Eskom	Scope of work	Kriel Power Station

Title: **Inspection, repairs, fabricate, supply and install of ceramic lined pulverised fuel pipes, hangers and supports at Kriel Power Station over a period of five years**

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1. Introduction

This document is required to establish a 5-year contract for Inspections, Maintenance, fabrication, refurbishment, repairs, and installation of the PF (pulverized fuel) pipework system and associated components like dampers, splitters, hangers and supports. The activities PF pipes and hangers' inspections, fabrication of new ceramic line PF pipes, installation of new hangers and supports, replacement of VJ couplings, maintenance of PF pipes and hangers on as when required basis. The activities shall be happened on GO, MGO, Opportunity Outages and mill services

This scope of work is driven by SHE (Safety, Health and Environmental and production efficiency)

2. Supporting Clauses

2.1 Scope

2.1.1 Purpose

2.1.2 Applicability

This document shall apply to Kriel Power Station.

2.1.3 Effective date

This document is effective from the date of authorisation

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] QM 58 Quality Standards or Procedures
[3] 240-43156827 Introduction to the Welding Rulebook
[4] 36-505 Personnel and Entities Performing Welding Related Special Processes on Eskom Plant
[5] 36-775 Control of Plant Construction Repair and Maintenance Welding Activities
[6] OHS Act - Occupational Health and Safety Act and Regulations (Act No.85 of 1993)
[7] SANS 347 – Categorization and conformity assessment criteria for all pressure equipment

2.2.2 Informative

[8]

2.3 Definitions

Item	Definition
Contractor	A group of people and facilities (corporation, firm, enterprise, institution etc.) with an arrangement of responsibilities, authorities and relationships. It also refers to supplier, consultant and service provider.
Quality Control Plan (QCP)	A document specifying the activities to be inspected throughout the execution of the project, inclusive of test methods, procedures and acceptance criteria. (This term is equivalent to QIP and ITP)
Contract Manager	This term refers to a person responsible for fulfilling the role concerned with the contractual aspect of the Eskom Commercial relationship with the Contractors in respect of the specific contract
Data Package	All documentation and certification required to be issued by the Contractor in order that the takeover can be certified by Eskom

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2.4 Abbreviations

Abbreviation	Explanation
VJ	Viking Johnson
PF	Pulverised Fuel
ISO	International Organization for Standard
QCP	Quality control plan
GO	General Overhaul

2.5 Roles and Responsibilities

System Engineer – The System Engineer is responsible for the technical specifications, sound engineering practice and scope defined in the document.

Project Manager – The Project Manager is responsible for the procurement document required to establish a contract with a contractor capable of executing the scope.

2.6 Process for Monitoring

N/A

2.7 Related/Supporting Documents

N/A

3. Scope of work

3.1 Boundaries

The boundaries of the plant where this scope covers the following high-level plant areas:

- PF pipe work from mill outlet up to the burner square to round.
- PF pipes hanger(s) and support components.
- All PF pipes and hangers' accessories such as bolts, nuts and gaskets etc.
- The scope excludes primary and secondary distribution boxes.

3.2 Scope Summary of Activities

In The scope of work covers the following

- PF Pipes Fabrication and Erection
- Hanger and Support Selection and Installation
- Quality Control
- Documentation

3.3 PF Pipes Fabrication and Erection

The contractor shall be required to fabricate the PF pipes on "as and when required basis" it is required that the fabrication work is conducted in a workshop that is equipped with the machinery that can fabricate the PF pipes sizes to prevent challenges with PF pipes supply when required. The workshop must comply to safety and quality standards stipulated on the quality section of this document. The fabrication of the PF pipes shall not be done from the drawings supplied by the employer; the drawings supplied by the employer do not reflect exactly what is installed in the plant but act as a guide on the elevations of the PF pipework etc. but the details of the PF pipes such as thickness, flange sizes etc. are not accurate. It is recommended that the measurements are taken from the plant by the contractor who will be conducting the Fabrication of the PF pipes.

The PF pipes at Kriel Power Station are from below 15ML of the boiler up to 31ML which means during the PF pipes erection process a lot of rigging will occur. This will require a suitable qualified rigger or a team and rigging equipment. Before the rigging process starts, the rigging procedure must be approved by a suitable qualified person from both the contractor and employer. The risk assessment must be in place and approved by contractor safety representative before rigging starts

PF pipes sections shall be clearly and permanently marked in line with available drawings. Kriel Power Station PF pipes are made of carbon steel pipes with different types of lining installed; however, all the new or refurbished pipes section shall only be ceramic lined, and detail of lining shall comply to Eskom Ceramic Lined Pulverised Fuel Pipework Standard-240-56239143.

Kriel Power Station units 1-3 have same PF pipes configuration and sizes while units 4-6 has same PF pipes configurations and sizes. The design of the PF pipes from distribution box to the square to rounds on units 1-3 PF pipes inner diameter is 450mm and outer diameter of 478mm. Units 4-6 inner diameter of 500mm and outer diameter of 520mm. These are design figures not truly the reflection

of what is in the plant due to over the years PF pipes installations. The drawings are on Appendix B which indicate locations of the PF pipes and dimensions. The drawings shall not be used for fabrication but to create a general idea of the elevations and the sizes of the pipes that will need to be fabricated and ceramic lined etc.

The inspections conducted on unit 4 and 6 indicate that on the PF pipework system the VJ coupling are the weakest link after the hangers and support systems. The hangers were the most eroded system and weld build ups were done hence the drive to replace VJ couplings. There are 72 VJ couplings on six PF pipes from distribution box to PF burners square to rounds per unit and a total of 8 VJ couplings on six PF pipes from all 6 mills to the distribution box. The six pipes from the mill classifier outlet inner diameters are 1122mm for units 1-3 and 1230mm for unit 4-6. The configuration for unit 4 E mill is on appendix B Figure 15, These figures are not meant for fabrication purposes.

3.4 PF pipes hangers and supports and Installation

Kriel Power Station PF pipes hangers are spring hangers' type; there are different sizes of hangers installed at different sections of the PF pipes.

The current PF pipes hangers and supports installed at Kriel Power Station need to be replaced, since they are the main problem when it comes to PF leaks especially on the PF pipes couplings. There are several issues that were identified on hangers such as

- missing hangers,
- broken rods,
- missing clamps,
- untightened clamps,
- missing bolts and nuts
- Broken springs

The contractor is required conduct visual inspections and assessments of the PF pipes hangers and supports. The contractor shall carry out Caesar model and 3D scan to select appropriate spring hanger type, location as built structure also to Identifying conflicts with other plant structures or equipment such as fire hydrant system pipe work, core airs and to ensure proper elevations of the pipework to prevent PF settlements inside the PF pipework.

The hangers support means all hanger components such as clamps, bolts and nuts etc.

3.5 Maintenance services during unit outages and mill services

Kriel Power Station outages are separated into GO, MGO and Opportunity Outages. The scope of works for the GO and MGO is attached on the appendix A. The opportunity outage scope will be determined by duration of the opportunity outage and defects identified while the unit was in operation. The opportunity outages will be used by the contractor to conduct inspections and maintenance on critical components of PF pipes, hangers and supports. The inspection findings during opportunity outage shall be used in planning the works that will be done on the upcoming GO, MGO and mill services.

The outage duration from breaker open to breaker close is approximately 98 days for a GO and 55 days for an MGO. Outage Coordinator shall communicate unit outage schedule and changes with the contractor. Boiler Auxiliary Maintenance Supervisor shall communicate the mill outage plans with the contractor in advance based on mill running hours and MMD mills supervisor plan. The mills at Kriel are serviced at 5000hours in operation.

3.6 Scope requirements for the Contractor on PF pipework, hanger support and VJ couplings

- The contractor shall conduct visual inspections and assessment of PF pipework and hangers
- The contractor shall carry out Caesar modelling and 3D scan to ensure proper support design, accommodate thermal expansion and optimize pipe routing to minimize pressure drop which contributes to PF settlements inside the PF pipes.
- The contractor shall submit a Ceasar model and 3D scan reports with recommendations to the employer. One report for units 1-3 and one report for units 4-6 unless there are noted differences in the plants that require an independent model for the same units.
- The contractor shall supply, install, calibrate, test, set and lock new PF pipes spring hangers and accessories as discussed and agreed with the employer on an “as and when” required basis to Kriel Power Station Stores.
- The contractor shall remove from the plant and refurbish PF pipes hangers and then deliver to Kriel Power Station stores on an “as required basis”. The contractor shall ensure that where the hanger(s) were removed the pipes remain supported in a safe manner with no risk of movement and falling.
- The contractor shall ensure that all quality documents accompany both new and refurbished hangers
- The supply, installation, calibration of the new PF pipes spring hangers and accessories shall be done during GO’s, MGO, mill 5000-hour services and when the employer and contractor agree to conduct this work
- The contractor shall fabricate, supply and install new ceramic lined PF pipes sections and deliver to Kriel Power Station stores on an “as required basis”.
- The contractor shall refurbish, repair and ceramic line PF pipe sections
- All pipes removed for refurbishment shall be ceramic lined as per Eskom Standard.
- The painting of the PF pipes shall be done as per Eskom Standard.
- On areas where PF pipes are damaged by PF erosion, thickness tests shall be done to determine the size of patch to be used in order to maintain the thickness uniformity of the pipe. Then the pipe shall be ceramic lined
- The severely damaged (50% or more thickness eroded), that PF pipe bend shall be replaced with a new ceramic lined PF pipe bend.
- The contractor shall supply and install new VJ couplings and its accessories on “as and when” required to Kriel Power Station Stores.
- The supply, installation, calibration new VJ couplings and accessories shall be done during GO’s, MGO, mill 5000-hour services and when the employer and contractor agree to conduct this work.
- The contractor shall remove from the plant and refurbish couplings and deliver to Kriel stores

on an “as required basis”. The contractor shall ensure that where the VJ coupling was removed the pipes remain supported in a safe manner with no risk of movement and falling.

- During GO and MGO’s the contractor shall conduct detailed inspections and generate an inspection report. The generated outage PF pipes and hanger report shall be approved by responsible engineer and MMD Supervisor.
- The contractor is also required to execute outage SOW for the PF pipes and hanger supports (refer on appendix for outage scope of work).
- When the mill is taken out for service, the contractor shall ensure that the PF pipe is blanked/isolated from the boiler below square to round. The contractor shall provide the blanking procedure for the PF pipes and conduct a risk assessment for the works; The contractor shall consider on the risk assessment the flammable material that might be inside the PF pipe, the flammable material can be PF or fuel oil especially on the horizontal pipes’ sections.
- The contractor performs maintenance works during planned (MGO’s and GO’s), corrective and short-term opportunity outages on PF pipes and hanger supports.
- The contractor shall be required to perform maintenance work on as when required basis.
- The contractor shall be required to execute any new or additional scope of works on PF pipes, hanger supports and VJ couplings both off load and on-load conditions.
- The contractor shall be required to execute any approved modification that is on the PF pipes and hangers and supports.
- The contractor performs all planning and scheduling associated with (MGO’s and GO’s), corrective and short-term opportunity outages.
- The contractor shall have a senior person as a representative for all MGO’s, GO’s and short-term outage meetings to provide feedback as required by the meeting.
- The contractor is responsible for rigging and to ensure rigging is done safely.
- The contractor shall ensure that rigging is done by suitable qualified person, and that an approved rigging procedure is in place with signed risk assessment for each rigging activity.
- The contractor shall manufacture, supply and install PF sampling test points as instructed by the employer; this shall be a total of 432 units in a 5-year period.
- Repair defective PF sampling test points as per Performance and Testing or the System Engineer scope of work.
- The contractor shall bring a suitable qualified and experienced team that will execute the PF pipe, hangers and support works during opportunity outages, mill services, GO’s and MGO’s with all necessary equipment and tools required to execute the scope of work.
- The contractor shall generate detailed drawings from sampling points provided by the employer; the drawing shall be approved by P&T Senior Advisor. The generated drawing shall remain the property of Eskom.
- The contractor shall bring own cleaning team to clean PF and ash accumulation around PF pipework and scaffolding before, during and after outages which will ensure that housekeeping is done.
- The contractor shall remove and dispose all severely eroded, cracked, bent PF pipes hangers and supports systems that mechanical integrity and safe function cannot be restored as per Eskom procedure.
  Note: All scrap material removed and disposed of material remains a Eskom property.
- The contractor shall conduct alignment of all PF pipework, PF pipes hangers and supports systems.
- The detailed planning of critical/major activities, together with Standard Maintenance Package (SMP) including QCP’s, and risk assessments will be done by the contractor and approved by the employer (maintenance supervisor or his representative). Where Permit to

Work is required, the work will be planned with the person in charge of the plant and maintenance supervisor.

- All unpreventable and unforeseen plant failure occurrences, replacement of defective PF pipes and hanger components shall be done by the contractor with approval by the maintenance supervisor or his or her delegated representative
- The contractor shall have own Authorised Supervisor on site when conducting the works.
- Planned maintenance schedules initiated by Employer will be executed by the contractor to prevent any potential breakdowns or equipment failures and secondary plant damages.
- The contractor shall be responsible for clearing any form of PF pipe blockages reported and shall supply a procedure and risk assessment for such activity.

3.7 Scope requirements for the Employer on PF pipework, hanger support and VJ couplings

- Inspections and temporal repairs on PF pipes, hanger and supports shall be done by the employer through maintenance supervisor. The inspection and temporal repairs sheet shall be compiled by the Employer.
- The check sheet shall be done by employer at least (3x per week) including plant walks with the intention to identify PF pipes leaks, defective hangers and pipes.
- The employer shall conduct temporal repairs on PF pipes, hangers supports and VJ couplings. All temporal repairs shall be properly repaired on the next available opportunity outage by the contractor or when that mill with a defect is out for service or the unit is off load on opportunity outage.
- The Employer shall be responsible for calling out the contractor to come to site and conduct repairs on the PF pipes, hangers supports and VJ couplings.
- The employer shall identify and record all defects or potential failures on PF pipes and hangers and record on SAP for planning and history capturing.
- The employer will have the list of recorded defects and have a plan in place for corrective actions which will be as per the priority of the defects.
- The authority for determining the criticality of work rest with the person in charge of the plant and maintenance supervisor. On plant breakdowns repairs the works shall start as soon as possible and continue until the plant is back in operation. Except for safety reasons the employer maintenance supervisor permission is required to postpone breakdown work.
- Maintenance opportunities are sometimes provided on short notice. When unit(s) comes down for repairs it is expected that all outstanding works on the unit is planned, in readiness for execution on short notice and that when the unit returns to service that there are no outstanding work orders, this is the responsibility of the Employer maintenance Supervisor or his delegated representative.
- The employer shall provide the scaffold material and manpower to erect scaffold through a third party.

3.8 Quality Control

- Quality control plan must be developed and submitted to Eskom for approval prior to work starts. The plan must include quality control for refurbished components and new material components supplied to Kriel Power Station Stores.

- The approval of the quality control plan must be done but not limited to the following people, must be approved before t by Contractor Supervisor, Contractor Quality Controller, Employer Quality Controller, Employer Maintenance Supervisor and Employer Engineer.
- The work done on PF pipes and hangers must be visually inspected in relation to the agreed drawings and specifications. This is checking the PF pipes elevations to prevent PF settlements inside the PF pipework.
- All Standards stipulated in this document shall be adhered to
- PF pipes must be inspected for foreign material that might be inside the PF pipes before boxing up the pipework.
- The contractor shall have relevant documentation for all new supplied material to Kriel site, these include but not limited to material specification, sizes, thicknesses etc.
- The refurbished material such as PF pipes sections, hangers and supports must have relevant QCP's that has been agreed with the Employer.
- All welding shall be done as per latest version of Eskom Welding Standard 240-106628253
- All PF pipes work including tiling shall comply with the latest Eskom Ceramic Lined Pulverised Fuel Pipework Standard-240-56239143
- Each PF pipes section shall be clearly and permanently marked in line with available drawings, but the type of marking will be agreed with the employer.
- The employer's representative may from time to time visit the contractor's workshop or site to inspect and monitor progress of the works without prior notice.
- After every patch work is done, necessary NDTs shall be conducted on all welds.

3.9 Documentation and Records

- The contractor shall provide Eskom with detailed drawing for each component being fabricated for the first time and installed on PF pipes, hangers and accessories; the drawing shall be an Eskom property.
- After the completion of the PF pipework and hanger supports the contractor shall generate PF pipes and PF hanger support detail drawings which shall also show PF pipes elevations, hangers and detailed scale drawings. The drawings package shall be an Eskom property
- The hanger inspections, testing and calibration documentations shall form part of the data pack and will remain an Eskom property.
- Boiler Auxiliary Maintenance Supervisor to keep record of all works done.

3.10 Drawings and markings

- The contractor shall provide Eskom with detailed drawing for each component being fabricated for the first time and installed on PF pipes and hangers.
- Drawings must detail each component installed on the PF pipes and hangers i.e. size, type, material etc
- Each PF pipes section/component shall be clearly and permanently marked in line with available drawings.

4. Acceptance

This document has been seen and accepted by:

Name	Designation
Nkosana Shabangu	Boiler Auxiliary Maintenance Supervisor – Kriel Power Station
Vhudzisani Mulaudzi	Boiler Auxiliary Maintenance Senior Technician – Kriel Power Station
Tsepo Makgetha	Boiler Auxiliary Maintenance Senior Artisan – Kriel Power Station
Yolani Cwala	Outage Co-ordinator

5. Revisions

Date	Rev.	Compiler	Remarks
November 2025	2	X. Sigwebela.	Review of the PF pipes and Hanger's contract scope of work
September 2022	1	X. Sigwebela.	Final PF pipes

Final PF pipes and Hangers Contract Scope of work

6. Development Team

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

- N/A

7. Acknowledgements

- N/A

Appendix A – Outage (MGO and GO) scope of work

SYSTEM		**PF Pipework and hanger support systems**		
№	**COMPONENT FLOC (AKZ CODE)**	**COMPONENT DESCRIPTION**	**ACTIVITY**	**WORK SPECIFICATIONS**
1			Pre-job	• Erect scaffold around the PF pipes before the works starts • Ensure the scaffold is declared safe before use. • Ensure sufficient light before work starts. • Ensure adherence to hook up at heights cardinal rule • Ensure a risk assessment is conducted before PF pipes are opened and rigged out of position for internal inspections, Risk assessment(s) must be signed by all relevant parties. • Ensure a rigging procedure is in place and approved by all relevant parties.

SYSTEM		**PF Pipework and hanger support systems**		
№	**COMPONENT FLOC (AKZ CODE)**	**COMPONENT DESCRIPTION**	**ACTIVITY**	**WORK SPECIFICATIONS**
	05-06NMX0G	PF Pipes straights (These include the PF pipes from the mill up to the primary distribution box)		• Clean all PF and Ash around and on the PF pipes and scaffold. • Ensure PF pipes that will be inspected are correctly supported in a stationary structure with an approved rigging or support material as per approved rigging procedure. • Clean all PF, ash settlements and fuel oil inside the PF pipes before conducting inspections.
			Inspections	Conduct visual inspections for the following: • Blocked PF pipes • Eroded and holed PF pipes. • High eroded PF pipes lining, missing lining and unlined PF pipes • Temporal repaired PF pipes (Epoxy repaired etc.) • Window patched PF pipes – integrity of the patch and weld repair.

SYSTEM		**PF Pipework and hanger support systems**		
№	**COMPONENT FLOC (AKZ CODE)**	**COMPONENT DESCRIPTION**	**ACTIVITY**	**WORK SPECIFICATIONS**
	05-06NMX0G			• Foreign material inside the PF pipes
			Tests	• Conduct thickness tests on all holed and eroded PF pipes to determine the size of patch needed to maintain uniform thickness of the PF pipe. • Old welds on the pipes must be tested for integrity and if any of the welding has developed defects or the patch show signs of defect then the patch must be rewelded or re-done altogether
			Replace/Repair	• PF pipe that requires more than 50% patches must be replaced with a new pipe, any deviation from this must be approved by Engineering. • patches, lining must be in good condition or replaced. • Old welds on the pipes must be tested for integrity and if any of the welding has developed defects or the patch show signs

SYSTEM		**PF Pipework and hanger support systems**		
№	**COMPONENT FLOC (AKZ CODE)**	**COMPONENT DESCRIPTION**	**ACTIVITY**	**WORK SPECIFICATIONS**
		PF Pipes straights (These include the PF pipes from the mill up to the primary distribution box)		of defect then the patch must be rewelded or re-done altogether • All unlined pipes and new pipes must be ceramic lined as per Eskom Standard, where this is not done this must be approved by Engineering. The specific unlined pipe section must be marked from outside. • Thickness test must be conducted on all the pipes that has holes and wear to determine the amount of patch needed to repair the pipe back to uniform thickness. • All inspection findings must be included on the inspection report with recommendation to replace, refurbish or repair.
	05-06NMX0G	PF pipes bend (60deg)	Inspect	Conduct visual inspections for the following: • Blocked PF pipes • Eroded and holed PF pipes. • High eroded PF pipes lining, missing lining and unlined PF pipes

SYSTEM		**PF Pipework and hanger support systems**		
№	**COMPONENT FLOC (AKZ CODE)**	**COMPONENT DESCRIPTION**	**ACTIVITY**	**WORK SPECIFICATIONS**
2.				• Temporal repaired PF pipes (Epoxy repaired etc.) • Window patched PF pipes – integrity of the patch and weld repair. • Foreign material inside the PF pipes
			Replace/Refurbish/Repair	• PF pipe that requires more than 50% patches must be replaced with a new pipe, any deviation from this must be approved by Engineering. • patches, lining must be in good condition or replaced. • Old welds on the pipes must be tested for integrity and if any of the welding has developed defects or the patch show signs of defect then the patch must be rewelded or re-done altogether • All unlined pipes and new pipes must be ceramic lined as per Eskom Standard, where this is not done this must be approved by

SYSTEM		**PF Pipework and hanger support systems**		
№	**COMPONENT FLOC (AKZ CODE)**	**COMPONENT DESCRIPTION**	**ACTIVITY**	**WORK SPECIFICATIONS**
				Engineering. The specific unlined pipe section must be marked from outside. • Thickness test must be conducted on all the pipes that has holes and wear to determine the amount of patch needed to repair the pipe back to uniform thickness. • All inspection findings must be included on the inspection report with recommendation to replace, refurbish or repair.
3.	05-06NMX0G	PF pipes Kinks (45deg)	Inspect	Conduct visual inspections for the following: • Blocked PF pipes • Eroded and holed PF pipes. • High eroded PF pipes lining, missing lining and unlined PF pipes • Temporal repaired PF pipes (Epoxy repaired etc.) • Window patched PF pipes – integrity of the patch and weld repair.

SYSTEM		**PF Pipework and hanger support systems**		
№	**COMPONENT FLOC (AKZ CODE)**	**COMPONENT DESCRIPTION**	**ACTIVITY**	**WORK SPECIFICATIONS**
				• Foreign material inside the PF pipes
			Replace/Repair/Refurbish	• PF pipe that requires more than 50% patches must be replaced with a new pipe, any deviation from this must be approved by Engineering. • patches, lining must be in good condition or replaced. • Old welds on the pipes must be tested for integrity and if any of the welding has developed defects or the patch show signs of defect then the patch must be rewelded or re-done altogether • All unlined pipes and new pipes must be ceramic lined as per Eskom Standard, where this is not done this must be approved by Engineering. The specific unlined pipe section must be marked from outside. • Thickness test must be conducted on all the pipes that has holes and wear to determine

SYSTEM		**PF Pipework and hanger support systems**		
№	**COMPONENT FLOC (AKZ CODE)**	**COMPONENT DESCRIPTION**	**ACTIVITY**	**WORK SPECIFICATIONS**
				the amount of patch needed to repair the pipe back to uniform thickness. • All inspection findings must be included on the inspection report with recommendation to replace, refurbish or repair.
4.		Sampling points	Install/Repair	• Assess the integrity of all the PF sampling in terms of position, functionality with Plant Performance and include this in the inspection report. • Manufacture new 36 PF sampling points as per sample from Plant Performance • Install or re-install PF sampling points as per plant performance recommendations. • Open all PF sampling points that cannot be opened, all damages must be repaired or replace depending on the Performance and Testing Recommendations
		VJ Couplings		Inspect for the following on the VJ couplings • General condition of the VJ couplings

SYSTEM		**PF Pipework and hanger support systems**		
№	**COMPONENT FLOC (AKZ CODE)**	**COMPONENT DESCRIPTION**	**ACTIVITY**	**WORK SPECIFICATIONS**
5	05-06NMX0G		Inspect	• VJ Coupling alignment with both pipes • Check temporal repaired sections e.g. epoxy repairs, welded bolts etc. • Holed VJ coupling • Missing bolts and nuts
			Replace/Repair/Refurbish	• Replace all VJ couplings rubber seals/gaskets • Badly damaged VJ coupling must be replaced or refurbished. • Establish VJ coupling installation procedure. The procedure must be approved by all relevant parties. • Install VJ couplings as per approved procedure

SYSTEM		**PF Pipework and hanger support systems**		
№	**COMPONENT FLOC (AKZ CODE)**	**COMPONENT DESCRIPTION**	**ACTIVITY**	**WORK SPECIFICATIONS**
				• Replace all missing VJ coupling bolts and nuts • Replace all defective VJ couplings components
6.	05-06NMX0G	Gaskets	Replace	• Replace all PF pipes rope gaskets
7.	05-06NMX0G	Hangers and Supports accessories	Inspect	• Inspect and establish the types of hangers used and recommend suitable hangers for the pipes and application. • Conduct load test to establish suitable hangers for the application.
			Replace/Repair/Refurbish	• Replace all defective PF pipes hangers and supports such as clamps, bolts, nuts, rods with new and suitable type as per assessment and recommendation from suitable qualified personnel.

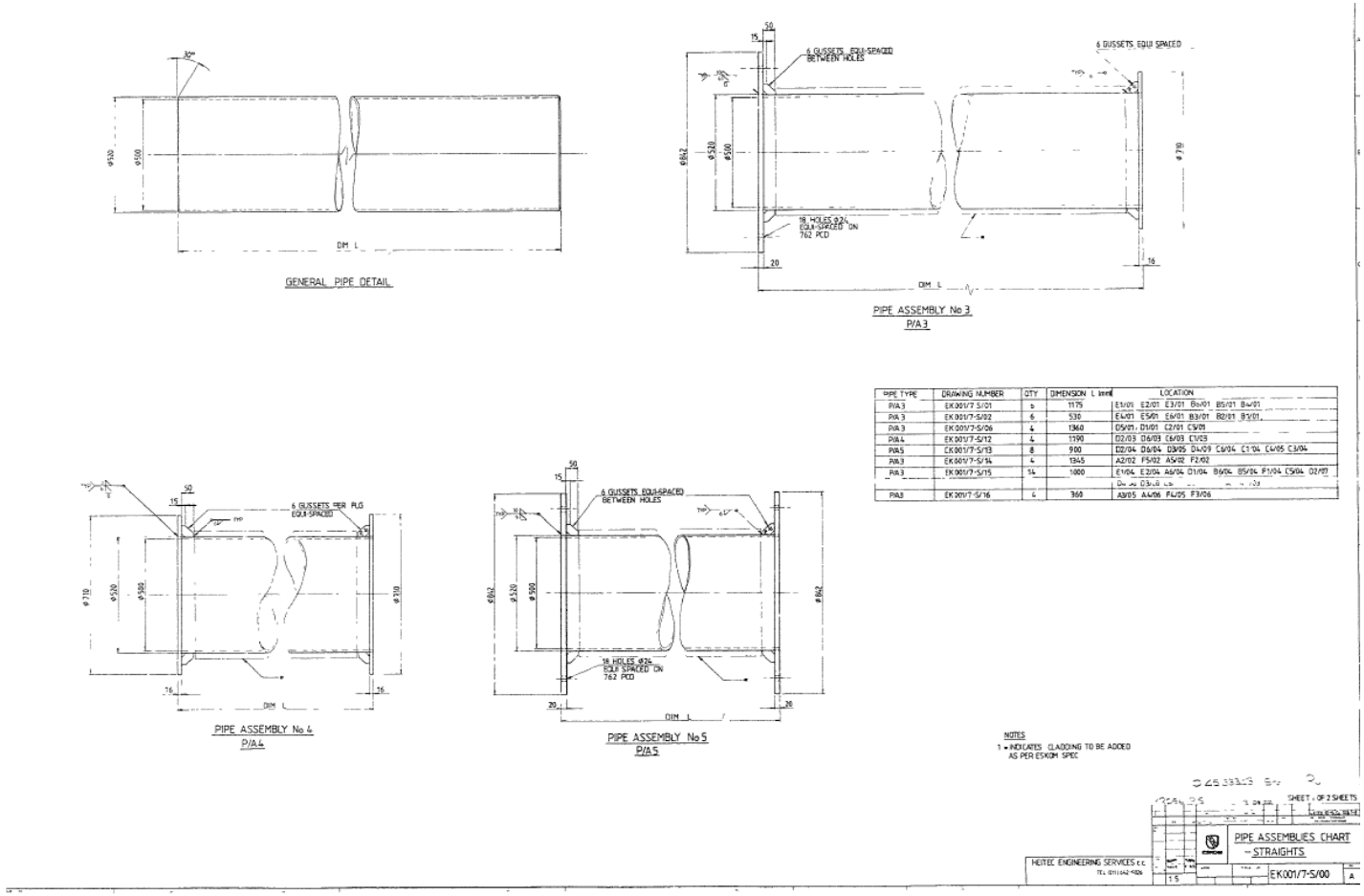
SYSTEM		**PF Pipework and hanger support systems**		
№	**COMPONENT FLOC (AKZ CODE)**	**COMPONENT DESCRIPTION**	**ACTIVITY**	**WORK SPECIFICATIONS**
				• Accessories of the hangers and support that can be re-used i.e. rods, bolts and nuts, lugs must be inspected to be free off mechanical defects such as cracks before re-use.
8.	05-06NMX0G	Pipework and Hanger systems	Replace/Repair	• Align and re-calibrate PF pipework with VJ couplings and hanger supports. Ensure an approved procedure is used to perform re-installation of the VJ couplings, alignment of the PF pipework and hanger supports. No VJ coupling rubber that should be misaligned and out of position.
9.		Pipework and Hanger Systems	Final Checks	• At installation completion, the Contractor carries out checks and inspections as per completion check sheets and as per approved QCP to the satisfaction of the Employer prior to commissioning. • The contractor calls the employer for final inspection when satisfied by own work to be fully complete.

SYSTEM		**PF Pipework and hanger support systems**		
№	**COMPONENT FLOC (AKZ CODE)**	**COMPONENT DESCRIPTION**	**ACTIVITY**	**WORK SPECIFICATIONS**
10.	05-06NMX0G	Pipework and hanger system	Commissioning	• Removing temporary support or travel stops on spring hangers • Ensure proper alignment and no PF leaks during on load condition.

Appendix B – PF Pipes Drawings dimensions and locations

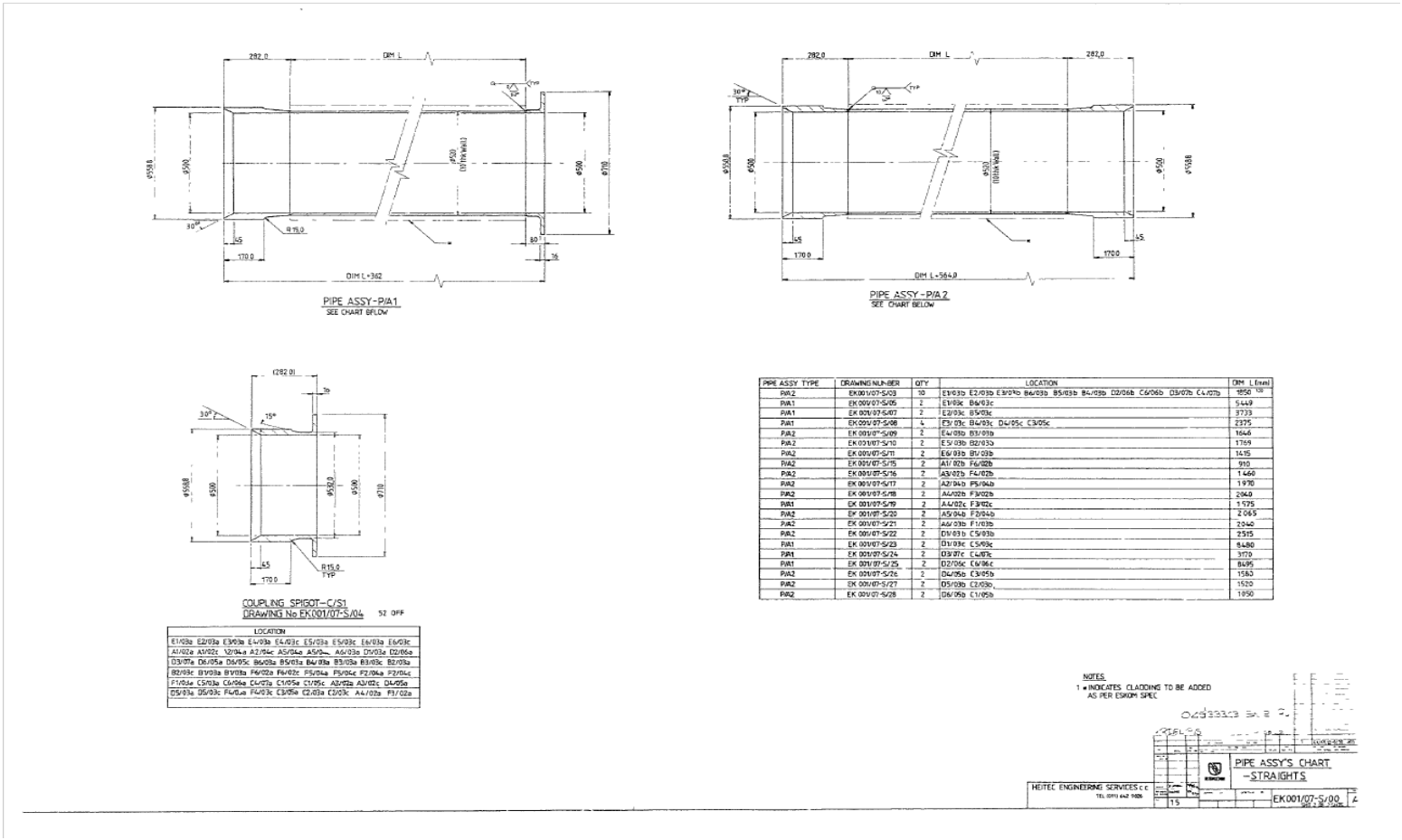
NB:

1. The drawings shall not be used for fabrications.
2. The drawings are for units 4-6. The drawings for information only for units 1-3 can be communicated on request.



PIPE TYPE	DRAWING NUMBER	QTY	DIMENSION L (mm)	LOCATION
P/A 3	EK001/7 S/01	6	1175	E1/01 E2/01 E3/01 B4/01 B5/01 B6/01
P/A 3	EK001/7-S/02	6	530	E4/01 E5/01 E6/01 B3/01 B2/01 B1/01
P/A 3	EK001/7-S/06	4	1360	D5/01 D1/01 C2/01 C3/01
P/A 4	EK001/7-S/12	4	1190	D2/03 D6/03 E6/03 E1/03
P/A 5	EK001/7-S/13	8	900	D2/04 D6/04 D3/05 D4/09 C6/04 C1/04 C4/05 C3/04
P/A 3	EK001/7-S/14	4	1345	A2/02 F5/02 A5/02 F2/02
P/A 3	EK001/7-S/15	14	1000	E1/04 E2/04 A6/04 D1/04 B6/04 B5/04 F1/04 C5/04 D2/03
P/A 3	EK001/7-S/16	4	360	A3/05 A4/06 F4/05 F3/06

Figure 1: Units 4-6 straight PF pipes component locations and dimensions



PIPE ASSY TYPE	DRAWING NUMBER	QTY	LOCATION	DIM L (mm)
P/A2	EK001/07-S/03	10	E1/03b E2/03b E3/03b B6/03b B5/03b B4/03b D2/06b C6/06b D3/07b C4/07b	1850
P/A1	EK001/07-S/05	2	E1/03c B4/03c	5449
P/A1	EK 001/07-S/07	2	E2/03c B5/03c	3733
P/A1	EK001/07-S/08	4	E3/03c B4/03c D4/05c C3/05c	2375
P/A2	EK001/07-S/09	2	E4/03b B3/03b	1646
P/A2	EK001/07-S/10	2	E5/03b B2/03b	1769
P/A2	EK001/07-S/11	2	E6/03b B1/03b	1415
P/A2	EK001/07-S/15	2	A1/02b F6/02b	910
P/A2	EK001/07-S/16	2	A3/02b F4/02b	1460
P/A2	EK001/07-S/17	2	A2/04b F5/04b	1970
P/A2	EK 001/07-S/18	2	A4/02b F3/02b	2040
P/A1	EK 001/07-S/19	2	A4/02c F3/02c	1575
P/A2	EK 001/07-S/20	2	A5/04b F2/04b	2065
P/A2	EK 001/07-S/21	2	A6/03b F1/03b	2040
P/A2	EK 001/07-S/22	2	D1/03b C5/03b	2515
P/A1	EK 001/07-S/23	2	D1/03c C5/03c	8480
P/A1	EK 001/07-S/24	2	D3/07c C4/07c	3170
P/A1	EK 001/07-S/25	2	D2/06c C6/06c	8495
P/A2	EK 001/07-S/26	2	D4/05b C3/05b	1580
P/A2	EK 001/07-S/27	2	D5/03b C2/03b	1520
P/A2	EK 001/07-S/28	2	D6/05b C1/05b	1950

LOCATION
E1/03a E2/03a E3/03a E4/03a E4/03c E5/03a E5/03c E6/03a E6/03c
A1/02a A1/02c \2/04a A2/04c A5/04a A5/04c A6/03a D1/03a D2/06a
D3/07a D6/05a D6/05c B6/03a B5/03a B4/03a B3/03a B3/03c B2/03a
B2/03c B1/03a B1/03b F6/02a F6/02c F5/04a F5/04c F2/04a F2/04c
F1/04a C5/03a C6/06a C4/07a C1/05a C1/05c A3/02a A3/02c D4/05a
D5/03a D5/03c F4/03a F4/03c C3/05a C2/03a C2/03c A4/02a F3/02a

Figure 2: Units 4-6 straight pipes components

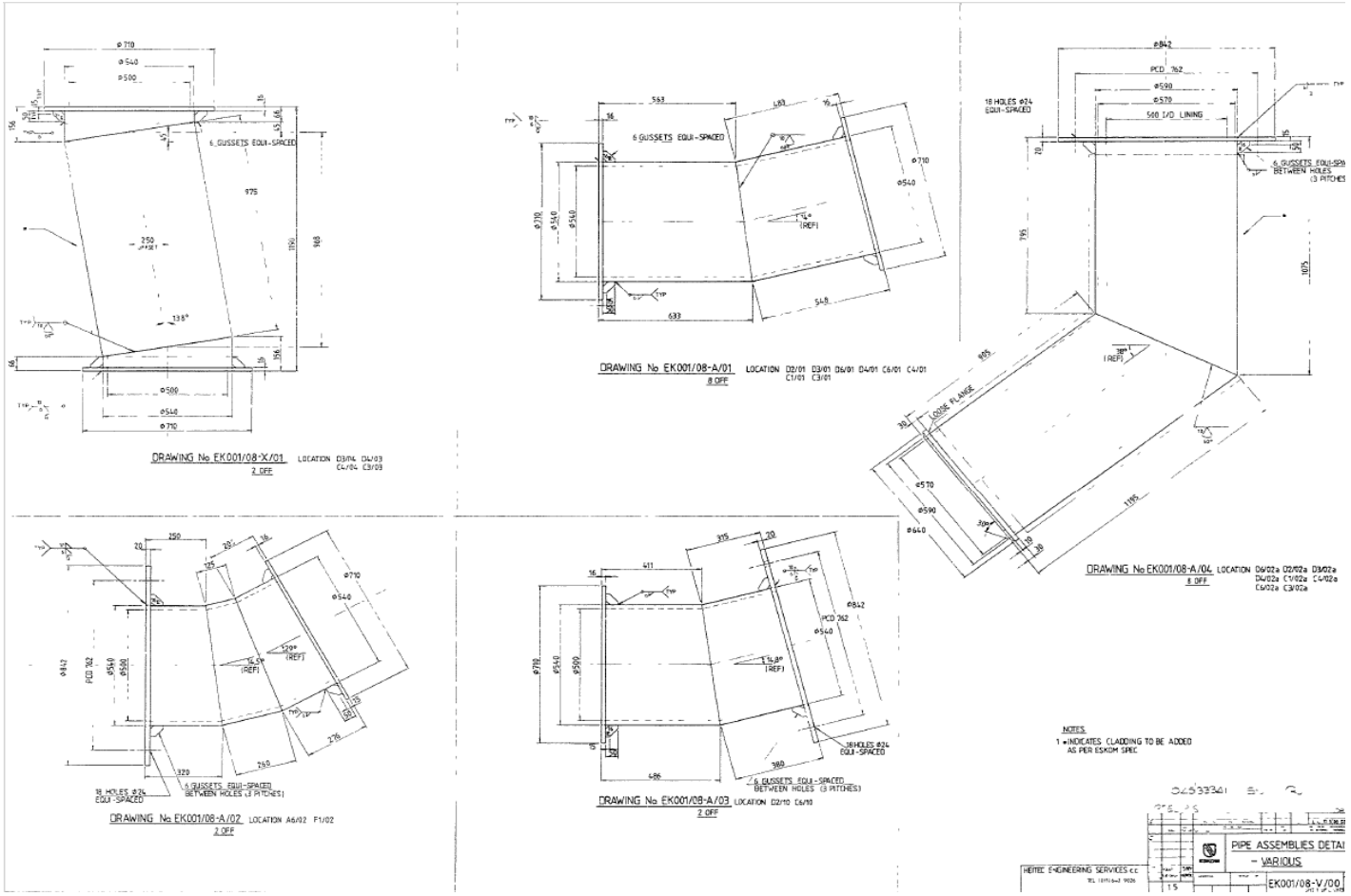


Figure 3: PF pipes components locations

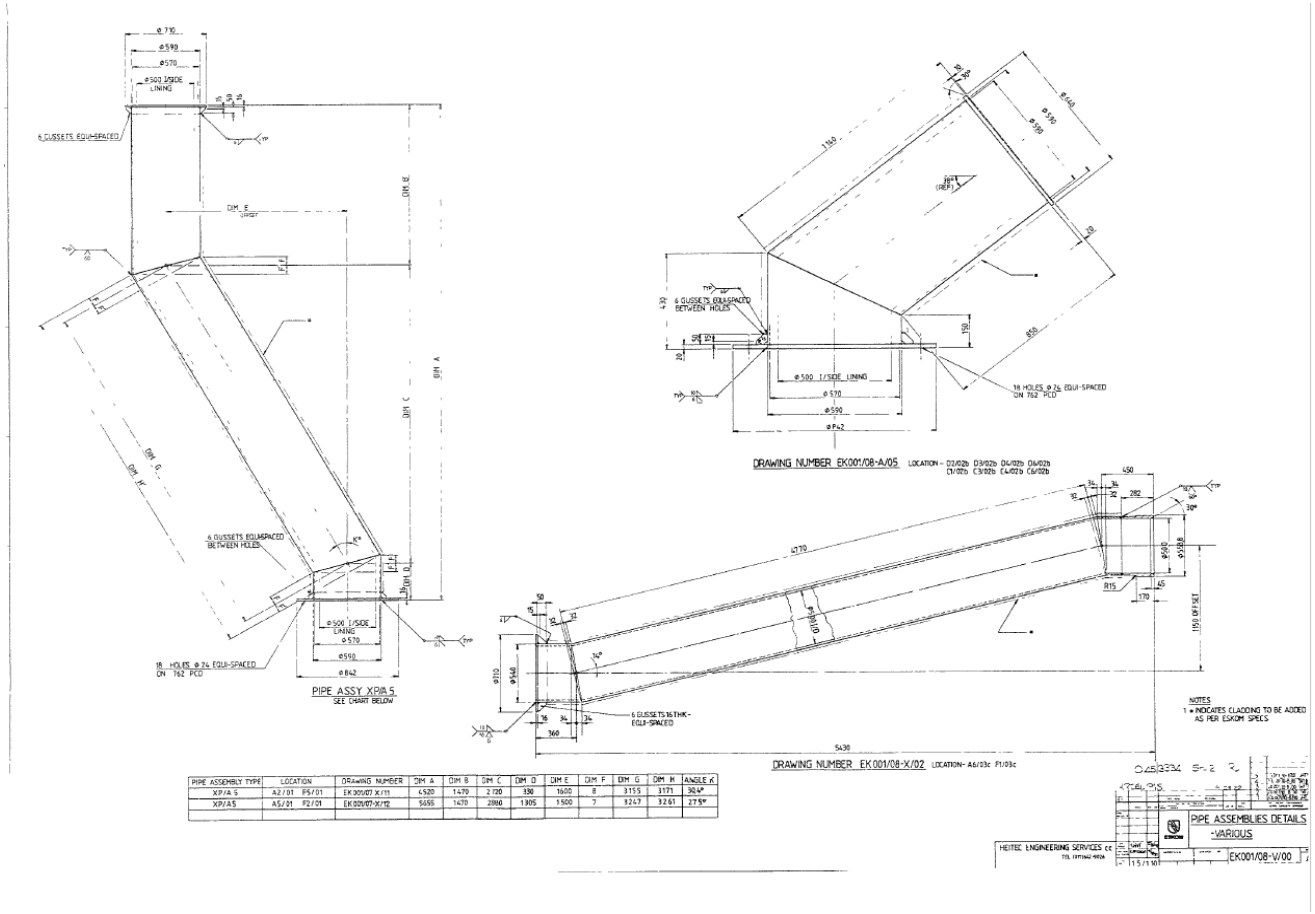
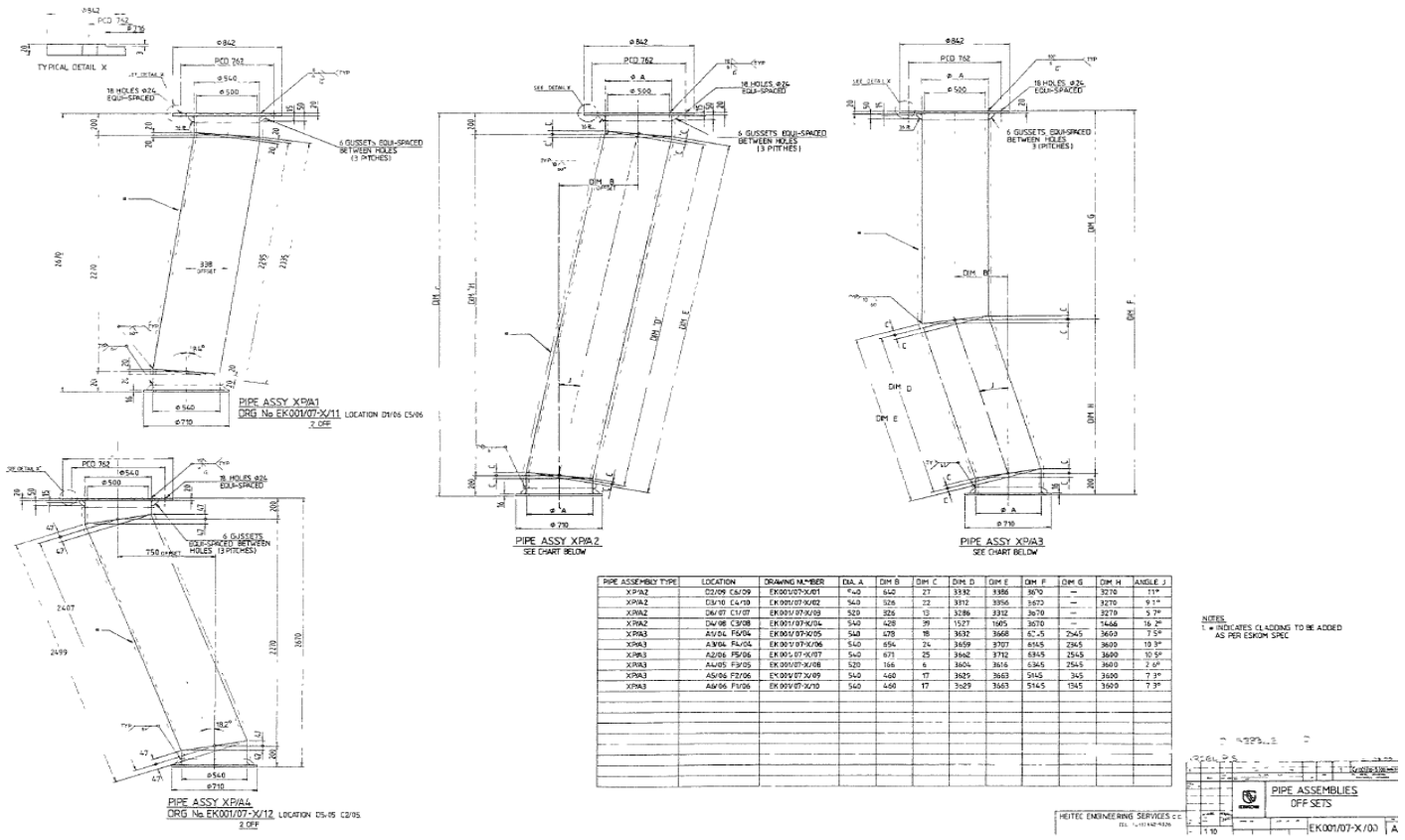


Figure 4: PF pipes 45 deg bends locations dimensions



PIPE ASSEMBLY TYPE	LOCATION	DRAWING NUMBER	DIM A	DIM B	DIM C	DIM D	DIM E	DIM F	DIM G	DIM H	ANGLE J
XP/A2	D2/09 C5/09	EK001/07-X/01	540	540	27	3332	3386	3670	–	3270	11°
XP/A2	D3/10 E4/10	EK001/07-X/02	540	526	22	3312	3356	3672	–	3270	9 1°
XP/A2	D4/07 C1/07	EK001/07-X/03	520	326	13	3286	3312	3670	–	3270	5 7°
XP/A2	D4/08 C3/08	EK001/07-X/04	540	428	39	1527	1605	3670	–	1468	16 2°
XP/A3	A1/04 F5/04	EK001/07-X/05	540	478	18	3632	3668	6745	2545	3600	7 5°
XP/A3	A3/04 F4/04	EK001/07-X/06	540	654	24	3659	3707	6145	2545	3600	10 3°
XP/A3	A2/06 F5/06	EK001/07-X/07	540	671	25	3662	3712	6345	2545	3600	10 5°
XP/A3	A4/05 F3/05	EK001/07-X/08	520	166	6	3604	3616	6345	2545	3600	2 6°
XP/A3	A5/06 F2/06	EK001/07-X/09	540	460	17	3625	3663	5145	345	3600	7 3°
XP/A3	A6/06 F1/06	EK001/07-X/10	540	460	17	3629	3663	5145	1345	3600	7 3°

Figure 5: PF pipes 45 deg bends locations dimensions

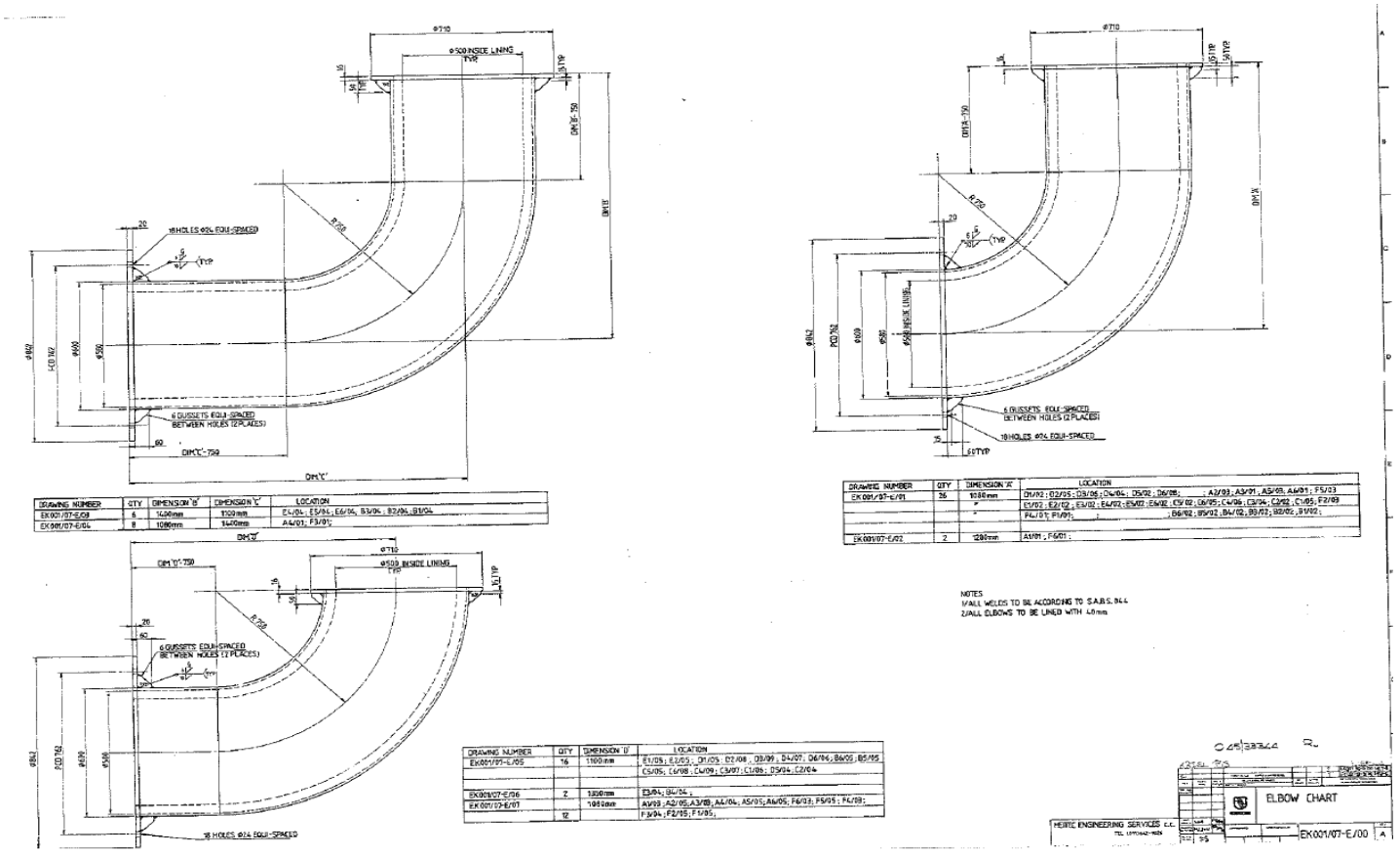


Figure 6: Units 4-6 PF pipes elbow dimensions and locations

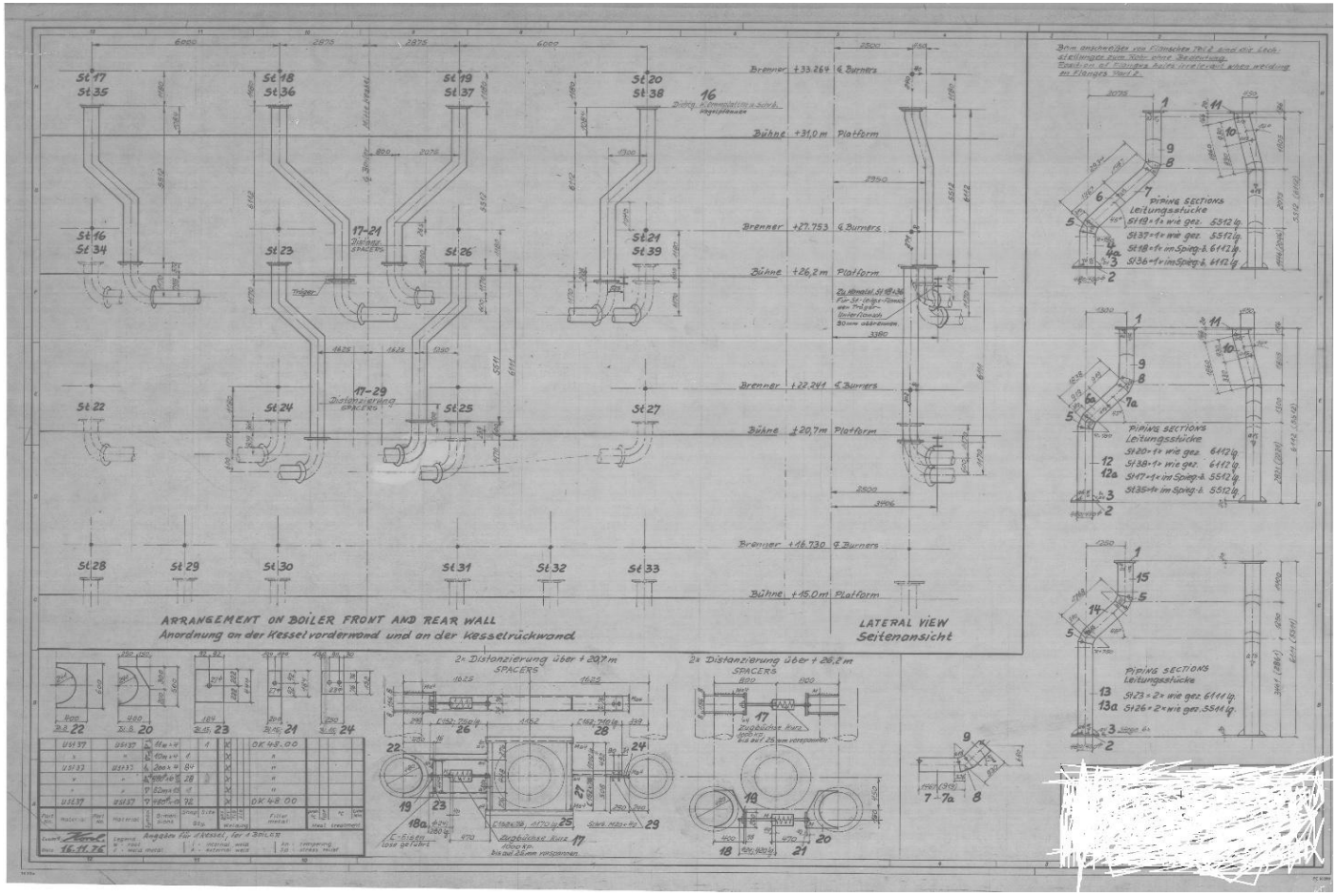


Figure 7: PF pipes arrangements on boiler front and rear wall

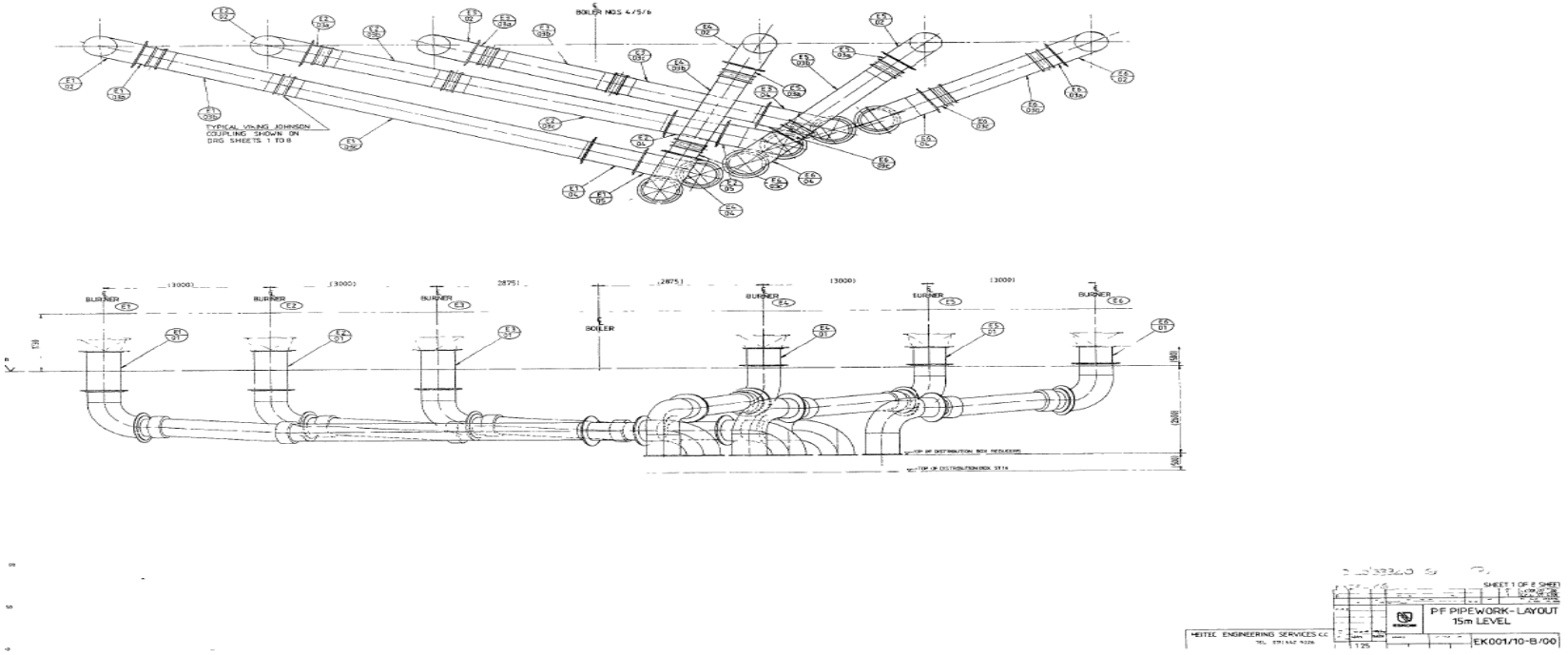


Figure 8: Unit 4-6 Mill E PF pipes arrangements and elevation around the boiler

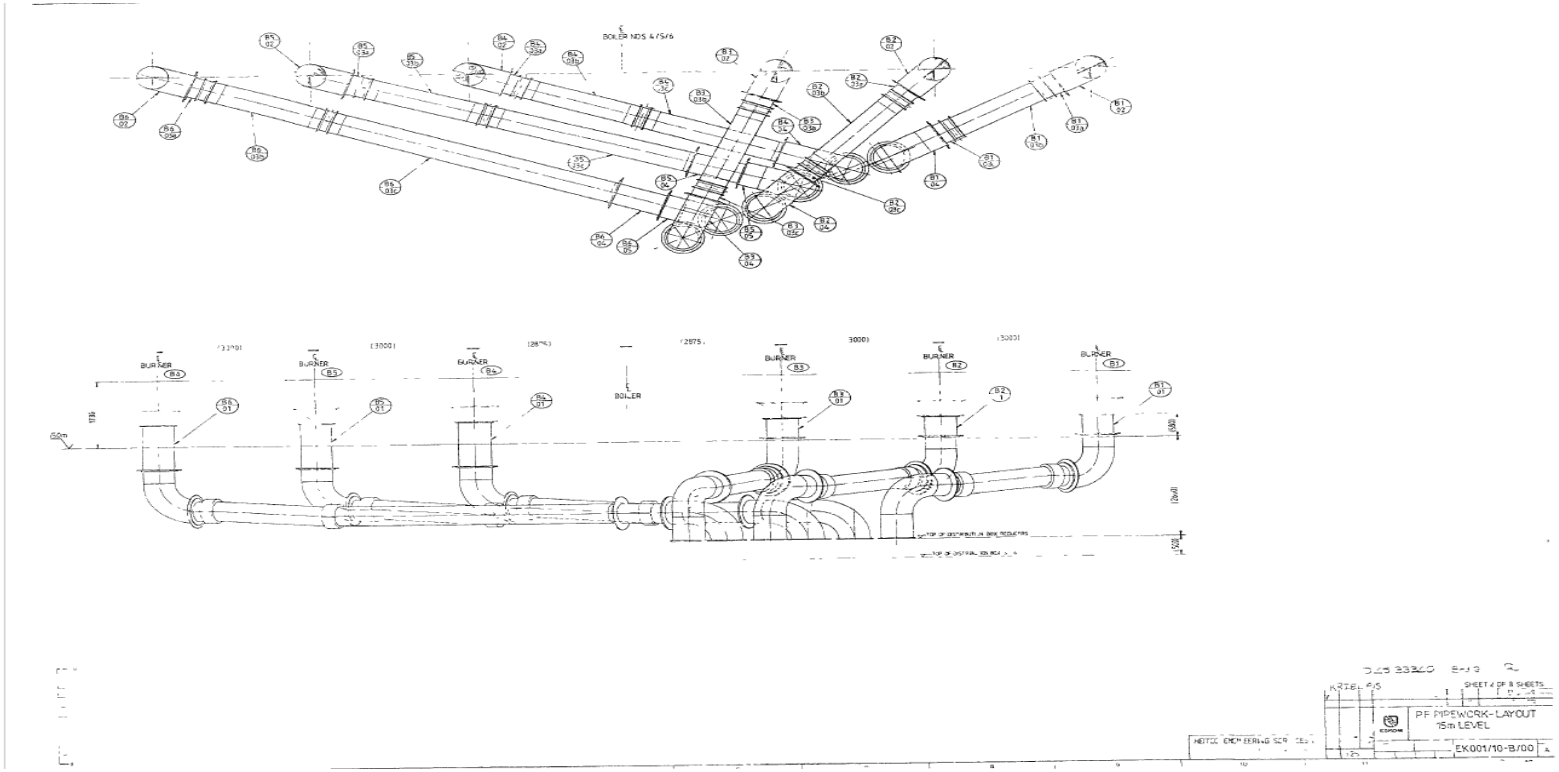


Figure 9: Unit 4-6 Mill B PF pipes arrangements and elevation around the boiler

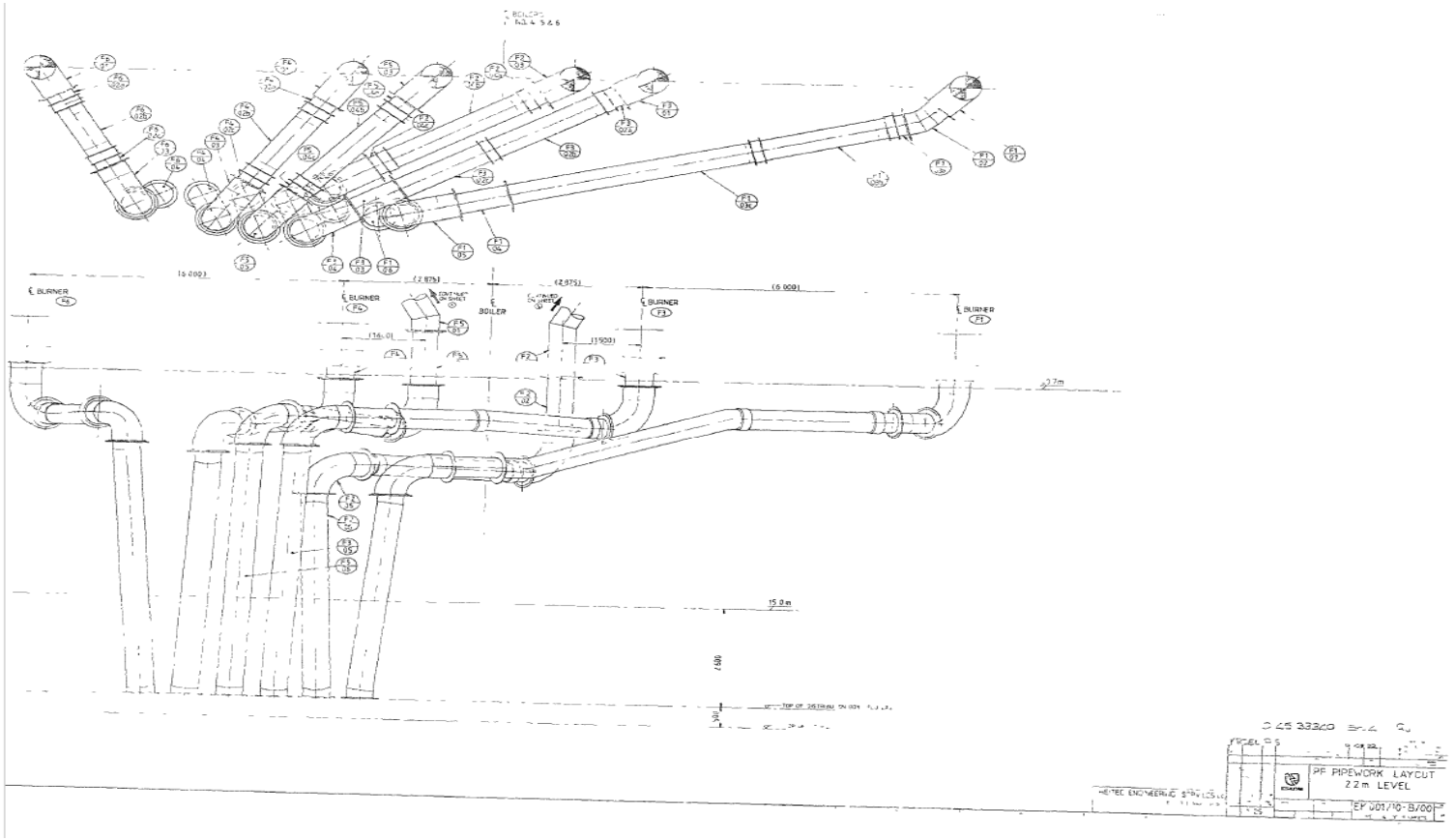


Figure 10: Unit 4-6 Mill F PF pipes arrangements and elevation around the boiler

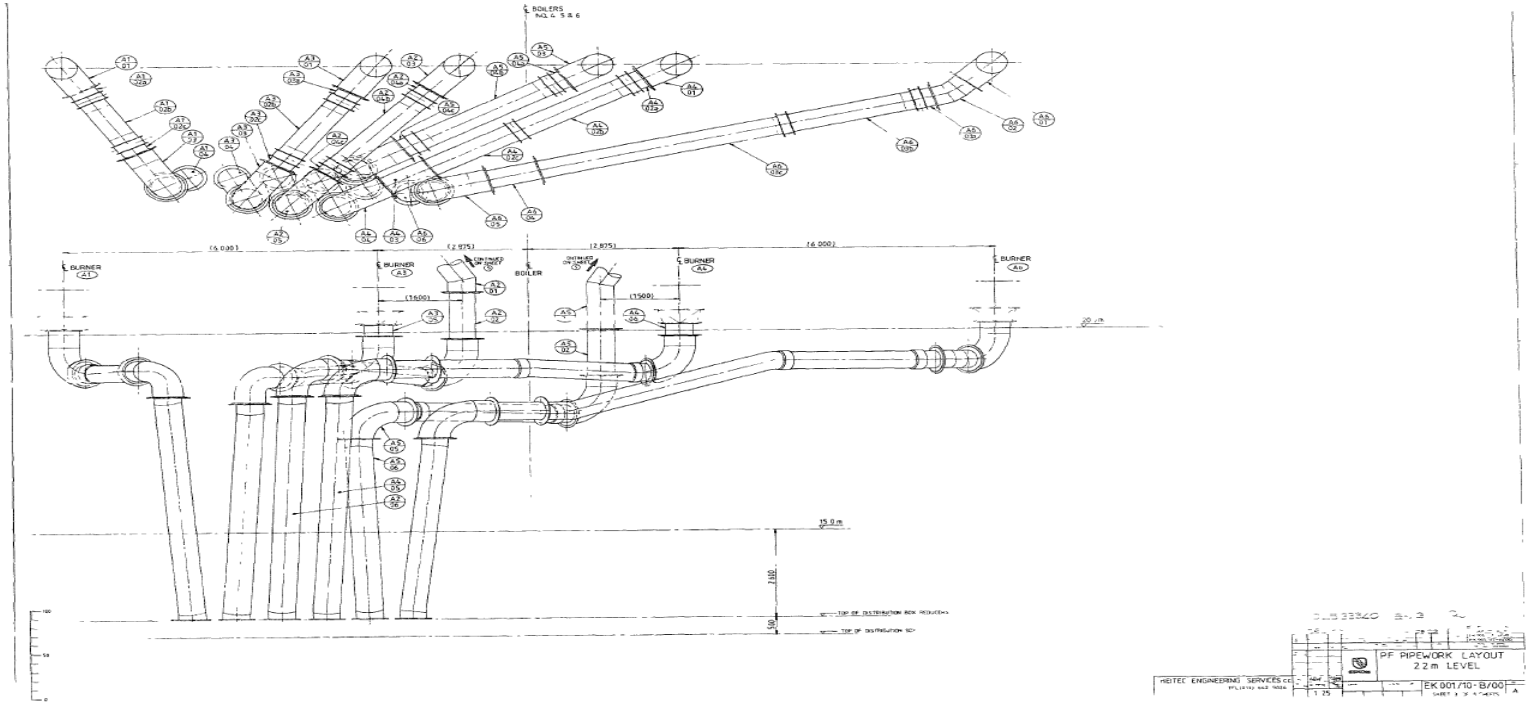


Figure 11: Unit 4-6 Mill A PF pipes arrangements and elevation around the boiler

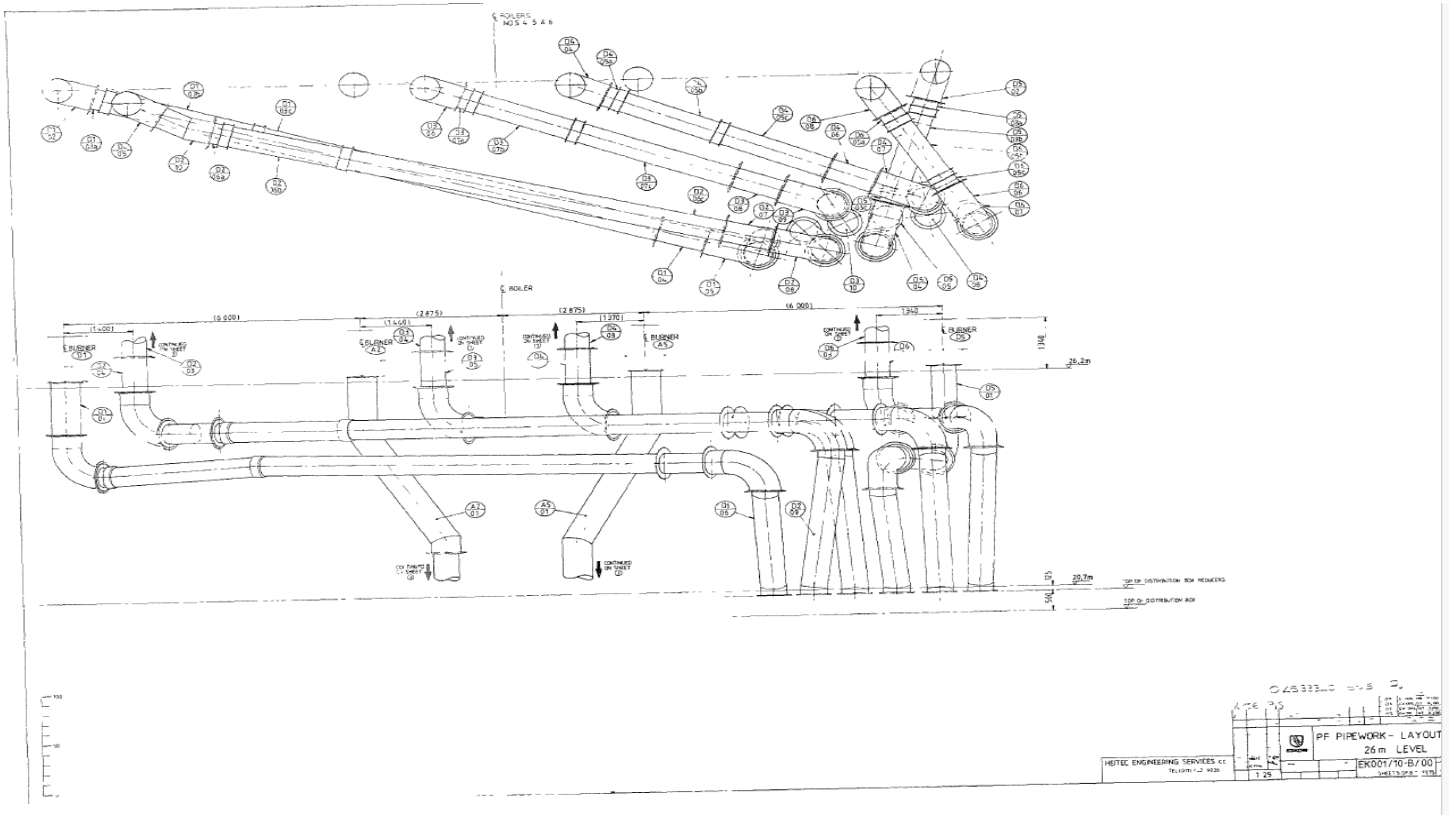


Figure 12: Unit 4-6 Mill D PF pipes arrangements and elevation around the boiler

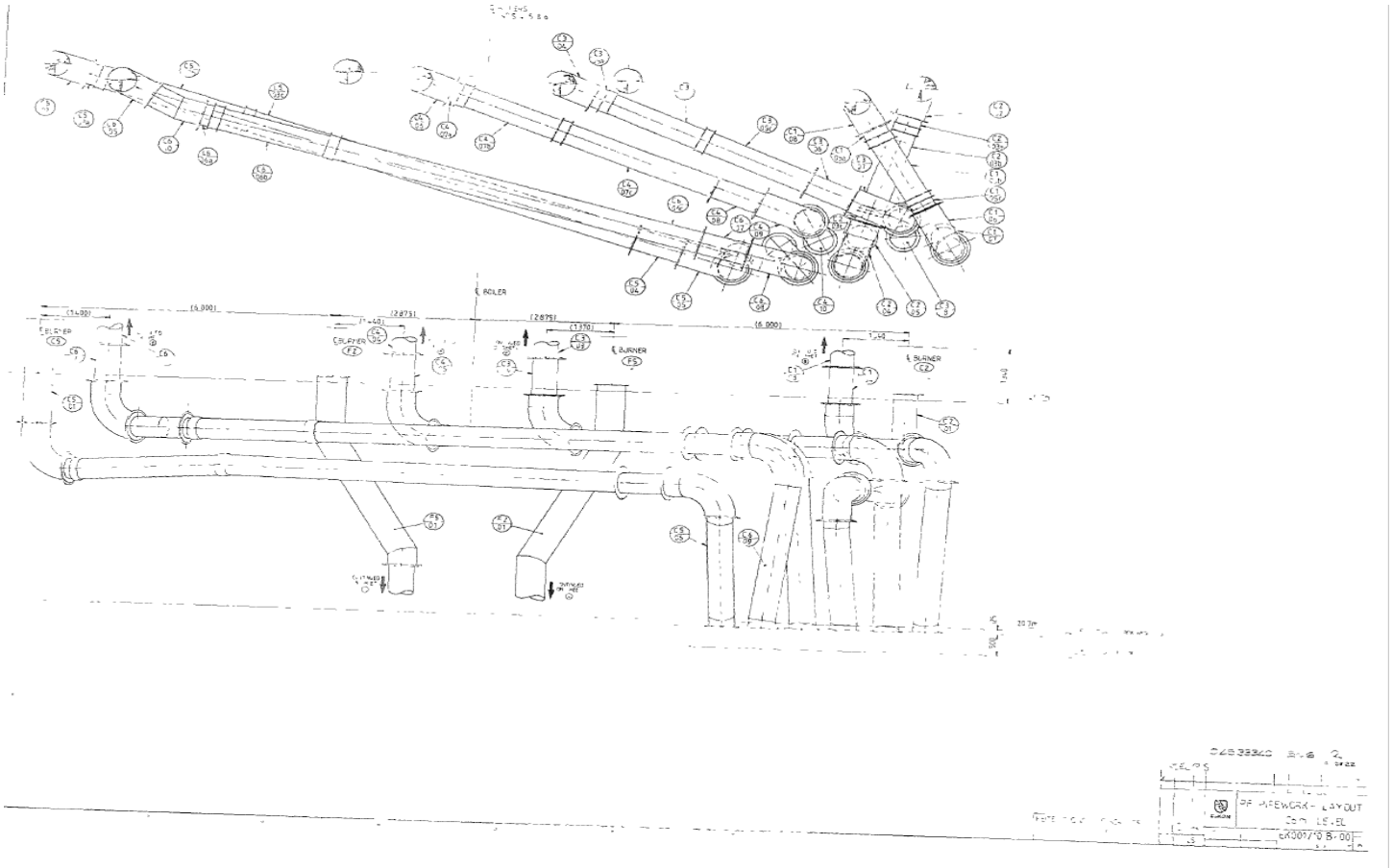


Figure 13: Unit 4-6 Mill C PF pipes arrangements and elevation around the boiler

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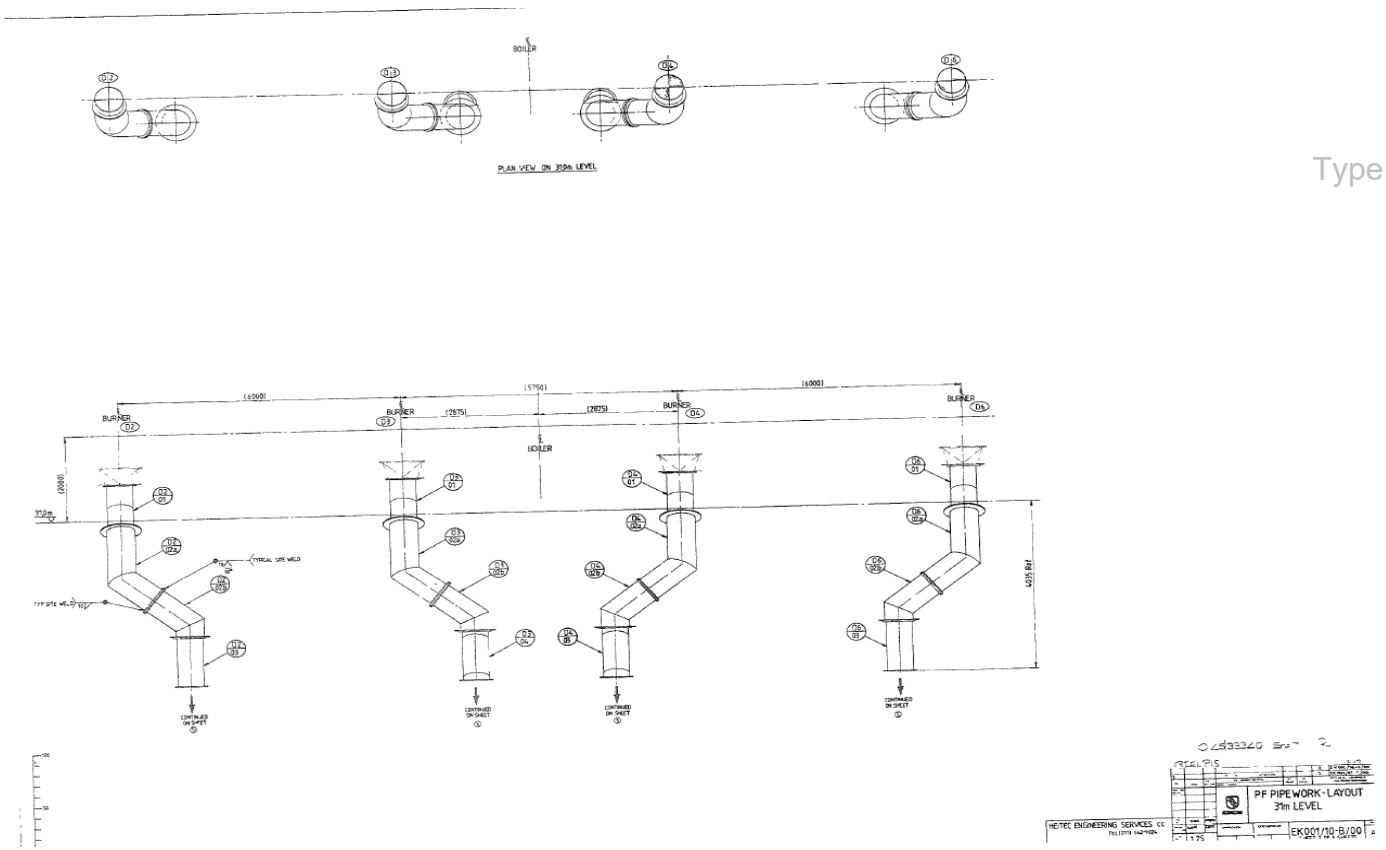

Figure 14: Unit 4-6 Mill D PF pipes arrangements and elevation around the boiler 26ML to 31ML

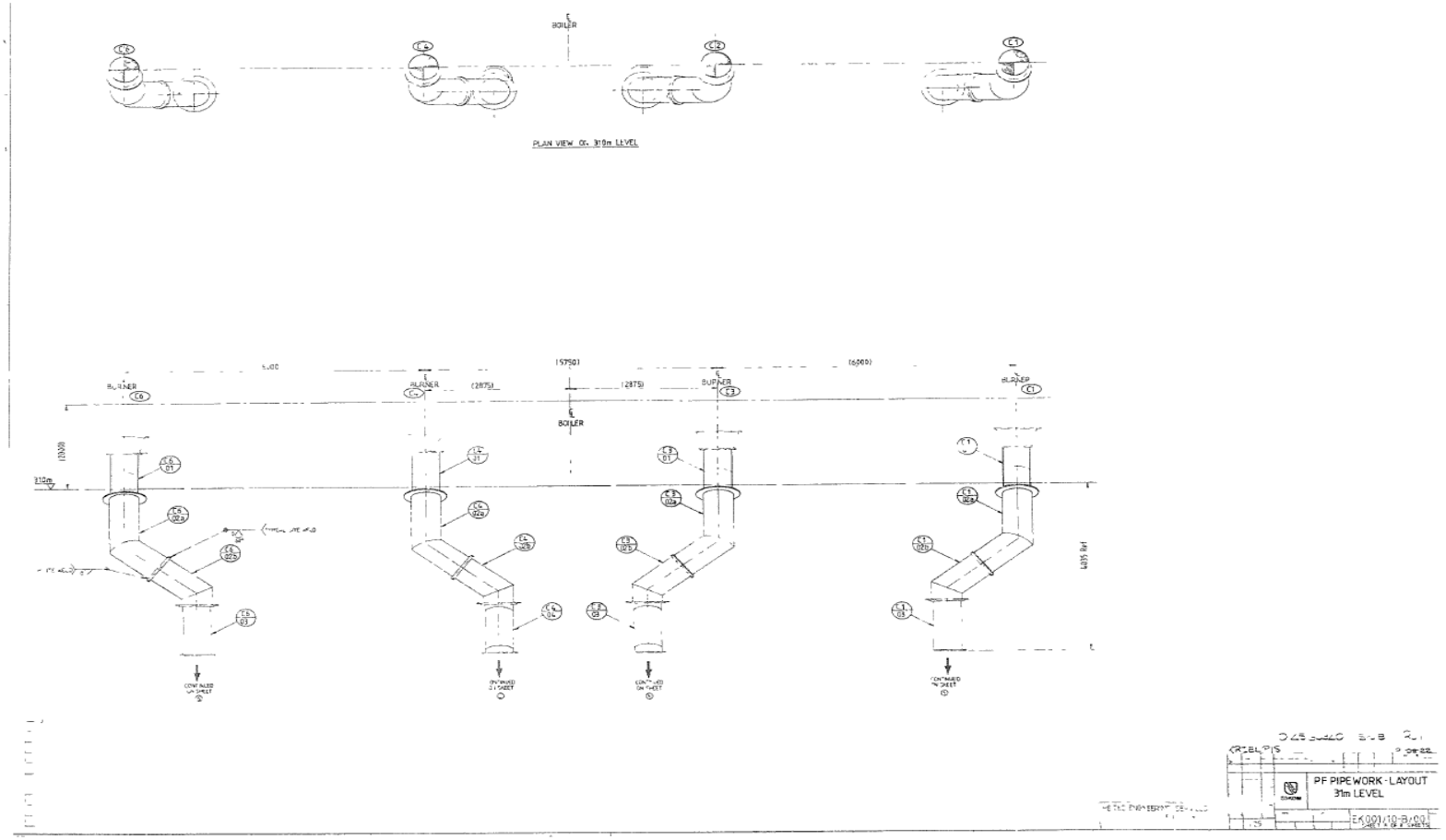

Figure 15: Unit 4-6 Mill C PF pipes arrangements and elevation around the boiler 26ML to 31ML

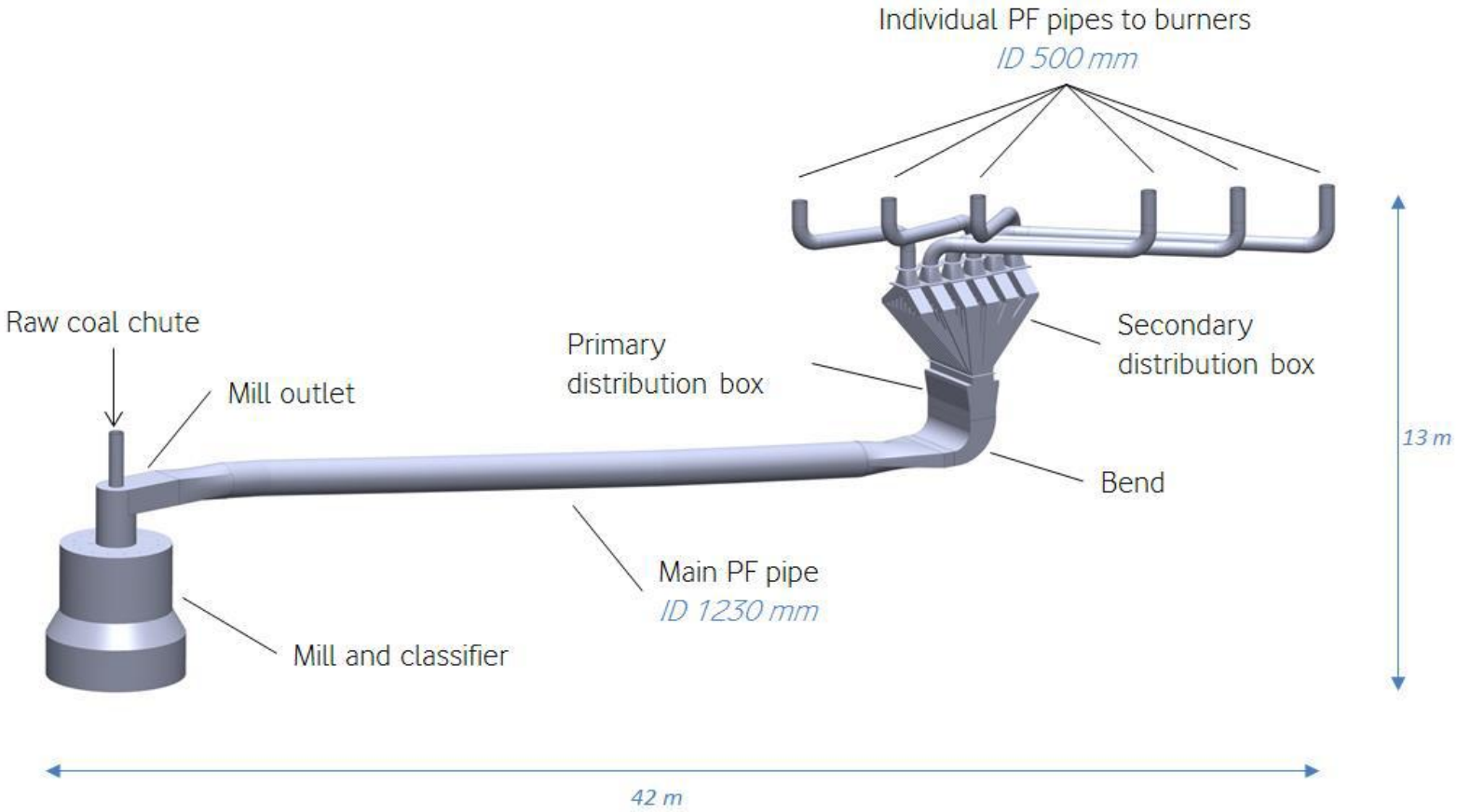

Figure 16: The main PF pipe ID is 1230mm for units 4-6 and units 1-3 is 1122mm