Eskom	**Scope of Work**	**Kriel Power Station**

Title: **Inspection, repairs, fabricate, supply and install of ceramic lined pulverized fuel pipes, pf pipes hangers and pf pipes support**

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Alternative Reference Number: **N/A**

Area of Applicability: **Kriel Power Station**

Functional Area: **Engineering**

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1. Introduction

Pulverized Fuel pipe work is meant for conveyance of pulverized fuel and primary air mixture from the mill to the burners. In any one mill at Kriel Power Station one pipe comes out of the mill to the distribution box which splits the pipe into six pipes through to the burners. There are 6 mills in any unit at Kriel Power Station and 36 burners per unit which means there is a total of 36 pipelines from the distribution box to the burners. The PF conveyed has some abrasive characteristics causing erosion in the PF pipes especially on the bends and kinks.

PF Pipe work project is driven by SHE (Safety; Health and Environmental) and production efficiency concerns. Safety of the system is an important consideration when considering replacement of individual pipe supports or re-calibration of the entire support system. There is currently a significant number of pulverized fuel leaks from the PF pipe work. PF leaks at the station are a frequent occurrence and this result in mill shutdowns and load losses are incurred due to mill unavailability if the standby mill is not available. Furthermore, PF leaks result in accumulation of PF outside boiler causing risk of fire and health hazards.

The PF pipes hanger's replacement, repair, re-calibration is driven by deterioration of Kriel Power Station. There is lack of evidence that the hangers were replaced or re-calibrated especially when PF pipes lining. There is a quite a number of broken, missing, bent, corroded PF pipes hangers at Kriel Power Station.

The lack of data on which PF pipes were lined or PF pipes hangers replaced dictates that the scope of work focuses thorough inspections of the PF pipework and Hangers in order to identify PF pipes and Hangers that can still last for extended period without compromising the targeted period of >9 years without PF leaks in the plant and desirable maintenance free on this period.

2. Supporting Clauses

2.1 Scope

The scope of this document is to provide requirements for the Inspections, repairs, fabrications/manufacture, supply and installations of ceramic lined pulverized fuel pipework, pf pipework hangers, pf pipework support and re-calibration of the new or part of the existing support system and alignment of the PF pipes, PF pipes hangers and PF pipes supports

The scope also includes inspections, testing, supply, and installation of extra components on PF pipes, PF pipes hangers, PF pipes supports. The extra components include but not limited to gaskets, Viking Johnson flange adaptors, couplings such as VJ couplings, compression bolts, bolts and nuts, hanger rods, washers, PF pipework clamps, lugs, support plates, flange gaskets, rope

gaskets etc.

The scope is in general the refurbishment of the entire PF pipework, PF pipework hangers and PF pipework support systems such as clamps, hanger rods, spring support cans and all other accessories

The scope of work entailed the removal of identified eroded/damaged PF pipe work components downstreamof the secondary distribution box, manufacturing, supply, delivery and installation of the new and ceramic tiled components in the PF pipe work system(s).

The scope includes the generation of general and manufacturing/design drawings as per PF pipes and hanger components, the complete drawing package including detailed manufacturing drawings on CAD program.

2.1.1 **Applicability**

This document is applicable to Eskom Kriel Power Station PF pipework, PF pipework hangers, PF pipes supports from PF distribution box up to PF burner (after the square to round).

2.1.2 **Effective date**

This document is effective from the date of authorization on the cover page.

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] ISO 9001 Quality Management Systems

[2] Unit Standard ID:114458

[3] 240-48929482 Tender Technical Evaluation Procedure

[4] BS 2971:1991, Specification for Class II arc welding of carbon steel pipework for carrying fluids

[5] BS EN 10210-1:2006 (Hot finished structural hollow sections of non-alloy and fine grain steels. Technical delivery requirements)

[6] BS EN 10025-3:2004 (Hot rolled products of structural steels. Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels)

[7] BS EN 10025-4 2004 (Hot rolled products of structural steels. Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels)

[8] BS EN 10025-1:2004 (Hot rolled products of structural steels. General technical delivery conditions)

[9] BS EN ISO 18286:2010 (Hot-rolled stainless-steel plates. Tolerances on dimensions and shape)

[10] BS7668:2016 (Weldable structural steels. Hot finished structural hollow sections in weather resistant steels. Specification)

[11] BS EN 1092-1:2007+A1:2013 (Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Steel flanges)

[12] BS EN 1092-3:2003 (Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Copper alloy flanges)

[13] BS EN 1092-2: 1997 (Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Cast iron flanges)

[14] [11] SABS 630: 2009, Decorative high gloss enamel paints.

[15] SIS 055900, Practical surface preparation standards for painting steel surfaces

[16] SABS ISO 9001:2015, Quality Management Systems - Requirements

[17] 240-105658000: Supplier Quality Requirements Specification

2.2.2 **Informative**

[18] 32-1033: Eskom Procurement and Supply Chain Management Policy

[19] 32-1034: Eskom Procurement and Supply Management Procedure during the tender process

[20] 240-106027729: Burner Manufacturing Standard

[21]

2.3 Definitions

None.

2.4 Abbreviations

Abbreviation	Explanation
VJ Couplings	Viking Johnson Couplings
PF	Pulverized Fuel
ISO	International Organization for Standard
P&ID	Piping and Instrumentation diagram
SANAS	South African National Accreditation Standard
MPa	Mga Pascal
kg	Kilogram

2.5 Roles and Responsibilities

2.5.1 Eskom Power Station PF Pipe System Engineer

- Ensure that the correct revisions of the manufacturing drawings are available and signed off for manufacturing (if the drawings are owned by Eskom)

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- Ensure that all concessions applied for by the supplier are considered and resolved proficiently and timeously whilst ensuring that the technical integrity of the ceramic linings will not be compromised.

- Ensure that the Eskom Power Station Appointed Approved Inspection Authority is involved with the quality control and acceptance of the manufactured product as specified below.

- To be involved with the manufacturing and quality control inspections of the ceramic linings as required.

2.5.2 Third Party Inspector (Eskom Approved Inspection Authority)

- Ensure that the ceramic linings are manufactured according to Ceramic Lined Pulverised Fuel Pipework Standard – 240-56239143 and applicable drawing(s).

- Notify the Eskom PF Pipe System Engineer of any deviations of the manufacture ceramic linings from 240-56239142 Ceramic Lined Pulverised Fuel Pipework Standard, the order placed by Eskom or the approved manufacturing drawing and inspection sheets.

2.5.3 Supplier and Manufacturer

- Ensure that Eskom is immediately informed of any deviation during the manufacturing process that can influence the technical integrity of the ceramic linings or result in a deviation from these standard and manufacturing drawings.

- Ensure that Eskom PF Pipe System Engineer and Third-Party Inspector are notified when the ceramic linings and data books are available for inspection, review and final acceptance.

- Should the supplier not be the manufacture, then Eskom reserve the right to approve or disapprove the use of any alternative manufacturer, should there be a need to change the manufacturer.

- Shall ensure that all equipment used for verification of tolerances are certified by a SANAS approved laboratory.

2.5.4 **Eskom Buyer**

- Ensure that orders are placed according to the station requirements to meet the required delivery dates.

- Ensure that the order for the Third-Party Inspector is placed timeously.

2.5.5 **Eskom Project Manager**

- Ensure changes to the Project Management Principles in accordance to Eskom Procedures are followed on all the processes involved until the finalisation of this scope of work.

2.6 Process for Monitoring

- The process for monitoring will be as per Eskom processes and procedures on the Procurement Management, Project Management and Technical Management of the project from start to completion.
- Eskom approved quality control systems shall be used to monitor the quality of work executed and any possible deviations in the execution of this scope of work shall be approved and monitored through approved Eskom systems and policies.

2.7 Related/Supporting Documents

- Unit Standard ID : 114458

3. Scope of Work

3.1 Summary of the scope of work

3.1.1 Inspections and surveys of PF pipework, PF pipework hangers and PF pipework supports from PFdistribution box up including burner square to rounds.

3.1.2 Carry out 3D Scanning of PF pipework and hangers

3.1.3 Carry out Caesar model of PF pipework

3.1.4 PF pipes hangers and support standard that will be used on this work shall be clearly stated on the report through expect opinion of the contractor, however, this shall be agreed by Eskom QC and Eskom Engineering prior the works execution.

3.1.5 Generate PF pipework surveys and inspection report(s) and work schedule, the report(s) and schedule must be approved by contractor supervisor, contractor QC, Eskom QC and Eskom Engineering. The work to be executed from the report(s) shall be approved by Eskom QC and Eskom Engineering.

3.1.6 PF Pipework, Fabrication, ceramic lining, deliver to site and transport to working site area, rigging of PF pipes approval by Eskom Kriel Power Station after the surveys, inspections and testing reports has been approved on which sections of PF pipework will be replaced. Eskom Engineering reserve the right to add additional scope before final scope of work is approved

3.1.7 Repairs, supply and installation of PF pipework hangers and PF pipes supports shall be done aśper approved contractor and Eskom generated report, Eskom approved report and Eskom approved work to be executed from the report. Eskom Engineering reserve the right to add additional scope before final scope of work is approved

3.1.8 Alignment and re-calibration of all PF pipework, PF pipework hangers and PF pipes supports systems.

3.1.9 Painting of exposed pipework on all assemblies shall be painted as per 240-56239143, Ceramic Lined Pulverized Fuel Pipework Standard which detail Surface preparation, coating systems and identification

3.1.10 All PF pipework after execution of this scope of work shall be ceramic lined as per approved Eskom latest standard. (240-56239143, Ceramic Lined Pulverized Fuel Pipework Standard)

3.1.11 Quality of work shall be monitored through Eskom approved quality control systems and any deviations on the execution of the scope of work or an Eskom approved standard shallbe approved through an Eskom approved process.

3.1.12 Contractor to recommend PF pipework and Hanger's maintenance strategy to preserve the integrity of the pipework and hangers for contractor and employer agreed guarantee period.

3.2 Work to be performed and materials to be supplied by the contractor for PF pipes hangers and PF pipes supports and hangers and support components works

3.2.1 Contractor shall conduct site visit to establish a proper working plan and familiarizewith the working condition(s) in order to plan for deployment of man and machinery.

3.2.2 Conduct hot and cold surveys on PF pipework hangers and PF pipes supports to assess the general condition of the PF pipework entire support system per mill and per pipe.

3.2.3 Inspect for physical deterioration of the PF pipe hangers and support system(s).

3.2.4 Inspect for signs of corrosion on all PF pipes hangers and support systems.

3.2.5 Inspect for mechanical defects such as bent, broken off, cracked welds and cracks on PF pipes hangers, corroded and damaged cans, springs, lugs, rods and all other supports system

3.2.6 Inspect for loose PF pipes support rods and bent rigid rod supports.

3.2.7 Inspect for loose and missing PF pipe support clamps, bolts, nuts, springs and PF support damp mechanical integrity, cracks

3.2.8 Inspect all PF pipes hanger for lugs mechanical integrity defects and lugs weld cracks

3.2.9 Contractor to supply a detailed report(s) with detailed scope of work and detailed work schedule of the overall works to the employer for approval of the works.

3.2.10 Systematically remove all PF hangers and support spring assembly systems

3.2.11 Inspect and provide expert assessment of all PF pipes spring assemblies mechanical condition and performance if replacement of individual components of a spring assembly may be necessary to restore the physical integrity of the hanger and support system.

3.2.12 Conduct a total hanger and support system analysis to determine if factory replacement is required or if field adjustments or complete replacement with new cans to restore the support system to safely function.

3.2.13 Compile a list of all parts and quantities required for individual components for PF pipes hangers and supports that is required to restore individual components of PF pipe hangers and supports

3.2.14 Compile a detailed PF pipes hanger and supports inspections and survey report and expert assessment on PF pipe hanger and support conditions, recommendations, and alternative methods to restore the hanger and support system mechanical integrity and safety aspects of the system.

3.2.15 Compile a list of all PF pipes hangers and supports that is require complete replacements to maintain safe and keep within guarantee period.

3.2.16 The contractor shall in writing gives a guarantee period on PF pipes hangers and hanger accessories for both new hangers and repaired hangers and recommend maintenance regime/plan that shall be followed in order to keep the hangers and hanger components in healthy condition within the guarantee period and outside of the guarantee period.

3.2.17 Generate PF pipe hanger and support general arrangement drawings with angles of PF pipe elevations and detailed scale drawings. This should be approved by Eskom QC and Engineering.

3.2.18 The drawings package (General drawings, detailed drawing, any other soft copy package including drawings CAD program etc) shall be an Eskom property.

3.2.19 Supply and install all materials and consumables other than Eskom supplied materials, required for permanent installation PF pipe hangers and support system.

3.2.20 The contractor shall have the replacement and associated hardware along with necessary tools to complete the removal of the existing support and installation of the new or refurbished PF pipe hanger and PF pipes supports.

3.2.21 The contractor to ensure suitable qualified rigging personnel for rigging to ensure safe and quality removal and re-erection and comply with OH Act and Construction Regulations.

3.2.22 Supply all consumables and equipment's required for all types of tests and NDT's such as radiography, ultrasonic testing, magnetic particle, dye penetrant examination etc.

3.2.23 Remove and dispose as per Eskom procedure all severely eroded, cracked, bent PF pipe hangers and supports systems that the mechanical integrity and safe function cannot be restored. Note: all scrap material removed from work site is an Eskom property.

3.2.24 Supply and replace all severely corroded clamps, spring assemblies, spring coils, bent rods and cracked lugs with new ones.

3.2.25 Supplied and replacement by the contractor materials support shall be equivalent or superior to those used for original construction of the PF pipes hangers and supports components.

3.2.26 At installation completion, the Contractor carries out checks and inspections as per completion check sheets to the satisfaction of the Employer prior to commissioning

3.2.27 The contractor shall carry out all alignment and re-calibration of all PF pipes hangers both hot and cold calibrations also marked on hanger cans,

3.2.28 The contractor shall detail the hanger calibration reports, calculations, hanger type, materials, ceeza model results, 3D scanning etc in relation to PF pipework and these details shall be included on the reports and detailed drawings of the hanger systems . This information will be the property of Eskom.

3.2.29 The contractor shall give access for the employer to carry out inspection and random surveillance on any of the tests and test sites or requirements detailed in this standard 240-56239143 and access on all manufacturing/fabrication sites.

3.2.30 The contractor work will only be final for execution after the Eskom QC and Eskom Engineering has approved the works executed, this includes reports, detailed drawing.

3.3 Work to be performed by the contractor on PF pipework

3.3.1 Contractor shall conduct planned site visit in order to establish the working plan and familiarize themselves with working conditions in order to efficiently plan for the deployment of personnel and machinery to site.

3.3.2 The Contract*or* carries out risk assessments and provides such report to the Project Manager at project kick-off meeting.

3.3.3 The Contractor clearly states in his work methodology how he is going to execute the works safely.

3.3.4 The contractor to provide technical services within the agreed guarantee and/or defect period and site visits rectify any problems experienced with the equipment (PF pipework and accessories, PF hanger systems) supplied and installed.

3.3.5 Review and approval of Contractor's entire work(s) by Eskom shall in no way relieve the Contractor of his responsibility for safe and efficient, engineering works, rigging, removal and re-installation of PF pipework components

3.3.6 The contractor shall furnish the employer with a PF pipework inspection preliminary report before work starts on PF pipework.

3.3.7 Generate PF pipework general arrangement drawings with angles of PF pipework and detailed scale manufacturing drawings. This should be approved by Eskom QC and Engineering.

3.3.8 The drawings package (General drawings, detailed drawing, any other soft copy package including drawings CAD program etc) shall be an Eskom property and shall be registered with Eskom drawing office.

3.3.9 Conduct cold pipe, hot pipe surveys including VJ coupling inspections

3.3.10 The contractor shall strip all the lagging and cladding on the PF pipework for proper and detailed inspections

3.3.11 The contractor shall properly show and guide the employer on areas where scaffold is required in order for the contractor to execute this scope of work.

3.3.12 Dismantling of PF pipework which include but not limited to opening of PF pipes flanges, straight pipes, bends,kinks, bends, square to rounds and VJ couplings. The components shall be marked in terms of the position they were removed as per drawing provided by employer to the contractor, discrepancies must be communicated and clearly recorded in the report**.**

3.3.13 The Contractor carries out all necessary rigging to get PF Pipe work components measurements, sandblasting for fabrications, refurbishments, replacements, and repairs whichever is necessary for a particular pipe section.

3.3.14 The contractor shall conduct both visual and necessary thickness tests in order to determine the best work to be conducted to restore the integrity of that particular PF pipe section to keep that pipe section with the pipework integrity guaranteed period

3.3.15 The Contractor manufactures/fabricate the PF pipe components to the available Eskom Drawings/as per available pipe section in the plant/ as per Eskom Standard -Ceramic Lined Pulverized Fuel Pipework Standard-240-56239143. The Contractor verifies these drawings and all sizes for accuracy prior to manufacturing the PF pipe components, the employer does not commit on the accuracy of the drawings and employer does not approve that thedrawing be used as manufacturing drawing without prior agreement to utilize part of or all of the drawing with Eskom QC and Eskom Engineering.

3.3.16 The Contractor notifies the Project Manager or any agreed form of line of communication on any discrepancies found in the drawings andwaits for his instruction prior to correcting and such findings of discrepancies shall form part of the inspection report.

3.3.17 The contractor shall supply straight pipes, bends, and kinks with two fixed flanges on both ends.

3.3.18 The contractor shall fabricate, supply and install ceramic lined straight, bends, kinks steel pipe sections with two fixed flanges on both ends.

3.3.19 Remove and dispose as per Eskom procedure all severely eroded, cracked, bent PF pipework that the mechanical integrity and safe function cannot be restored. Note: all scrapmaterial removed from work site remain an Eskom property.

3.3.20 The contractor shall supply ceramic lined pipe sections as per Eskom standards: 240-56239143

3.3.21 The contractor shall use ceramic lining on all unlined PF pipes found unlined but still in goodcondition, this will be agreed with Eskom Engineering and Eskom QC before the final scope is approved.

3.3.22 The contractor shall apply painting (surface preparation, coating system and identification) as per Eskom standards: 240-56239143 on all PF pipes fabricated, PF pipes repaired

3.3.23 Permanent identification, An assembly reference number shall be permanently marked on each assembly. Details of the proposed method of permanent identification shall be submitted to Eskom for approval

3.3.24 The contractor shall conduct inspection on all VJ couplings and its components for areas withcompromised mechanical integrity such as cracks, corrosion, bent sections.

3.3.25 The contractor shall replace VJ couplings rubber seals, bolts and all other coupling components and where old material will be used this shall be agreed with Eskom QC and Engineering and included on the report and final scope of work, however, this should be in line with contractor guarantee period on his works.

3.3.26 The contractor shall replace all old gaskets with new rope, flange and rubber gaskets, where old gaskets will be used it shall be in agreement with Eskom QC and Eskom Engineering and in line with contractor guarantee period.

3.3.27 The contractor shall supply and install the PF sampling points as instructed by the employer (PF sampling points samples shall be provided by Employer)

3.3.28 The contractor shall generate the sampling points drawings from sampling point sample provided by the employer. The generated drawing shall be the property of the Eskom and drawing approved by Eskom QC and Eskom Engineering then be submitted to the Eskom drawing office.

3.3.29 The Contractor ensures the PF sampling points are installed at accessible positions on pipesections as instructed by Eskom QC and Eskom Engineering

3.3.30 The Contractor carries out the necessary rigging to get PF Pipe work components into place. The components are bolted / welded or clamped into place (as per drawing specifications), ensuring no PF leaks occur.

3.3.31 The Contractor shall guarantee the defects free and PF leaks free period, the period shall beapplicable to repair work on PF pipes.

3.3.32 The Contractor shall recommend the minimum maintenance regime or maintenance strategy of the PF pipework in order to keep the PF pipework PF leak free within the guarantee period.

3.3.33 The Contractor checks the installed PF pipe components for tightness and ensures that PF leaks, if found during commissioning and on-load contractor shall repair leaks at no costs tothe employer.

3.3.34 At installation completion, the Contractor carries out checks and inspections as per completion check sheets to the satisfaction of the Employer prior to commissioning

3.3.35 The contractor shall carry out all alignment and re-calibration of all PF pipes, PF pipes hangers and PF pipes supports systems.

3.3.36 The contractor works shall only be final for after Eskom Quality controller and Eskom Engineering has approved the works executed, this includes reports, detailed drawing.

3.3.37 The contractor prepare and issue detail manufacturing drawings for each steel pipe, bend and kink for approval, drawing of each item include detailed ceramic lining layouts as per 240-56239143

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3.4 Work to be performed by the employer

3.4.1 The employer shall supply and erect all scaffolding needed by contractor to gain access to PF Pipework, PF pipes hangers and PF pipes supports.

3.4.2 The Employer shall review the PF pipes hanger and support reports

3.4.3 The Employer shall review the PF pipework inspection reports

3.4.4 The Employer shall give the contractor reference PF pipe drawings that available to the employer, the employer does not commit to accuracy of the drawings and employer does not approve the drawing to be used as manufacturing drawings

3.4.5 The employer shall carry out inspection and random surveillance on any of the tests or requirements detailed in standard 240-56239143

3.4.6 The Employer gives the Contractor access within Kriel Power Station site boundaries

4. Technical information

Technical information for this scope of work shall comply with Eskom Standard: Ceramic Lined Pulverized Fuel Pipework Standard and where the standard does not make any provision to accommodate works stipulated on this scope of work or no Eskom Standard exist to accommodate such works then any other standard to be used or suggested standard shall be agreed in writing by Eskom QC and Eskom Engineering..

4.1 Design temperature and pressure

- All ceramic-lined PF pipework shall be capable of withstanding an internal pressure of 0.350 MPa, with no detrimental effect on either the lining material or the attachment of such.
- All adhesives and grouts employed in the construction of any ceramic lined assembly shall be non-flammable and capable of withstanding sustained operating temperatures of 120°C. In

addition, the fixing method employed in all ceramic lined assemblies shall ensure that the lining remains secure even in the event of a mill fire, or similar occurrence resulting in temperature excursions above 120 °C. Withstanding higher temperatures than stipulated will be advantageous.

4.2 Fixing Method

- Internal preparation of the pipework shall be done to ensure adequate adhesive/grout adhesion and shall fulfil the specified requirements of the adhesive/grout supplier.

- The preparation and fixing method shall be provided by a specialist company for ceramic lined pulverised fuel pipes and needs to be declared to Eskom and approved by Eskom, to ensure quality work is done.

- The section were the ceramic linings need to be applied needs to be free of rust, scale or oil substances.

4.3 Size tolerance — pulverized fuel pipe bends

The following tolerances shall apply:

Table 2: Size Tolerance

Nominal bore	Tolerance
Up to 400 mm	□ 3 mm
401 mm to 600 mm	□ 4 mm
Greater than 600 mm	□ 5 mm

The ceramic lining shall be flush with the flange face or within 3 mm of the face and the lining shall not protrude above the flange face.

4.4 Painting

Exposed pipework on all assemblies shall be painted as follows:

- Surface preparation prior to painting, pipework shall be mechanically wire-brushed to St3 of SIS 055900
- Coating system pipework shall be painted with one coat of zinc chromate applied by brush or

airless spray. Dry film thickness shall be 35 micrometers minimum

- For Identification purposes high gloss enamel paint to SABS 630 Grade 1 shall be used (refer clause 3.6). Dry film thickness shall be 30 micrometers minimum

4.5 Marking of Assemblies

Identification for erection purposes

Ceramic lined assemblies shall be marked in the supplier's works (refer clause 3.5.3). The following information shall be clearly marked on each assembly:

- Manufacturer's name
- Power Station concerned
- Assembly reference number
- Direction of pulverized fuel flow

The assembly reference numbers shall, whenever possible, correspond with reference numbers shown on original Eskom drawings.

Permanent identification

An assembly reference number shall be permanently marked on each assembly. Details of the proposed method of permanent identification shall be submitted to Eskom for approval, The method shall be fully compatible with unit 3 PF pipework identification method as stipulated in Ittem listing.

4.6 Materials

Casing

The casing of all assemblies shall be manufactured from steel to BS 4360 Grade 43A, or equivalent approved material, and shall be designed with adequate structural strength to ensure compatibility with the existing support system

The following shall be the minimum requirements for casing thickness:

Table 1: Casing Thickness Internal diameter	Casing thickness	Flange thickness
Up to 360 mm	3 mm	20 mm
361 mm to 450 mm	5 mm	25 mm
451 mm to 800 mm	6 mm	25 mm
Greater than 800 mm	8 mm	30 mm

Lining — pulverised fuel pipe bends

Ceramic linings shall conform to either of the following alternatives

a. Sintered type, containing not less than 89 % alumina.

b. Composite type, consisting of a lining conforming to clause 3.3.2 (a) covering not less than 150° on diameter on the extrados of the bend, plus an abrasion resistant lining covering not more than 210° on diameter on the intrados of the bend.

Lining — other assemblies

Ceramic linings shall be alumina based and shall be of the sintered type, containing not less than 89 % alumina.

4.7 CONSTRUCTION

Welding

All welding shall be carried out in accordance with BS 2971. Where welding is carried out in accordance with other National or International standards, such standards shall be subject to Eskom approval, and the latest edition of such approved standards shall be used.

Flanges

Flanges shall be in accordance with BS EN 1092-1:2007+A1:2013, BS EN 1092-3:2003, and BS EN 1092-2: 1997 for all new systems. Flanges for existing systems shall be compatible with the existing pipework and flanges.

Lining method

a. Pulverized fuel pipe bends

- Lining shall be in the form of ceramic key pieces built up to form a ring such that a complete ring is self-supporting when fitted inside the steel casing
- The ceramic tiles shall be chamfered where necessary so that each tile is in intimate contact with adjacent tiles
- Gaps between tiles caused by tolerances on the casing or tiles shall be a maximum of 1mm provided that such tiles are in intimate contact at, at least one point.
- • Joints in the direction of pulverised fuel flow shall be staggered, as detailed in Figure 1.

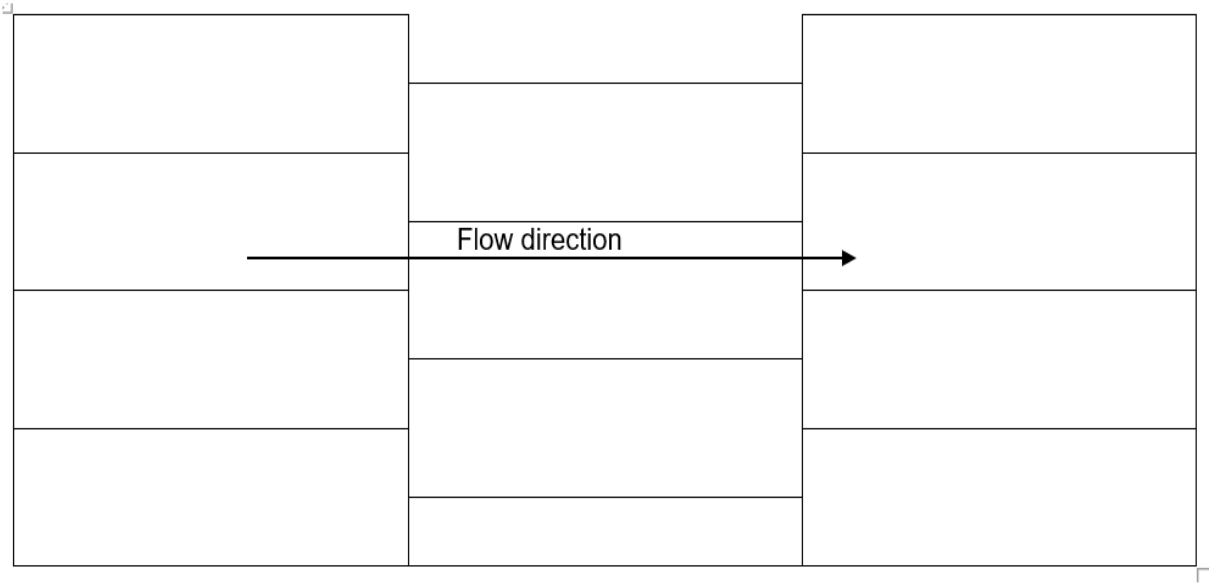

Figure 1: Joints in the direction of flow is staggered perpendicularly

- Tile edges, including weld-on tile plugs, shall not protrude into the pulverised fuel flow, and shall not be more than 1mm below the preceding/upstream adjacent tile.

- The use of “weld-on” ceramic tiles shall not be permitted in pulverised fuel pipe bends of round section unless the tile is specifically engineered for the bend.

b. Other assemblies

The lining procedure outlined in clause 3.4.3 (a) shall be followed where feasible.

4.8 Standard and Specification

- 240-106628253 Standard for welding requirements on Eskom plant
  - 240-56239143: Ceramic Lined Pulverized Fuel Pipework Standard
- BS EN 13480 Metallic Industrial Piping
- BS EN 12952 Water-tube boilers and auxiliary installations
- QM 58 Quality Management
- BS 2971
- BS EN 1092-1:2007+A1:2013,
- BS EN 1092-3:2003
- BS EN 1092-2: 1997
- SABS ISO 9001:2015

4.8.1 Configuration Management Standards

It is desirable for uniformity and accountability that PF pipework, PF pipes hangers and PF pipes support work remain under one service provider to prevent problems that comes with different service providers working systems that have high impact on the performance of one another. On this scope of work this is with re-calibrations, alignment of the system and defects with PF leaks on couplings, flanges that could occur.

5. Quality Management

A work methodology includes but not limited to the following:

- Quality control plans
- completion check sheets
- Commissioning
- Adhering to 240-56239143: Ceramic Lined Pulverized Fuel Pipework Standard

6. Acceptance

This document has been seen and accepted by:

7. Revisions

8. Development Team

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

9. Acknowledgements