Eskom	SOW	Camden Power Station

Title: **Removal and Application of Refractory for Camden Power Station for 60 Months**

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Content

1. Introduction

The document serves as a scope of work for the removal and application of refractory inside the boiler furnace. The scope was compiled taking into consideration previous application and poor workmanship experienced.

1.1 Purpose

The purpose of the scope of work is to give detailed clarification of the work to be done on the boiler walls, tubes, bifurcations, and tubing.

1.2 Applicability

This document applies to Eskom Camden Power Station. It is applicable to Boiler Engineering, Maintenance, Outage department, and Projects department, including any contractor that will be involved in execution of the scope of work.

2. Definitions and Abbreviations

2.1 Definitions

H - Customer to inspect the plant / equipment or advice before commencing with work activities.

W - Customer to inspect the plant/ equipment during work activities.

A - Copy of inspection report to be issued to customer.

R - Customer to review reports or checks sheets prior to re-assembly.

2.2 Abbreviations

DMS - Documentation Management System

NDE – Non-Destructive Examination

NDT – Non-Destructive Testing

PQP – Process Quality Plan

ITP – Inspection and Test Plan

QCP – Quality Control Plan

MT – Magnetic Testing (Magnetic Particle Inspection)

UT – Ultrasonic Testing

DIM – Dimension Testing (Profile gauging)

HD – Hardness Testing

RP – Replication

2.3 Normative/Informative References

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

2.3.1 Normative

[1] ISO 9001 - Quality Management Systems.

[2] OHS Act - Occupational Health and Safety Act and Regulations (Act No.85 of 1993)

[3] 240-56246601 - Personnel and Entities Performing Welding Related Special Processes on Eskom Plant

[4] 240-56247004 - Thermal Insulation Standard

[5] 240–56239129 – High pressure piping standard

3. Scope of Work Content

Department	Boiler	**System**	Various areas

3.1 Outage Goal

After successful execution and completion of the scope of work the following outcomes are expected:

- Precise application of correctly specified refractory in applied areas
- Application of refractory to last inside high temperature operation as per outage philosophy.

3.2 Outage Objectives

The following improvements are required after analysis of the outage effectiveness indicator:

3.2.1 Technical Criteria

- All work is to be executed according to code, and Eskom procedures.
- The work executed is to be of high quality and ITPs with MSD should be adhered to at all times.
- Method statements are required up front before the outage commences approved by engineering.

3.2.2 Scope Variations

Any scope variation to be submitted to Boiler Engineering for approval.

3.2.3 Financial Performance

- Execute within approved budget.

3.2.4 Time Management

- Availability of spares – outage to order/purchase 9 months before the outage start date such that the material/components are on site before the outage starts.
- Scaffolding erection – scaffolding to be erected before unit comes down where possible.

3.3 Plant History

Table 1: Summary of the number of areas in the outage SOW

1	Burner mouth A-E
2	Evaporator bottom deadspace front
3	Evaporator bottom deadspace rear
4	Evaporator Top Nose deadspace Roof
5	Evaporator Top Nose deadspace Rear wall
6	Evaporator Top Nose skincasing access
7	Evaporator front wall at 18m Burner row C
8	Evaporator front wall at 18m Burner row D
9	Evaporator LHS wall sample tubes at 29m level
10	Evaporator RHS wall sample tubes at 29m level
11	Evaporator Front wall CF sample tubes 29m level
12	Evaporator LHS wall at 32m Level
13	Evaporator RHS wall at 32m Level
14	Evaporator Front wall at 28m Level
15	Evaporator Front wall at 21m Level Burner Row D
16	Evaporator Front wall at 21m Level Burner Row E
17	Evaporator Front wall at 12m Level Burner Row A
18	Evaporator Front wall at 12m Level
19	Evaporator LHS wall at 12m Level
20	Evaporator RHS wall at 12m Level
21	Evaporator LHS wall at 14m Level
22	Evaporator RHS wall at 14m Level
23	Evaporator Rear wall at 12m Level
24	Evaporator Rear wall at 14m Level
25	Evaporator Rear wall sample tubes at 18m level
26	Evaporator Rear wall sample tubes at 21m level

27	Saturated steam tubes rear wall at 31m Level
28	Saturated steam tubes rear wall at 32m Level
29	Saturated steam tubes rear wall at 33m Level
30	Saturated steam tubes rear wall at 34m Level
31	Saturated steam tubes rear wall at 36m Level
32	Economiser side wall erosion at rear screen tubes
33	Economiser side wall LHS wall
34	Economiser side wall RHS wall
35	Economiser LHS wall Around soorblowers and manholes
36	Economiser side wall erosion above economiser top bank at wall plates
37	Evaporator Top Nose Deadspace floor

3.4 Operating Condition

The unit operates as per design and under design from time to time.

3.5 Plant Specific Safety Requirements

- Already addressed on the Power Station's SHE specification.

3.6 Risk Report and Mitigating actions

- As per R/A supported by contractor executing work.

3.7 Environmental Requirements

- All waste/scrap is to be disposed of in the appropriate scrap/waste bins.

3.8 Engineering Drawings

- Updated approved drawings can be submitted by Boiler Eng. as and when required.

3.9 Plant Preservation Requirements

- N/A

3.10 Transportation and Storage Requirements

- All spares are to be stored as per MSD from supplier.

3.11 Scope compilation references

Source	Source reference №
Previous outage service reports	N/A
Return to service data packages	QCP/MSD
SAP PM defects (attach list as appendix)	N/A
GHRMS (STEP) reports	N/A
Pre outage performance test results	N/A
Post outage performance test results	N/A
GPSS data on UCLF incurred	N/A
OMS / IIRMS recommendations	N/A
Risk controls (CURA system)	N/A
Previous audits and reviews	N/A
Engineering Change Requests	N/A

3.12 Subsystem

- As per detailed SOW

3.13 Service report and PQP

- A full-service report will be compiled and provided to Camden Power Station in duplicate. The report will contain a high-level description of the work done during the refurbishment. It will contain the approved PQP of work on site and all related check sheets and test reports. All technical notifications will be shown as well. It will contain a section on spares used report.
- PQP to be compiled and presented to Engineering for approval before start of outage. Duplicate service report provided to Camden Power Station within 14 days of the completion of the work. Report to be accepted by Engineering.

3.14 Quality

- Inspections to be carried out in accordance with check sheets as attached in master quality plan which should be compiled from this document and approved by Engineering. This document will contain all the PQP's of work that will be done on site and off site. Dismantling and assembly values to be recorded for all check sheets. Repair or replace all

damaged/worn components out of specification or obtain a concession from engineering staff. All abnormalities to be recorded and reported with technical notifications.

- All work carried out will be in line with the applicable ESKOM standards. Where nothing exists, good engineering practise will be followed. This includes but is not limited to the covering of all openings and the use of approved chemicals.
- Where digital photos are required, it will be of a resolution of at least 2228x1712.
- Supplier Contract Quality Requirement Specification (QM 58) shall be the governing document.

3.15 Experience of Staff

- All staff shall be adequately qualified and competent of performing all work within safe and correct technical specifications.
- Short CV's of all supervisors, quality technicians, artisan, stating qualifications and relevant experience will be provided at least two weeks before commencement of outage.
- The importance of correct equipment spares and procedures should be included in structured toolbox talk sessions with all contractors.
- All personnel shall have a medical certificate of fitness as per the Stations SHE specification.

3.16 Work Preparation

No.	Scope of Work	Responsible work centre	Procedure or Specification	Hold or Witness Points	Check sheet
Preparation					
1.	Install scaffolding and restraints as far as possible before unit comes off for GO.	TMS	N/A	N/A	N/A
2.	Prepare all MSD		N/A	Engineering Approval	N/A
3.	All material from the bill of material to be ordered and components verified before outage starts.	Outage	Keep engineering informed	N/A	N/A

4.	Review list of boiler defects A list of all the latest defects shall be obtained from SAP and repaired.	Maintenance	N/A	N/A	Normal defects process to be followed.
5.					

3.17 Insulation / Lagging/ Asbestos

- Any areas with known asbestos to be removed as per HSE standards.

3.18 Scaffolding Requirements

No.	Task	Responsible work centre	Procedure or Specification	Hold or Witness Points	Check sheet
1.	Build scaffolding on all areas as per SOW	Outage		Hold Point	
2.	Build scaffolding for inspections of refractory.	Outage			
3.					

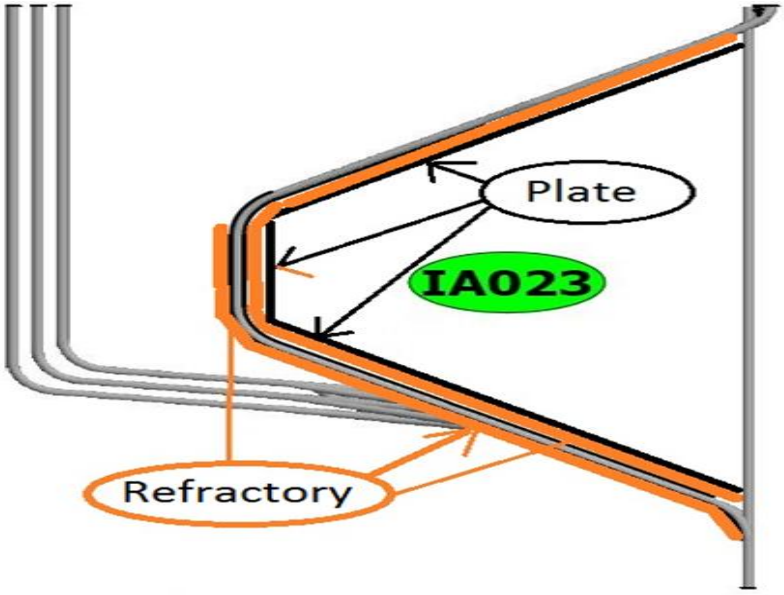
3.20 Detailed Scope of Work

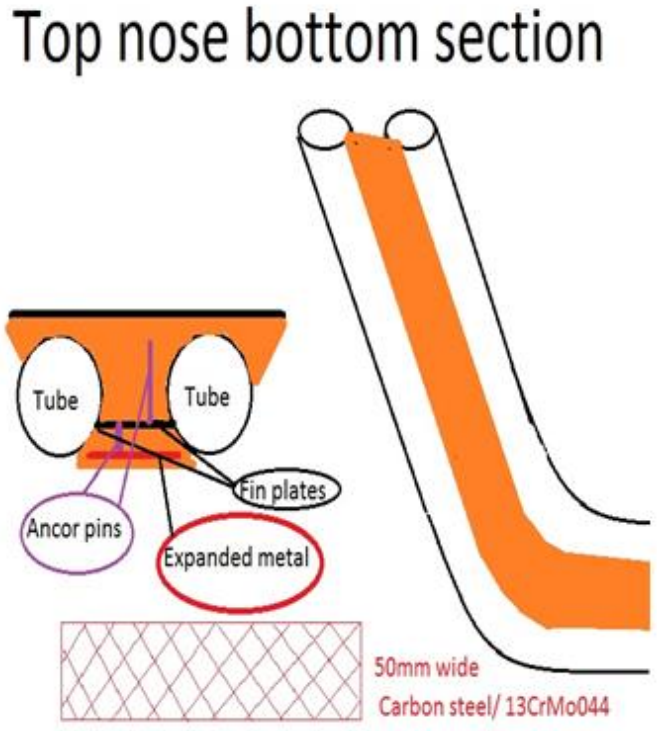
3.20.1 Bill of Materials

The material needed for the planned replacements during the GO are specified in the bill of materials in the tables below**.**

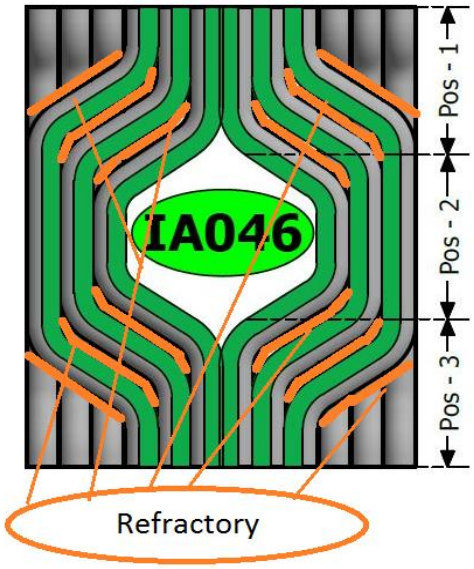
Top nose

	Refractory specification
Operating Temperature	Minimum 1450`C
Application	Top Nose
Thermal conductive	Yes
Thermal conductivity	Minimum 4 (W/m.K)
Abrasive area	Yes
Brick / cast able/ throw able	Throw able/ plaster
Maximum water mixture	4.5%-6%
Cold crush strength 110`C	Minimum 110 MPa
Minimum SiC %	55%
Alumina min Al2O3 %	12%
Iron oxide Fe2O3 % Min	1.3%
Optimised fibre mix %	2% of mixture
Comments	Please take the following in consideration We will need expanded metal or anchor points for top nose to ensure application will stay on We need small percentage optimized fiber separately to add with mixture to ensure long operating capability

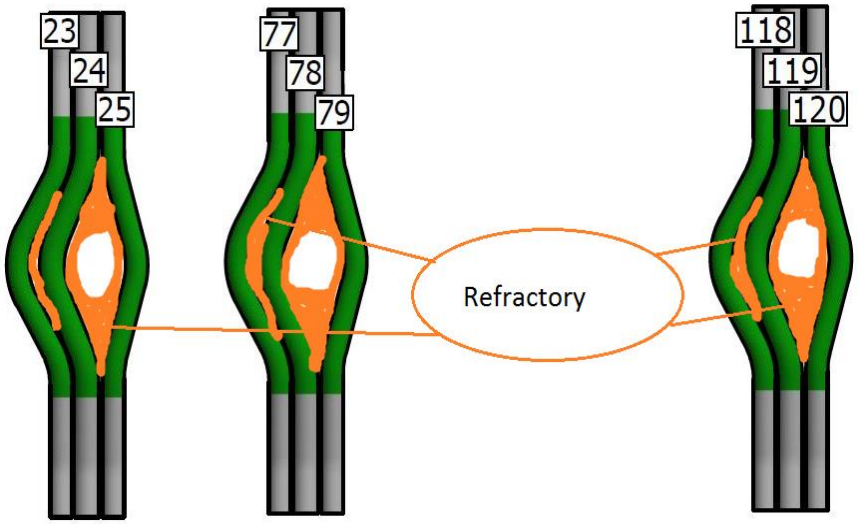




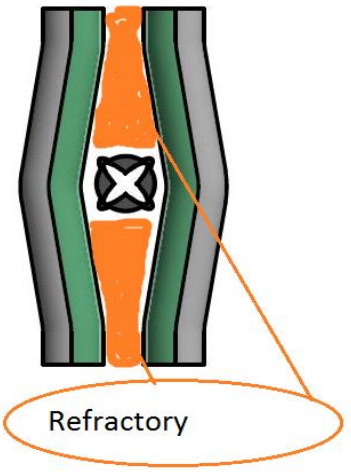
Manhole	
Operating Temperature	Minimum 1450`C
Application	Manhole furnace
Thermal conductive	Yes
Thermal conductivity	Minimum 4 (W/m.K)
Abrasive area	Yes
Brick / cast able/ throw able	Throw able
Maximum water mixture	4.5%-6%
Cold crush strength 110`C	Minimum 110 MPa
Minimum SiC %	55%
Alumina min Al2O3 %	12%
Iron oxide Fe2O3 % Min	1.3%
Optimised fibre mix %	2% of mixture
Comments	Please take the following in consideration
	We will need Anchor points to ensure application will stay on
	We need small percentage optimized fiber separately to add with mixture to ensure long operating capability



Pyrometers	
Operating Temperature	Minimum 1450`C
Application	Pyrometer openings
Thermal conductive	Yes
Thermal conductivity	Minimum 4 (W/m.K)
Abrasive area	Yes
Brick / cast able/ throw able	Throw able
Maximum water mixture	4.5%-6%
Cold crush strength 110`C	Minimum 110 MPa
Minimum SiC %	55%
Alumina min Al2O3 %	12%
Iron oxide Fe2O3 % Min	1.3%
Optimised fibre mix %	2% of mixture
Comments	Please take the following in consideration
	We will need Anchor points to ensure application will stay on
	We need small percentage optimized fiber separately to add with mixture to ensure long operating capability



Other Bifucations	
Operating Temperature	Minimum 1450`C
Application	Evaporator SB Opening
Thermal conductive	Yes
	Minimum 4 (W/m.K)
Abrasive area	Yes
Brick / cast able/ throw able	Throw able
Maximum water mixture	4.5%-6%
Cold crush strength 110`C	Minimum 110 MPa
Minimum SiC %	55%
Alumina min Al2O3 %	12%
Iron oxide Fe2O3 % Min	1.3%
Optimised fibre mix %	2% of mixture
	We will need Anchor points to ensure application will stay on
	We need small percentage optimized fiber separately to add with mixture to ensure long operating capability



Evaporator Sootblower Opening

3.20.2 Areas per SOW

Item	Bill Description	Unit	QTY	Gross rate	Amount
	As and when required				
	Hack up/off and removing average of 25mm thick refractory plaster from the araeas below to prepare for new refractory				
1	Burner mouth A-E	M²	300		
2	Evaporator bottom deadspace front	M²	124		
3	Evaporator bottom deadspace rear	M²	133		
4	Evaporator Top Nose deadspace Roof	M²	52		
5	Evaporator Top Nose deadspace Rear wall	M²	60		
6	Evaporator Top Nose skincasing access	M²	7		
7	Evaporator front wall at 18m Burner row C	M²	3.4		
8	Evaporator front wall at 18m Burner row D	M²	3.4		
9	Evaporator LHS wall sample tubes at 29m level	M²	8.21		
10	Evaporator RHS wall sample tubes at 29m level	M²	8.21		
11	Evaporator Front wall CF sample tubes 29m level	M²	37		
12	Evaporator LHS wall at 32m Level	M²	8.21		
13	Evaporator RHS wall at 32m Level	M²	8.21		
14	Evaporator Front wall at 28m Level	M²	37		
15	Evaporator Front wall at 21m Level Burner Row D	M²	3.4		
16	Evaporator Front wall at 21m Level Burner Row E	M²	3.4		
17	Evaporator Front wall at 12m Level Burner Row A	M²	16.2		
18	Evaporator Front wall at 12m Level	M²	16.2		

19	Evaporator LHS wall at 12m Level	M²	20		
20	Evaporator RHS wall at 12m Level	M²	20		
21	Evaporator LHS wall at 14m Level	M²	25		
22	Evaporator RHS wall at 14m Level	M²	25		
23	Evaporator Rear wall at 12m Level	M²	16.2		
24	Evaporator Rear wall at 14m Level	M²	35		
25	Evaporator Rear wall sample tubes at 18m level	M²	35		
26	Evaporator Rear wall sample tubes at 21m level	M²	35		
27	Saturated steam tubes rear wall at 31m Level	M²	21		
28	Saturated steam tubes rear wall at 32m Level	M²	21		
29	Saturated steam tubes rear wall at 33m Level	M²	21		
30	Saturated steam tubes rear wall at 34m Level	M²	32		
31	Saturated steam tubes rear wall at 36m Level	M²	32		
32	Economiser side wall erosion at rear screen tubes	M²	69		
33	Economiser side wall LHS wall	M²	10.5		
34	Economiser side wall RHS wall	M²	10.5		
35	Economiser LHS wall Around soorblowers and manholes	M²	105.6		
36	Economiser side wall erosion above economiser top bank at wall plates	M²	15		
	Hack up/off and removing average of 200mm thick refractory plaster from the araeas below to prepare for new refractory				
37	Evaporator Top Nose Deadspace floor	M²	44.5		

M²	1422.14		

3.20.3 Material specification refractory blocks Unit 6 and Unit 7

Operating Temperature Minimum: 1450`C

Application: Economiser side wall deflection blocks

Thermal conductive: Yes

Thermal conductivity Minimum: 4 (W/m.K)

Abrasive area: Yes

Brick / cast able: Yes

Maximum water mixture: 4.5%-6%

Cold crush strength 110`C Minimum: 110 MPa

Minimum SiC %: 55%

Alumina min AI2O3 %: 12%

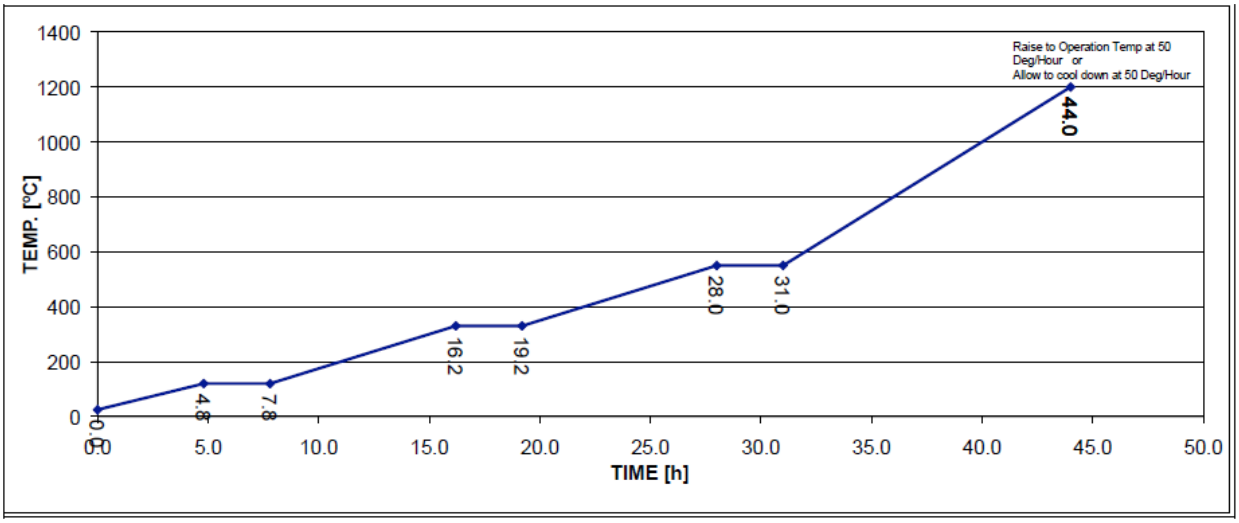
Iron oxide Fe2O3 Min %: 1.3%

Optimised fibre mix %: 2% of mixture

3.20.4 Dimensions of refractory blocks

475mmX400mmX75mm.

3.20.5 Heat chart for block



3.21 Deliverables for refractory blocks

- The contractor is expected to manufacture refractory blocks as per specification
- Delivery to site
- Material and tests reports

3.22 Ad Hoc Services for refractory blocks

- Cold Strength testing as per required specification on 2% of manufactured blocks with report.

3.22.1 Critical Component Testing of refractory blocks

- Cold Strength testing as per required specification on 2% of manufactured blocks with report.

3.23 Defects

- As per SAP

3.24 Tools and Equipment requirements

NO.	COMPONENT DESCRIPTION	QUANTITIES
1.	As per Contractors procedures	

3.25 Commissioning and Acceptance Testing Activities

NO.	TASK	RESPONSIBLE WORK CENTRE	PROCEDURE / SPECIFICATION
1.	Lagging and cladding	Outages and TMS	Eskom Thermal insulation standard
2.			

4. Summary of Revision Changes

Date	Rev.	Remarks/ Changes	Reasons

5. Acceptance

This document has been seen and accepted by:

Name	Designation	Signatures
Sydney Tshalane	Outage Co-ordinator	
Sipho Ndhlovu	Senior Boiler inspector	
Mlungisi Makhaya	Senior Boiler inspector	
Michelle Nchabeleng	System Engineer	

6. Template Revisions

Date	Rev.	Compiler	Remarks
21/08/2024	1	PA Sejake	Original document