14]	ASME PCC-2	Repair of Pressure Equipment and Piping
[15]	BS EN 16991	Risk-based Inspection Framework
[16]	ASME PCC-3	Inspection Planning Using Risk-based Methods
[17]	ASME 31.12	Hydrogen Piping and Pipelines

1.2.2 Eskom Standards

[18]	240-106628253	Standard for Welding Requirements on Eskom Plant
[19]	QM 58	Supplier Contract Quality Requirements Specification
[20]	240-56239129	High Energy Pipework Standard for Eskom Power Plants
[21]	240-5629133	High Pressure Pipework Supports Standard
[22]	240-56247004	Thermal Insulation Standard
[23]	240-56239129	High Energy Pipework Standard for Eskom Plant
[24]	240-43156827	Introduction to welding rulebook
[25]	229 – 11836	Camden Tube Leak Detection Procedure on LP Heaters and Drains Cooler
[26]	229 – 11839	Tube Leak Repair Procedure on LP Heaters
[27]	240-74778484	HP Heater Tube Plug Procedure
[28]	240-4892948	Tender Technical Evaluation Procedure
[29]	240-42045807	Off-Load Condenser Tube Leak Repairs (Condensate System)
[30]	240-89147446	Instrument Piping for Fossil and Hydro Power Plant Standard
[31]	240-123801640	Standard for Low Pressure Pipelines
[32]	240-83539994	Standard for Non-Destructive Testing (NDT) on Eskom Plant
[33]	240 - 54937751	Annual On-Load Inspection - Turbine Pressure Vessels

1.2.3 Informative

[34]	BS 806	Specification for design and construction of ferrous piping installations for and in connection with land boilers

1.3 DEFINITIONS

Definition	Description
Maintenance	Repair and replacement of components to endure the reliable operation of the plant and conformance to statutory legislation. Maintenance is conducted on plant areas that has been isolated, or when a short opportunity is granted, usually weekends.
Manufacturer	Means any person who has overall control and is responsible for the construction of the pressure equipment
Modification	means any change to the original design conditions of pressure equipment, including re-rating, or the addition or removal of elements that could affect the integrity of the pressure equipment, and a) *Component replacement with different material types is deemed a modification.* b) *Component replacement with different material grades or the replacement of obsolete materials can be deemed as a modification, depending on the rules and requirements of the applicable health and safety standard or in-service health and safety standards.*
Outage	Planned down-time for a specific power station Unit. An outage is a maintenance opportunity, during which outage scope of work is executed.
Repair	means restoration to original standard by the application of heat or welding to any pressure equipment, or the replacement of expanded tubes, and in the case of non-metallic equipment it means the application of heat, welding, solvent cement, laminate or curing of thermo-set. *Component replacement with different material grades or the emplacement of obsolete materials can be deemed as a repair where no changes to the original design are affected. The repair shall be in accordance with the rules and requirements of the applicable health and safety standard or in-service health and safety standards.*

1.4 ABBREVIATIONS

Abbreviation	Description
ADM	AD-Merkblatter (Design code)
AFC	Approved For Construction
AIA	Approved Inspection Authority
ASME	American Society of Mechanical Engineers
C&I	Control & Instrumentation

Abbreviation	Description
CDT	Clean Drains Tank
CEP	Condensate Extraction Pump
CUT	Continuous Ultrasonic Testing
CW	Cooling Water
DMS	Documentation Management System
ECSA	Engineering Council of South Africa
ECTE	Eskom Camden Turbine Engineer
EN	European Norm (Design Code)
FAC	Flow Acceleration corrosion
GO	General Overhaul
GTAW	Gas Tungsten Arc Welding
HP	High Pressure
ID	Inside Diameter
LP	Low Pressure
MPI	Magnetic Particle Inspection
NDE	Non-Destructive Examination
NRV	Non-Return Valve
NT	Total Number of Tubes (Vessel)
OC	Outage Coordinator
PD	Published Document (Design Code)
PER	Pressure Equipment Regulation
PMI	Positive Material Identification
PO	Purchase order
PSV	Parallel Slide Valve
PT	Penetrant Testing
PTW	Permit to work
Pr. Eng.	Professional Engineer (Registered with ECSA)
QCP	Quality Control Plan
RFT	Raw Feed-Water Tank
RT	Radiographic Testing
SE	System engineer
SMAW	Shielded Metal Arc Welding

Abbreviation	Description
SME	Subject Matter Expert
SOW	Scope of work
UT	Ultrasonic Testing
WRR	Weld Reject Rate
WT	Wall Thickness

1.5 SUMMARY OF REVISION CHANGES

Date	Rev.	Compiler	Remarks/ Changes
2024-09-09	02	A. Rudman	Updated signatories
2024-09-03	01	A. Rudman	First revision for review

2. TECHNICAL REQUIREMENTS

2. The original piping code of construction for the turbine plant piping was BS 806. However, all repairs and modifications at Camden will be carried out in accordance with EN 13480.

2.1 SYSTEM LIMITS

2.1.1 Feedwater System

2.1.1.1 Feedwater and Associated Piping Systems (EN 13480 Piping)

- Feedwater Piping - Deaerator feed water outlet Nozzle (pipe to nozzle weld) to Final Feed Water Isolation Valve outlet (pipe to valve weld).
- Vessel Distillate Piping *(vessels listed under 2.1.1.2)*
- Bled Steam Supply Lines to Vessels *(vessels listed under 2.1.1.2)*
- Vessel Vent, Drain, Impulse, Level indication lines *(vessels listed under 2.1.1.2)*
- Piping vent lines, drain lines, welded valves, flanges, and pipe fittings included for each of the piping systems mentioned above.
- Feedwater pumps, cooling and lubrication systems.

2.1.1.2 Feedwater Vessels

- BFP Suction Strainer – A (RSA/CI/OHSA / ASME VIII vessels)
- BFP Suction Strainer – B (RSA/CI/OHSA / ASME VIII vessels)
- High Pressure Heater 1 (PD5500/ADM vessels)
- High Pressure Heater 2 (PD5500/ADM vessels)
- High Pressure Heater 2 Flash Box (PD5500/ADM vessels)
- High Pressure Heater 3 (PD5500/ADM vessels)

2.1.2 Condensate System

2.1.2.1 Condensate and Associated Piping Systems *(EN 13480 Piping)*

- Condensate Piping – Connection to Condenser (flanged connection) hot well to the Deaerator (including all de-aeration vessels).
- Vessel Distillate Piping *(vessels listed under 2.1.2.2)*
- Bled Steam Supply Lines to Vessels *(vessels listed under 2.1.2.2)*
- Vessel Vent, Drain, Impulse, Level indication lines *(vessels listed under 2.1.2.2)*

- Piping vent lines, drain lines, welded valves, flanges, and pipe fittings included for each of the piping systems mentioned above.
- Extraction pumps cooling and lubrication systems.

2.1.2.2 Condensate Vessels

- Air Ejector – A (RSA/CI/OHSA / ASME 8 vessels)
- Air Ejector – B (RSA/CI/OHSA / ASME 8 vessels)
- Condenser Flash Box (EN 13445 / PD5500 vessels)
- Deaerator East and West (PD 5500 vessels)
- Deaerator Feedwater Tanks East, Centre, and West (PD 5500 vessels)
- Deaerator Vent Condenser (PD 5500 vessels)
- Drains Cooler (PD 5500 vessels)
- Gland Steam Condenser (PD 5500/ EN 13445 vessels)
- Gland Steam De-Superheater (PD 5500/EN13445 vessels)
- HP Drains Vessel (PD 5500/EN13445/EN13480 vessels/piping)
- Low Pressure Heater 1 (PD 5500 vessels)
- Low Pressure Heater 1 Flash Box (PD 5500/EN13445 vessels)
- Low Pressure Heater 2 (PD 5500 vessels)
- Low Pressure Heater 2 Flash Box (PD5500/EN13445 vessels)
- Water Extraction Condenser (PD5500/EN13445 vessels)
- Reserve Feedwater Tank
- Clean Drains Tank
- Main Condenser

2.1.3 Cooling Water System

2.1.3.1 Cooling Water and Associated Piping Systems *(EN 13480 Piping)*

- Cooling water Ducting
- Cooling water supply and return lines to equipment in the plant (i.e. lubrication oil coolers, generator stator coolant, H2 Coolers etc.)
- Piping vent lines, drain lines, welded valves, flanges, and pipe fittings included for each of the piping systems mentioned above.
- Cooling water strainers
- The oil and cooling system for the CW – Pumps.

2.1.4 Auxiliary Piping

2.1.4.1 Demineralized Water and Associated Piping Systems

- Unitised demineralised water make-up and dumping piping, including vents and drains.
- Common Demineralised water supply range

2.1.4.2 Hydrogen Piping Systems

- Unitised Hydrogen station piping
- Hydrogen manufacturing system and common supply range piping

2.1.5 Main Turbine and Generator System

2.1.5.1 Main Turbine and Generator Piping *(EN 13480 Piping)*

- Turbine Drain and leak-off piping.
- Turbine Gland Steam Piping
- Turbine and Generator Lubrication Oil Piping
- Generator Stator Cooling Piping
- Generator Seal Oil Piping
- Turbine Control oil system
- Impulse lines to turbine steam admission piping and casing
- Turbine LP-HP cross over piping.
- Turbine dowels and keys (structural welding)
- Piping vent lines, drain lines, welded valves, flanges, and pipe fittings included for each of the piping systems mentioned above.

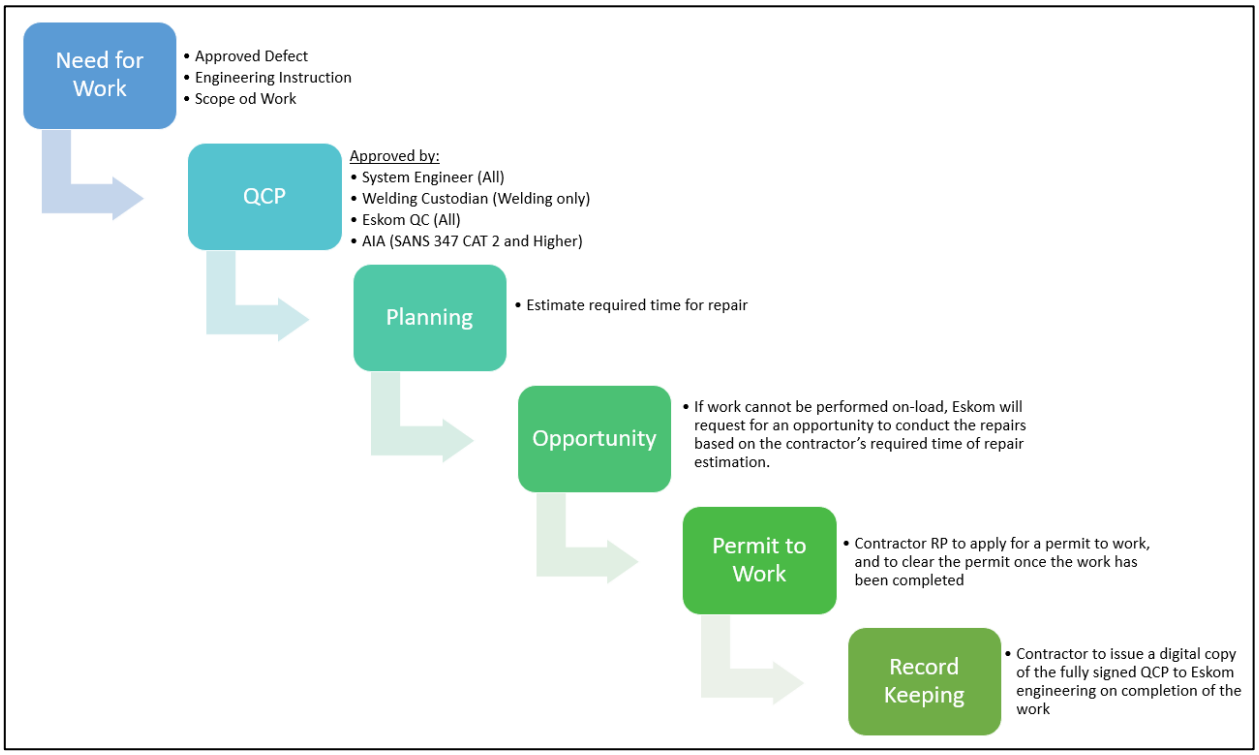
2.1.5.2 Main Turbine and Generator Vessels *(EN 13480 Piping)*

- Seal oil coolers (EN13445 vessels, PD5500 vessels)
- Lubrication oil coolers (EN13445 vessels, PD5500 vessels)
- Lubrication oil tank
- Stator coolant tank, Resin Coulomb, and filters

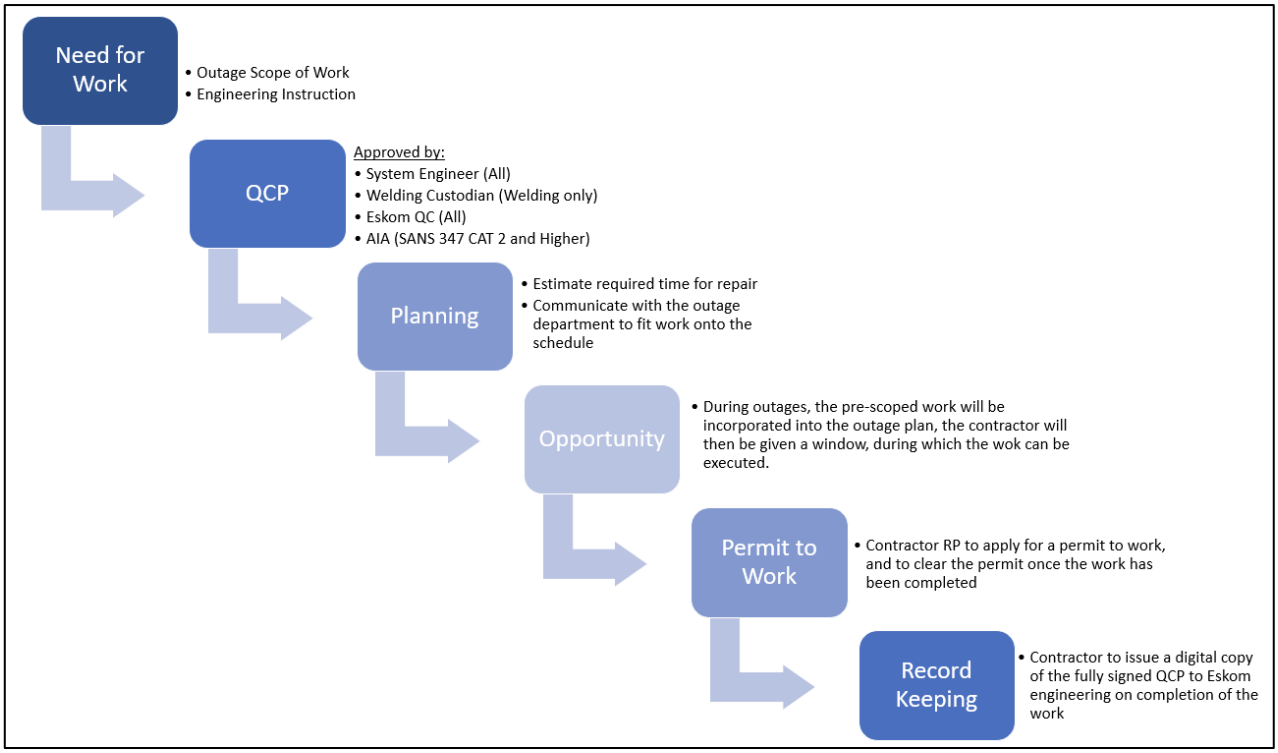
2.2 CONTRACT ACTIVITIES

PSR Training	The contractor is required to guarantee that an adequate number of their personnel are trained and qualified in accordance with Eskom Plant Safety Regulations (PSR), enabling proficient application and acceptance of work permits. Eskom employs a permit-to-work system to ensure the safe execution of tasks, and it is the full responsibility of the contractor to arrange for their personnel to undergo the Eskom Plant Safety Regulation Course immediately upon tender award. Throughout the contract's duration, the contractor must ensure that a satisfactory number of personnel remain trained and qualified in accordance with Eskom PSR.
Routine plant Inspections	The contractor is obligated to conduct weekly plant inspections to identify and report any defects. Furthermore, annual visual inspections of the pressure vessels must be carried out in strict adherence to the prescribed procedure: 240 – 54937751.
Perform Welding Activities	The core purpose of the contractor is to perform welding activities. The contractor will use Eskom turbine engineering instructions or approved defect notifications to compile a quality control plans (QCP) for the welding work. Each welding QCP must be approved (before any work is done) by Eskom Turbine Engineering and the Turbine Welding Custodian. The welding QCP for SANS 347 category 2 and higher rated equipment must be approved by the Authorised Inspection Authority (AIA). After completion of the welding work, a digital copy of the fully signed-off QCP must be given to Eskom Turbine Engineering.
Perform Mechanical Activities	The contractor is additionally tasked with executing mechanical work, encompassing, but not restricted to: – Removing equipment from the plant through cutting and loosening fasteners. Hydraulicly and mechanically torquing fasteners to precise torque specifications. – Rigging and moving heavy (ton-range) industrial equipment. – Precision cutting and installing gaskets. – Conducting pressure tests on vessels and piping. – Surveying and adjusting piping hanger support. – Heat treatment (welding and mechanical) – Plate Cutting and Rolling – Plasma Cutting – Pipe bending – Thread cutting – Drilling (magnetic base drill) – Heat treatment (post weld heat treatment & heating to remove close fit equipment.

2.2.1 Maintenance Activity Flow:



2.2.2 Outage Activity Flow:



2.3 BASE/CORE CREW AND OTHER RESOURCE REQUIREMENTS

2.3.1 Base / Core Crew Requirements

- Companies performing welding related activities on Eskom plant shall have accreditation to ISO 3834 Part 2 – Comprehensive that is valid for the construction standards specified under Section 2.1 of this document.
- Throughout the contract duration, the contractor is required to sustain a core crew stationed at the Camden Power Station.
- The contractor will be provided with a workshop where the core crew can be stationed.
- The base crew is supervised by the *contractor*, a two shift (12-hour shift) program shall be implemented to ensure personal availability during afterhours, and will consist of the following personnel:

Description of Labour [A3]	**Quantity: 1st Shift**	**Quantity: 2nd Shift**	**Total**
Site Manager	-	-	1
Site Foreman	-	-	1
SHE Officer	-	-	1
Welding Supervisor [A1]	-	-	1
Storeman	-	-	1
Data Capturer	-	-	2
Boiler Maker	1	1	2
Fitter - Mechanical	2	2	4
Fitter - Piping	2	2	4
Foreman - Piping	1	1	2
Quality Coordinator	1	1	2
Semi-Skilled Labourer (Mechanical)	2	2	4
SHE officer	1	1	2
Welder (Plate, Fillet and pipe qualification required)	1	1	2
Welding Inspector [A2]	1	1	2
Rigger	1	1	2

NOTES:

[A1] Required Qualification: Either IWS or IWP is acceptable, with the following requirements: IWS in line with IIW document IAB-252R2-14 or latest version, or IWP in line with IIW document IAB-252R2-14 or latest version.

[A2] Any of the following is acceptable: SAIW welding and fabrication Inspector Level 2, IIW International Welding Inspector: Comprehensive (IWI- C) or IIW International Welding Inspector: Standard (IWI-S).

[A3] The contractor must hold valid an ISO 3834 Part 2 – Comprehensive certificate valid for the construction standards listed under Section 2.1 of this document to be able to tender for this contract (see Section 2.8).

The qualification requirements for the ***Welders, Welding Coordinator, Welding Supervisor, and Welding Inspector*** are set out in the *Eskom* ***Standard for Welding Requirements on Eskom Plant: 240-106628253.***

- Any changes to the base/core crew submitted for tender evaluation, must be communicated, and approved by the Eskom *Contract Service Manager* in writing.
- The Base / Core Crew must be equipped with all the required tools and equipment to perform the work; this is *the contractor's responsibility*.
- The Core / Base crew may be utilised for other related tasks within the skill set of the labourers should they be available during the normal working hours.
- *For Outages* additional resources may be required in addition to the core crew on a temporary basis. The *Contractor* must motivate for additional recourses using the outage SOW and duration as basis for the motivation. The contractor may only employ additional resources after the additional resource request has been reviewed and accepted by the contract manager and a Task Order for the project or work is issued to this effect.

2.3.2 Engineering Requirements

The contractor shall have access to the following engineering capabilities:

- Provide Technical Advice, Engineering & Design support "as and when" required for the following:
- Welding Coordinator (Welding Engineer / Technologist). Required Qualification: Either IWE or IWT is acceptable, with the following requirements: IWE in line with IIW document IAB-252R2-14 or latest version, or IWT in line with IIW document IAB-252R2-14 or latest version. The IWE or IWT shall be registered with ECSA as Professional Engineer/Technologist.
- Compiling and reviewing repair method statements in accordance with design standards.
- Component detailed design calculations in accordance with design standards.
- Pipe Stress analysis (CAESAR II®)
- Finite element analysis in accordance with design standards.
- Isometric, general arrangements, detail, and fabrication drawings

- Erection mythology statement for component replacements and modification
- Rigging / blocking method statements including calculations (temporary blocking frames).

For all engineering activities, Eskom Camden Turbine Engineering (ECTE) must be supplied with completed design packs, including but not limited to design calculations, design drawings, layouts drawings, stress analysis etc. The engineering work carried out by the contractor for Eskom plant, belongs to Eskom, this is the intent of the contract.

2.3.3 Design Standards

The contractor shall have a copy of the latest versions of the following design standards in their possession:

[1] PD 5500	Specification for unfired fusion welded vessels
[2] EN 13445	Unfired Pressure Vessels
[3] EN13480	Metallic Industrial Piping
[4] AD-2000	Technical rules for pressure vessels (TRB) / AD-Merkblatter
[5] ASME Section VIII	Rules for construction of pressure vessels (divisions 1-3)
[6] ASME Piping Codes	B31.1 – Power Piping, B31.3 – Process Piping
[7] ASME PCC-2	Repair of Pressure Equipment and Piping
[8] ASME 31.12	Hydrogen Piping and Pipelines

2.3.4 Drafting Services

- On an ‘as and when’ required basis, contractor must have access to drafting services that can produce drawings as specified in *Section 2.7.*

2.4 PLANNED OUTAGE SCHEDULE

Outage Description	Abbreviation	Outage Duration [Estimated Days]	Planned Outages for Contract Duration (5 years)
General Overhaul	GO	180	6
Mini-General Overhaul	MGO	56	6
Interim Refurbishment	IR	21	6
Opportunity Maintenance	OM	10	6

2.5 SPARES

- It is the responsibility of the *contractor* to supply, store and manage all the consumables required for them to perform the activities detailed in this document. PPE is the responsibility of the contractor.
- The contractor shall supply and maintain their welding and manufacturing equipment. (ISO 3834-2 requirements)
- Eskom will provide material (piping, plate, valves etc.) with the required material certification; it is the responsibility of the contractor to keep copies of the material certification related to the material in a filing system where it is easily accessible.

2.6 CONTRACTORS EQUIPMENT AND TOOLING

The contractor is required to possess and maintain their own equipment, ensuring it adheres to the highest standards, specifically in accordance with ISO 3834-2, throughout the entire contract period. The necessary equipment for the contractor's tasks can be determined based on the specifications outlined in this document.

2.7 DRAWING REQUIREMENTS

Camden continuously updates documentation and drawings in line with the actual footprint of the plant. In cases where drawings do not exist it will be required from the contractor to compile drawings that can be used for future reference as and when required.

It is required for all replacement work and new installations to include a drawing that indicates the components that were replaced / installed, to be included in the QCP / data pack.

All the drawings that are generated by the appointed contractor during the period of this contract, will belong to Camden power station. The contractor does not have the right to add any proprietary / ownership clauses to the drawings whatsoever.

2.7.1 As-Built drawings

- Repairs or “like for like” replacements will be done according to as -built drawings (Drawing provided by Eskom if available). A like-for-like replacement is one where neither the material nor geometry of a replacement component differs from the originally installed component.
- In cases where no drawing is available, As Built drawings will be drawn up, referenced, reviewed, and signed by the contractor before submission to the ECTE for review and approval.
- These drawings may be drawn and referenced neatly by hand & may be transferred to electronic copy if so, required by the client. The documents requirements stated below are to be followed for all drawings. Any existing component may be measured and drawn accurately, and this may be stamped as an As-Built drawing. As built drawings commonly used in maintenance and outage activities are as built isometric drawing of piping indicating hanger supports, flanges, KKS, lengths elevations etc.

- It is important for the correct material to be stipulated in a bill of materials on the As-Build drawing. There will be cases where PMI (Positive Material Identification) will be used to identify the material as best possible, Camden has an existing non-destructive testing contract that includes PMI testing.

2.7.2 Approved for construction drawings.

- Isometric drawings shell be used as AFC drawings.
- AFC drawings are to be used for the manufacture of new components.
- AFC Drawings are stamped as approved for construction by a Pr. Eng (if regulated equipment according to SANS 347) once the design review has taken place and is accepted by Eskom.

2.8 ISO 3834 CERTIFICATION

The contractor must uphold their ISO 3834 Part 2 – Comprehensive certification throughout the contract period for the following design standards:

i.	*AD-2000*	*Technical rules for pressure vessels (TRB) / AD-Merkblatter*
ii.	*ASME B31.12*	*Hydrogen Piping and Pipelines*
iii.	*ASME B31.1*	*Power Piping, B31.3 – Process Piping*
iv.	*ASME Section VIII*	*Rules for construction of pressure vessels (divisions 1-3)*
v.	*EN 13445*	*Unfired Pressure Vessels*
vi.	*EN13480*	*Metallic Industrial Piping*
vii.	*PD 5500*	*Specification for unfired fusion welded vessels*

Additionally, beyond the initial requirement for ISO 3834 Part 2 – Comprehensive certification during the tender phase, the contractor must ensure that the welding workshop established at Camden Power Station also attains ISO 3834 Part 2 – Comprehensive certification for all the above listed design standards, post-contract award.

While the ISO 3834 certification obtained during tendering pertains to the contractor's primary workshop (located elsewhere, not at Camden Power Station), it is imperative to certify the new workshop at Camden. Therefore, a certification audit for ISO 3834 Part 2 – Comprehensive must be conducted for the new site workshop following contract finalization. Recertification of on-site workshop will be required after a period of 3 years (certificate validity period).

This responsibility lies with the contractor; however, Eskom retains the right to conduct a surveillance audit for ISO 3834 Part 2 – Comprehensive at the Camden-based workshop six months after contract award, and annually for the duration of the contract. Should the Camden-based workshop fail to possess a valid ISO 3834 Part 2 – Comprehensive certificate within six months of contract commencement, Eskom reserves the right to terminate the contract entirely. The Camden-based site workshop is required to maintain its ISO 3834 Part 2 – Comprehensive certification for the entire duration of the contract.

2.9 HIGH LEVEL MAINTENANCE AND OUTAGE ACTIVITIES AND REQUIREMENTS

Listed below are high level activities that the staff must be able to perform.

2.9.1 Contractor Engineering Requirements

#	Activity	Requirements
1.	Repair Recommendations	Consider all relevant plant history, procedures, standards, legislation, best practice, and subject matter experts (SMEs) will be consulted in the compilation of repair recommendations. ESKOM business requirements are to be kept in mind in recommendations as to repair costs and necessity of repairs. These recommendations are subject to review by ESKOM engineering for adherence to the above-mentioned requirements.
2.	Piping & process design engineering, Piping hanger design	– Pr. Eng
3.	Vessel and piping design to code of construction (Design by rule)	– Pr. Eng – OHS, PER compliant.
4.	Drafting/Detail drawing of equipment	Where a drawing is needed and does not exist, or if the original drawing is unclear or is inadequate. All drawings that are generated for Camden by the contractor during the period of this contract, belongs to Camden, the contractor cannot claim these drawings as their own property.
5.	Piping Surveys	Conduct Piping surveys on piping systems, CAESAR II® (outsourcing permissible) analysis, to issue a detailed report containing all findings and recommendations
6.	Design by Analysis	In instances where the design by rule calculations do not authorize the operation of pressure equipment, a Design by Analysis (FEA) approach can be employed to demonstrate the equipment's fitness for service. Consequently, the contractor must possess the necessary expertise to conduct such analyses as needed
7.	Welding Engineer	As and when required basis for approval of welding procedures.

2.9.2 Contractor Drafting Requirements

#	Activity	Requirements
1.	Drawing Revision/Creation	The contractor must have access to drafting resources where drawings (As-Build and Approved for Construction) can be altered and/or generated. It is a requirement that will be utilised on an “as required” basis.
2.	Permissions	*All the drawings that are generated by the appointed contractor during the period of this contract, will belong to Camden power station. The contractor does not have the right to add any proprietary / ownership clauses to the drawings whatsoever.*

3.	Drawing format	Apart from the printed and approved drawing versions, all drawings made by the contractor during the period of this contract must be supplied to Eskom in DGN files compatible with the program Microstation CAD program.

2.9.3 Welding and Mechanical Requirements

#	Activity	Requirements
1.	Plate Rolling	Reducers, Vessel shells, Seamed Pipe
2.	Inspections, Cleaning, Gasket replacement, Flange assembly, Pressure vessel preparation for leak or hydraulic pressure test, Condenser/pressure vessel manhole removal, inspection, cleaning, tube plugging and manhole assembly.	Piping Flanges, Valves, Pressure Vessels, Condensers
3.	Flame Cutting	As required
4.	Plasma Cutting	As required
5.	Valve removal and installation	Bolted and welded valves
6.	Drilling	Magnetic Base, Press, Hand Portable
7.	Grinding	Hand grinding, angle cut-off, ripping/excavation (bullnose/pencil grinders) removing NDT defects.
8.	Pipe Bending	as required (heavy duty up to 6” nominal size – on -site)
9.	Tapping / thread cutting	Metric & Imperial
10.	Heat Treatment	Pre-Heat and Post-Weld- Heat.
11.	Welding	SMAW, GTAW
12.	Pipe Fitting	Including Rigging Equipment, Pneumatic tools, hand tools
13.	Jacking	as required
14.	Painting	Painting of turbine plant equipment
15.	Maintenance on Piping Supports	Hanger surveys (hanger inspection, correction & refurbishment.)
16.	Piping hanger and elevation surveys	As required hot and cold surveys and slope evaluations
17.	Vessel and Condenser tube leak repair	As Required
18.	Pipe Blocking	Per Approved Blocking Method Statement
19.	Pipe Internal Blockage Removal	As Required
20.	Pressure Testing of Piping systems	PER and SANS 347
21.	Pipe Rigging	As required

2.9.4 Quality Management Activities

#	Activity	Requirements
1.	MS Office Competence	Quality Controllers to be formally trained in MS office. (Excel and Word).
2.	Plant walks	Leaks and defective equipment are to be accurately identified by KKS. QCs will be held responsible for the reference information and KKS accuracy.
3.	High quality colour printer and scanner	A3 & A4 high-res colour printing capability. 600 DPI colour scanning. This is essential equipment required for quality

#	Activity	Requirements
		reporting and data pack compilation.
4.	High speed, reliable internet connection for all QC staff.	Eskom uses e-mail to communicate (issuing of instructions), the on-site contractors are all responsible to ensure that their staff have e-mail readily available for the receiving of instructions / communications
5.	Computers/Laptops with Office 365	Adobe reader, MS office 365 as minimum software.
6.	Antivirus software	For all contractor computers.

2.9.5 Site Establishment

Eskom to provide site location on site, the site will be supplied with electricity and water.

#	Activity	Requirements
1.	All offices for resources	Contractor's responsibility: Office Buildings / Park homes, Copiers, Faxes, Telephones, Printers, Ablution facilities, Change Rooms, Dark room, Smoking areas.
2.	Workshops	Contractor Responsibility – ISO 3834 Part 2 – Comprehensive certified
3.	Material Handling Equipment	Contractor Responsibility
4.	Contractor Area Maintenance	Contractor Responsibility
5.	Transport & Accommodation	Contractor Responsibility
6.	Gardening and General Site Condition	Contractor Responsibility: Maintain the garden / grass around the office building neatly, conduct general maintenance in and around the site location to ensure all is in working order (rest rooms, doors, ect.)

2.9.6 Pressure Vessel Specific Activities

#	Activity	Requirements
1.	Tube Plugging	Specific to each heat exchanger in accordance with Camden procedures
2.	Statutory vessel refurbishment	In accordance with PER and vessel design codes.
3.	Pressure Testing	Including Blanking, Certified Calibrated Gauges and Pressure Test Pumps for test pressures up to 30MPa.
4.	HPH – Water Box Pressure Seal Removal	The water boxes of the HPH's at Camden are sealed with two different sealing arrangements: a pressure sealing arrangement (CASS and HAMOND SOBALCO heaters), and a flange type (PARSONS).
5.	Hydraulic Torquing of fasteners	The contractor will be provided with specific torque requirements for different vessel components, hydraulic torque machines are required to achieve the desired torque.
6.	Weld-Repair on all areas of the vessels	Contractor Certification to be valid for vessel code of construction as specified in *Section 2.1* of this document
7.	Tube Leak Inspection	As Per Eskom Specification, See section 1.2.2 of this document.
8.	Lapping of Components (Heater Half Joints)	As per Eskom Specification
9.	Internal Visual Inspection access granting to NDE contractor and AIA.	SOW requirement

2.9.6.1 Pressure Test Equipment Requirements

For the duration of the contract, it is the responsibility of the contractor to design, supply and maintain pressure testing equipment with the following minimum specification:

Nr. *(Figure 1)*	Description	Specification
1	Isolation Valves (3)	– Nominal Diameter ½” – Pressure rating suitable for a pressure of 30MPa and at a temperature of 80°C
2	Pressure Test Pump	– Positive displacement type water pump. – Capable of reaching a pressure of 30MPa
3	Pressure Gauge	– SANAS calibrated pressure gauge
4	Connecting Pipework with pump bypass setup for straight filling including connection fittings.	– Nominal Diameter ½” – Pressure rating suitable for a pressure of 30MPa and at a temperature of 80°C
5	Spring operated pressure relief valve.	– Capable of reaching a pressure of 30MPa – Sized for the maximum flow the pump can deliver.

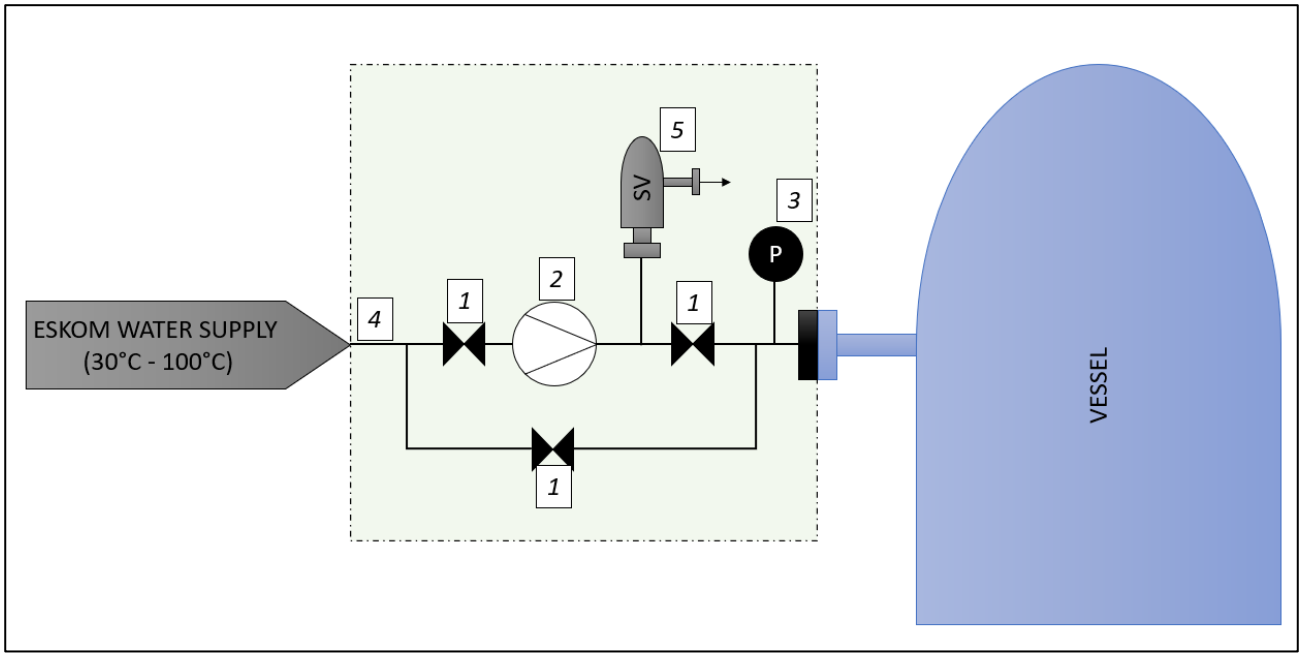


Figure 1, Schematic showing a basic pressure test setup.

3. CONTRACT BUDGETING AND QUANTITY SURVEILLANCE (QS)

3.1 LABOUR COST ESTIMATION

The contract revolves around the contractor providing a core and outage crew labourers to be utilised at Camden Power station for mechanical and welding work. The contractor shall ensure that the core crew is furnished with all the equipment, consumables, and other requirements necessary for them to perform the work described in this document. It is required for the contractor and quantity surveyor to provide cost estimations for the core crew and outage crews.

Table 1 and Table 2 below serves as a guideline for estimating contract costs. Labour costs are determined by multiplying the specified normal and overtime hours for each labour type by the corresponding rates for normal and overtime work. The hours indicated are approximate averages and may not precisely align with actual working hours. However, for budgeting purposes, these hours provide a reasonably accurate representation of the expected workload.

Table 1: Core Crew Cost Estimation

Description of Labour	Total Employees	Annual Normal Working Hours	Annual Overtime Hours	Annual Labour Cost Estimate	Annual Accommodation and Transport Cost for Employee
Site Manager	1	2070	350	R	R
Site Foreman	1	2070	350	R	R
SHE Officer	1	2070	350	R	R
Welding Supervisor	1	2070	350	R	R
Storeman	1	2070	350	R	R
Data Capturer	2	2070	50	R	R
Boiler Maker	2	2190	550	R	R
Fitter - Mechanical	4	2190	550	R	R
Fitter - Piping	4	2190	550	R	R
Foreman - Piping	2	2190	550	R	R
Quality Coordinator	2	2190	550	R	R
Semi-Skilled Labourer (Mechanical)	4	2190	550	R	R
SHE officer	2	2190	550	R	R
Welder (Plate, Fillet and pipe qualification required)	2	2190	550	R	R
Welding Inspector	2	2190	550	R	R
Rigger	2	2190	550	R	R
			Total:	R	R

Table 2: Outage Crew Cost Estimation (Additional labour required during outages)					
Description of Labour **Additional to core crew**	**Total** **Employees**	**Annual Normal Working Hours**	**Annual Overtime Hours**	**Annual Labour Cost Estimate**	**Annual Accommodation and Transport Cost for Employee**
Site Foreman	1	2070	350	R	R
Outage Coordinator	1	2070	350		
Storeman	1	2070	350	R	R
Welding Supervisor	1	2070	350	R	R
Data Capturer	1	2070	50	R	R
SHE Officer	2	2070	350	R	R
Boiler Maker	2	2190	550	R	R
Fitter - Mechanical	8	2190	550	R	R
Fitter - Piping	3	2190	550	R	R
Quality Coordinator	1	2190	550	R	R
Semi-Skilled Labourer (Mechanical)	8	2190	550	R	R
SHE officer	2	2190	550	R	R
Welder (Plate, Fillet and pipe qualification required)	3	2190	550	R	R
Welding Inspector	3	2190	550	R	R
Rigger	4	2190	550		
			Total:	R	R

3.2 WELDING CONSUMABLES AND COST ESTIMATION

Since it's challenging to provide a precise description of the work to be performed under this contract, **Tables 3 to 8** offer a historical summary of welding activities carried out over a one-year period. This historical data should be used to estimate the cost of consumables. The required consumables include welding filler materials, grinding disks, brushes, and all necessary welding personal protective equipment (PPE). To estimate the annual cost for these consumables, calculate the cost needed to execute all the welds listed in **Tables 3 to 8** and enter the total in the designated area.

Annual Welding consumable Cost Estimation: R _____

Table 3: BUTT WELDS - PIPING

PIPE DIAMETER RANGE DN	PIPE BUTT WELDS	ISO 15608 MATERIAL GROUP	WALL THICKNESS RANGE
8 - 100	220	1, 2	SCH 40 TO SCH120
8 - 100	80	5	SCH 40 TO SCH120
8 - 100	200	8	SCH 40 TO SCH120
100 - 300	100	1, 2	SCH 40 TO SCH 80
100 - 300	110	8	SCH 40 TO SCH 80
300 - 1000	30	1, 2	SCH 40 TO SCH 80

Table 4: FILLET WELDS - PIPING

PIPE DIAMETER RANGE DN	PIPE FILLET WELDS	ISO 15608 MATERIAL GROUP	WALL THICKNESS RANGE
8 - 100	80	1, 2	SCH 40 TO SCH120
8 - 100	50	8	SCH 40 TO SCH120
100 - 300	50	1, 2	SCH 40 TO SCH 80
100 - 300	40	1, 2	SCH 40 TO SCH 80
300 - 1000	20	1, 2	SCH 40 TO SCH 80

Table 5: NOZZLE WELDS - VESSELS (Set-in, Set-on and Set Through)

NOZZLE DIAMETER RANGE DN	NOZZLE WELDS	ISO 15608 MATERIAL GROUP	NOZZLE WALL THICKNESS RANGE	VESSEL SHELL WALL THICKNESS RANGE
20 - 100	8	1, 2	SCH 40 TO SCH120	6mm - 25mm
100 - 300	4	1, 2	SCH 40 TO SCH120	6mm - 25mm
300 - 100	5	1, 2	SCH 40 TO SCH120	6mm - 25mm

Table 6: TUBE - PLUG WELDS - VESSELS

PIPE DIAMETER RANGE DN	TUBE PLUG FILLET WELDS	ISO 15608 MATERIAL GROUP	TUBE PLUG THICKNESS RANGE	VESSEL TUBE SHEET WALL THICKNESS RANGE
15 - 25	45	1, 2	4mm - 6mm	180mm - 250mm

Table 7: FLANGE FILLET WELDS - VESSELS

NOZZLE DIAMETER RANGE DN	NOZZLE WELDS	ISO 15608 MATERIAL GROUP	WALL THICKNESS RANGE
20 - 100	10	1, 2	SCH 40 TO SCH120
800 - 1400	8	1, 2	SCH 40 TO SCH80

Table 8: PLATE BUTT WELDS - VESSELS		
PLATE THICKNESS RANGE	BUTT WELD LENGTH (meters)	ISO 15608 MATERIAL GROUP
5mm - 25mm	15	1, 2
25mm - 40mm	5	1, 2