Eskom	**Process Control Manual** (Basic)	

Title: **Process Control Manual (PCM) for Perform Coal Power Plant Boiler Engineering**

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Eskom	**Process Control Manual** (Basic)	

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1 FOREWORD

Coal Power Plant Boiler Engineering is committed and actively participating in Eskom's commitment to compliance with International Standards and World Class business practices across the Engineering domain of the organisation and it is being realised through the consistent implementation of Business Management Systems.

Perform Coal Power Plant Boiler Engineering realises this initiative by ensuring an optimal Coal Power Plant Boiler Engineering process to meet the requirements of any specific Coal Power Plant Boiler Engineering project, inclusive of new technologies, modification and refurbishment requirements as well as any required operational, safety and maintenance conditions

The initiative is further realised, with the overall objective of the Back to Basics (B2B) program, to eliminate waste and create efficiencies through standardisation, simplification and optimisation of above mentioned processes and systems in order to increase overall engineering performance across the Eskom organisation.

2 INTRODUCTION

This centre of excellence provides mechanical engineering design to Eskom's internal clients. These designs result in mechanical design packs which contain the results of the mechanical engineering specific design processes of complete boiler plant products. These include, but are not limited to, mechanical specifications, drawings, P&ID's, operating parameters and design reports.

3 PURPOSE

3.1 FUNCTIONAL PURPOSE

This addresses activities for specifying the fuel properties to be combusted, designing the necessary interface requirements to all subsystems which include mills for pulverising the fuel and draught groups for air injection for optimum fuel combustion.. Further specifying the requirements of the flue gas systems for reducing emissions to acceptable levels and finally specifying the high pressure parts requirements related to steam generation.

3.2 PCM PURPOSE

The Basic Process Control Manual's (PCM) purpose is to describe the high level process design for the level 4 Process Flow within a level 3 Business Capability as defined by the EHPUM framework. A Basic PCM document is generated for each level 4 Process Flow within the relevant level 3 Business Capability.

This document is intended to provide a holistic view of all the key elements of the process including business roles, key risks and controls, technology requirements, process requirements, reporting requirements and process measures in a format and language that is appropriate for business review and sign-off. The PCM is driven by content relative to the process and additional technical information about the process and are used to produce a PCM document.

A Basic PCM comprises the following elements:

- Business Capability and Process Flow;
- Activity and Task Process Flow(s);
- Narratives to the Process Flows;
- Risk and Controls (RACM) documented at an Activity Flow level;
- Roles and responsibilities (RACI) documented for the Activities / Tasks;
- Key Performance Indicators (KPIs) documented at an Activity Process Flow level and/or for Activities;
- Reporting documented for Activities or Tasks; and
- Referenced documents such as policies (Normative), and Informative.

4 SCOPE

4.1 FUNCTIONAL SCOPE

To outline activities required to produce performance technical specifications by, identifying all the interfaces for all auxiliary systems necessary for correct operation of the boiler and subsystems. Specify the requirements for management of fuel into the boiler, specify requirements for management of the removal of by products from combustion such as ash, specifying the requirements of the High pressure parts and High pressure piping to main steam turbine, specifying requirements for harmful elements present in the emissions by dust removal , desulphurisation systems, Nox reduction and suitable height in chimneys that ensure low temperatures at exit of flue into the environment.

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The capabilities apply to all necessary for asset creation, modification and refurbishment as well as any operational and maintenance requirements.

4.2 PCM SCOPE

This PCM deals with the following:

- Perform Coal Power Plant Boiler Engineering
    - Perform Flue Gas Desulphurisation Process Design
    - Perform Boiler Process Design
    - Perform Computational Fluid Dynamics (CFD) Analysis
    - Perform Air Heater System Concept Design
    - Perform Air Heater System Basic Design
    - Perform Boiler Cleaning Equipment Concept Design
    - Perform Boiler Cleaning Equipment Basic Design
    - Perform Boiler Cleaning Equipment Detail Design
    - Perform Duct System Concept Design
    - Perform Duct System Basic Design
    - Perform Electrostatic Precipitator System Concept Design
    - Perform Electrostatic Precipitator System Basic Design
    - Perform Fabric Filter Plant Concept Design
    - Perform Fabric Filter Plant Basic Design
    - Perform Fan System Concept Design
    - Perform Fan System Basic Design
    - Perform Flue Gas Desulphurisation System Concept Design
    - Perform Flue Gas Desulphurisation System Basic Design
    - Perform High Pressure Piping Concept Design
    - Perform High Pressure Piping Basic Design
    - Perform High Pressure Piping Detail Design
    - Perform Lighting Up System Concept Design
    - Perform Lighting Up System Basic Design
    - Perform Milling System Concept Design
    - Perform Milling System Basic Design
    - Perform Main Firing System Concept Design
    - Perform Main Firing System Basic Design
    - Perform Main Firing System Detail Design
    - Perform Pressure Parts Concept Design
    - Perform Pressure Parts Basic Design
    - Perform Pressure Parts Detail Design

4.3 APPLICABILITY

This document shall apply throughout Eskom Holdings SOC Limited.

4.4 CONTEXT

The alignment to the HPUM framework is as follows:

❖ Eskom High Performance Utility Model (EHPUM)
- ➢ Level 1 Service the Operations
    - Level 2 Engineering
        - ♦ Level 3 Specialised Engineering

5 DEFINITIONS AND ABBREVIATIONS

The following definitions are applicable for this process:

DEFINITION	DESCRIPTION
Activity	An Activity is a set of tasks that occur over time and has a defined result. It describes transformations from an initial state to a final state, consuming specific resources.
Activity Flow	The Activity Flow provides a specific predetermined deliverable that is delivered through completion of the activities, which are based on decisions using specific resources (people, technology and information) and controls.
Application System	An Application System is a computer program designed to solve a particular business problem

	or to be used for a particular user-defined requirement. Could be in house developed or bought and customised, configured for Eskom e.g. SAP, Maximo.
Authorised by	Process Sponsor.
Basic Design	Describes the Stakeholder needs (with a process focus), to be delivered by the proposed business solution. Defines the business solution requirements in terms of narratives, information flow, business rules, people, application systems and the required governance elements.
Business Capability	The Business Capability is the combination of resources, capacity and facilities, to ensure high performance in delivering the end product to the customer.
Business Objective	The Business Objective represents an Enterprise Strategic Objective that defines the strategic intent of the organisation for a specified time period. These objectives are also referred to as goals or focus areas.
Business Role	The Business Role is a set of behaviours, rights and obligations conceptualised in a business situation. A Business Role represents a set of Eskom positions which have the same characteristics. It may refer to similar authorisations and responsibilities; clearly defined qualification and skills or a specific competency requirement. For example: All 'employees' (a generic categorisation) includes all Eskom employees that are required to follow certain Human Resources related policies and procedures.
Business Rule	The Business rule represents a set of standard business practices or policies that need to be applied consistently across business activities in order to achieve organisational goals and stable business growth. Business rules are specifications that describe how a computer program or business process controlled by a business rule should behave. Business rules play a central role in the control and execution of process flows.
Committee / Forum	A committee has a life span and is a grouping of different business roles and, or jobs, that together share the responsibility of delivering the objective of the specific committee / forum.
Compiled By	Business Representative (stream lead).
Computational Fluid Dynamics	Computational fluid dynamics is a finite volume calculation and simulation tool used to solve flow phenomena, heat transfer and specie conservation .
Conceptual Design	High level statements of the business need, aligned to the organisational strategy, with a focus on the high level processes, linking it to the business objectives and the process objectives.
Control	A Control is measure that is put in place to reduce the impact should a risk be realised. Control involves the development of risk mitigation strategies that could minimise the impact of likely risks to which the organisation is vulnerable. A control is any action taken by management, the board, and other parties to mitigate or manage the risk and increase the probability that the business / process will achieve its goals and objectives.
Control Objective	A Control Objective is a statement of the desired result or purpose to be achieved by implementing control procedures in a particular process. A statement of purpose for the control (reason it exists) in order to minimise the identified potential business, operational, information and system risks to an acceptable level. Control Objectives ensure: reliability and integrity of information, compliance with policies, plans, procedures, laws and regulations, safeguarding assets, economical and efficient use of resources, Accomplishment of established objectives and goals for operations or programs. Based on CARAT: Completeness, Accuracy, Relevant, Accessibility and Timely.
Critical Control	The Critical Controls are those controls whose effectiveness will contribute materially to the achievement of the Eskom strategic objectives and budgets or are required for contractual or regulatory compliance. Critical Controls are a critical component towards driving continuous improvement and in embedding a discipline of control consciousness into the business. Both senior management and auditors can often get their assurance that the specified risk has not occurred (or that the controls mitigating such risk have been effectively deployed), by monitoring a single critical control. This is typically a control that covers a range of risks/control objectives and is detective in nature. Where a critical control fails, management would look to evaluating the individual components of the standard controls to evaluate the extent to which the risk may or may not have been mitigated. If Critical control is not selected the Control is automatically classified as a Standard Control. Standard controls are the controls or a set of controls (both detective and preventative) that will best achieve the control objectives for a specific process.
Detail Design	Describe the requirements with a focus on the functionality provided by a specific application system AND / OR Describe the operational detail for successful execution of the business processes at an activity or work instruction level.
Document / Info	Document / Info represents the informal documents not required to be stored on the central document management system. It also includes information that is used or provided to complete

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	activities that is not subjected to audit. Examples include: Audio visuals, Presentations or a Publications.
Electronic Report	The Electronic Report is a system generated report, for instance standard reports.
Electrostatic Precipitator	The Electro Static Precipitator sub-system within a Boiler Plant
Engineering Management Plan	Structured information describing how the system engineering effort, in form of tailored processes and activities, for one or more life-cycle stages, will be managed and conducted in the organization for the actual project.
Environmental Impact assessment	Determine and assessment of the environmental impact. Environmental impact is a change to the environment. Such change can be positive or negative. Environmental impacts are caused by environmental aspects. Environmental aspects can have a direct and decisive impact on the environment or contribute only partially or indirectly to a larger environmental change.
Eskom High Performance Utility Model	EHPUM organises Eskom's Business Functions represented in context of the High Performance Areas: Develop the Enterprise; Operate the Business; Service the Operations; and Support the Operations to achieve Eskom's strategic imperatives.
Eskom Managed Document	An Eskom Managed Document is a document that should be stored on the central document management system. It is controlled, the documents and content can be electronic or a hard copy. It could go beyond Eskom documents, some examples could be Regulations, Acts, and Industry Standards.
Fabric Filter Plant	The Fabric Filter Plant sub-system within Boiler Plant
Functional Responsibility	Process Owner.
High Pressure Piping	The High Pressure Piping sub-system within a Boiler Plant
Informative Reference	Represents documents that are used as additional information or useful information that relates to the PCM.
Key Performance Indicator	The Key Performance Indicator is formulated to measure business activities. These Key Performance Indicators may represent efficiency, quality and, or quantity produced by a specific business function. Well-structured Key Performance Indicators assist organisations decision makers to accurately measure the overall performance of the organisation as well as provide insight into aspects of the business that require improvement in order to improve performance.
Mass Energy Balance	Boiler Mass Energy Balance
Measure	A measurement standard of dimension or unit of quantity by which anything is estimated and stated.
Normative Process Knowledge	The process understanding that this refers to is indispensable for the application of the relevant activities. This always refers to a Basic/Detail (L4) PCM.
Normative Reference	Normative references are references that are indispensable for the application of this document, i.e. documents to be used together with this document. This refers to the Eskom Policies, Procedures, Standards and Guidelines, or legislation that establishes the governance over the process and to which users of the PCM must comply.
Piping and Instrumentation Diagram	The piping and instrument diagram (P&ID), based on the process flow diagram, represents the technical realisation of a process by means of graphical symbols for equipment and piping together with graphical symbols or process measurement and control functions. Minimum Information: * Kind of equipment and machinery, including drives, piping, conveyors, valves, fittings, installed spares * Identification number for equipment and machinery, including drives, conveyors, installed spares * Characteristic data of equipment and machinery * Indication of nominal diameter, pressure rating, material and type of piping * Details on thermal insulation, heating and cooling equipment, machinery, piping valves and fittings * Process measurement and control functions with identification number * Characteristic data of drives Additional Information: * Designation of throughputs and amounts of energy or energy carriers * Route and direction of flow of energy or energy carriers * Kind of essential primary elements and sensors * Essential materials of construction for equipment and machinery

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	* Elevation of platforms and approximate relative vertical position of equipment and machinery * Identification number for valves and fittings * Denomination of equipment and machinery
Position	A Position is the smallest unit in an organisation to which a human resource can be assigned, it denotes designations.
Process Flow	The Process Flow is the interdependent and logical sequencing of processes, where the deliverable of one process, is the input for the next process.
Process Flow Diagram	The process flow diagram represents a process or a process plant with the aid of graphical symbols, interconnected by flow lines. The graphical symbols represent equipment and the lines represent mass and energy flows or energy carriers. Minimum Information: * Kind of equipment and machinery necessary for the process, except drives * Identification number for equipment and machinery, except drives * Route and direction of in- and outgoing material and energy flows * Designation and throughputs or flow rates of inand outgoing materials * Designation of energy flows or energy carriers * Characteristic operation conditions Additional Information: * Designation and throughputs or flow rates of process fluids * Throughputs or amounts of energy, or energy carriers * Essential valves in the logical process position with respect to their function * Functional demands for process measurement and control at essential points * Supplementary operating conditions * Characteristic data of equipment and machinery * Characteristic data of drives * Elevation of platforms and approximate relative vertical position of equipment and machinery * Denomination of equipment and machinery
Process Integration	Process Integration clarifies the process triggers and handoffs between the process and the inbound (incoming) and outbound (outgoing) processes.
Process Objective	The Process Objective states the objective of the end-to-end process, usually in terms of time, quality and cost.
Record	A Record is defined as data generated as a result of business activities, a class of records can be added to a Records register. Content based records cannot be amended, as this would invalidate their content. The information is historical and it includes documents stating results of activities performed (examples: archived e-mail, previous versions of controlled documents, minutes of meeting, Correspondence, Data files, Drawings, Lists, Checklists, Logs, Meeting documents, Registers, Reports, Source code and Statements.
Record of Decision	The record of decision is the recording and proper description of important decisions as reflected in the minutes of the meeting where such a decision is made.
Risk	A Risk is defined as an event, hazard, variance, or an opportunity, which could influence the achievement of Eskom's strategic, operational and compliance objectives, for example non-compliance with legislation, fraud, natural disasters or competition. Risk is a measure of uncertainty. The chance of something happening that will have an impact on objectives. In the business process, the uncertainty is about the achievement of objectives.
Task	A Task is an atomic unit of work, which is performed by a single person (position) / role, utilising specific resources. A set of sub-tasks occur over time and has a defined result. It describes transformations from an initial state to a final state.
Task Flow	The Task Flow consists of the logical flow of the prescribed tasks to complete a single output.
Template / Form	A predetermined format defining the information required for a specific purpose and space for the provision of the information: A Template is a pre-developed page layout used to create new pages from the same design, pattern or style. A Form is a document with blank spaces for information to be inserted It could include: Authorisations and Approvals, Assessments, Certificates, Forms, Checklists, Meeting documents, Registers, Reports and Statements.
User Requirements Specification	The User Operational Requirements provide the operational performance requirements (operational capability) of the asset and details such items as output, performance, operational life expectancy requirements, etc.

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	Note: The User Requirements Specification has been superseded by the Stakeholder Requirements Definition

The following abbreviations are applicable for this process:

ABBREVIATION	FULL NAME
ASME	American Society for Mechanical Engineers
B2B	Back 2 Basics
BOP	Balance of Plant
C & I	Control and Instrumentation
CARAT	Complete, Accurate, Relevant, Accessible, Timely
CFD	Computational Fluid Dynamics
DCS	Direct Current Supply
EHPUM	Eskom High Performance Utility Model
EIA	Environmental Impact assessment
ESP	Electrostatic Precipitator
FEA	Finite Element Analysis
FFP	Fabric Filter Plant
FGD	Flue Gas Desulphurisation
HPP	High Pressure Piping
I/O	Input/Output
ID	Induced Draught
KPI	Key Performance Indicator
LPS	Low Pressure Serivices
MEB	Mass Energy Balance
P&ID	Piping and Instrumentation Diagram
PCM	Process Control Manual
PDM	Project Design Manual
PFD	Process Flow Diagram
RACI	R - Responsible A - Accountable C - Consult I - Inform
RACM	Risk and Control Matrix
SME	Subject Matter Expert
URS	User Requirements Specification
WI	Works Information

6 APPLICATION SYSTEMS

The following systems are applicable to this process:

- Air Heater / Steam Air Pre-Heater Calculation Tool (Excel)
- Air Heater Calculation Sheet (Excel)
- Air Heater Calculation Tool (Excel)
- Boiler cleaning equipment calculation Sheet
- Boiler MEB Software Tool
- Burner Calculation Sheet (Excel)
- Burner Design Tool (TBA)
- CAD
- CAESAR II
- CFD
- CFD Tool
- Computational Fluid Dynamics Software
- DimBo
- Duct System Calculation Tool (Excel)
- Equipment Sizing Software Tools (TBA)
- Eskom ESP Sizing Tool (Excel)
- Fabric Filter Plant Calculation Sheet
- Fan Calculation Sheet (Excel)
- Fan System Calculation Tool (Excel)
- FEA Tool
- FGD Calculation Spreadsheet
- Flownex

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- Forced Draught Fan Calculation Sheet (Excel)
- Forced Draught Fan System Calculation Tool (Excel)
- HP Piping Calculations Tool (Excel)
- Induced Draught Fan Calculation Sheet (Excel)
- Induced Draught Fan System Calculation Tool (Excel)
- Inventor CAD
- Lighting Up System Analysis Tool (Excel)
- Lighting Up System Calculation Sheet
- Load Simulation Excel Tool
- Main Firing System Design Tool (Excel)
- Milling System Calculation Tool (Excel)
- P&ID Software
- Primary Air Fan Calculation Sheet (Excel)
- Primary Air Fan System Calculation Tool (Excel)
- Probad (T.B.C)
- Process Calculation Sheets (Excel)
- Process Modelling Tool (TBA)
- ROHR II
- Smart Plant 3D
- Stress Analyses Excel Sheet
- Transient Modelling Tool (TBD)

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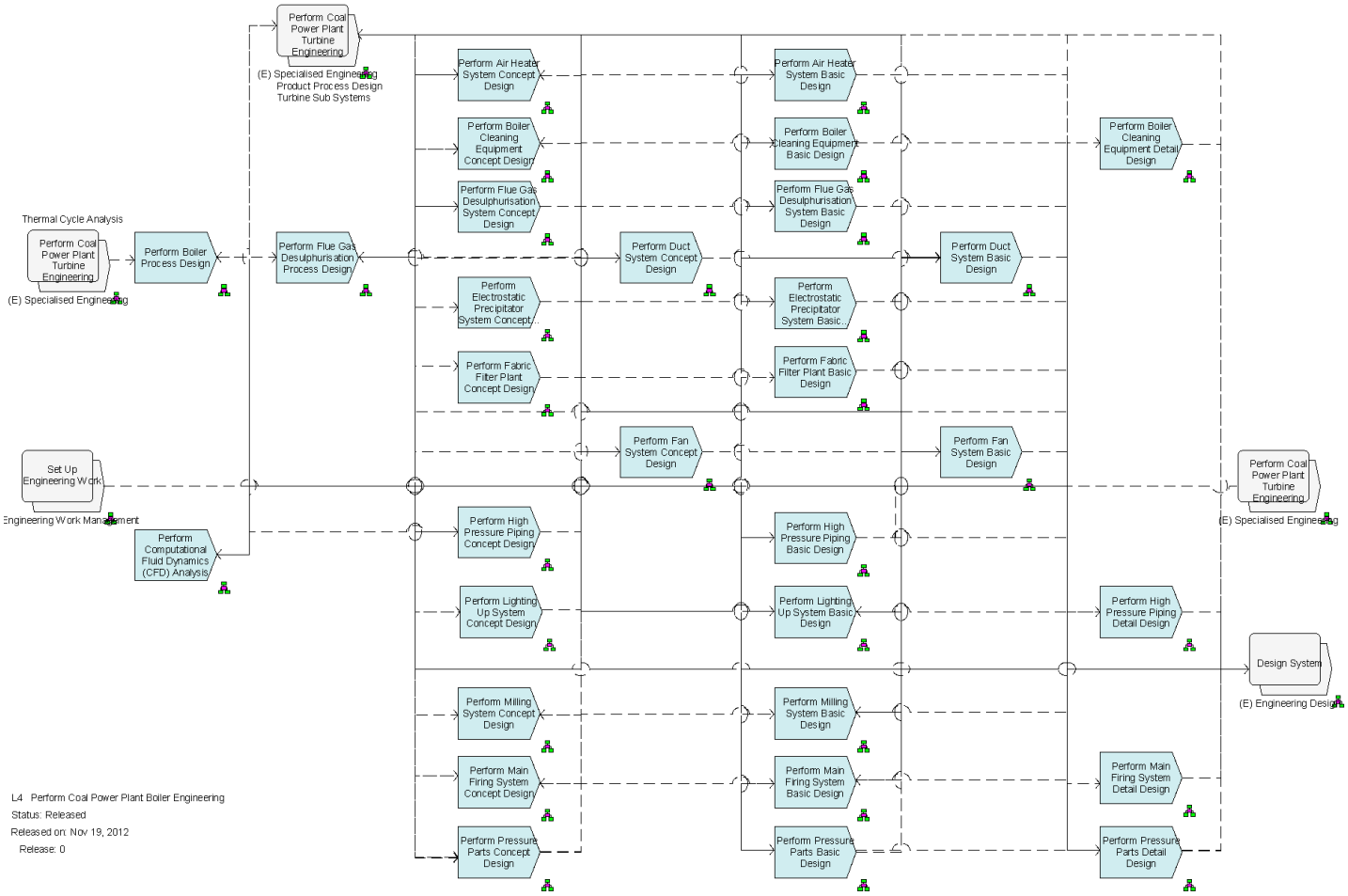
7 SINGLE FRAME

The Single frame provides a concise summary of the PCM before moving into the more detailed sections for each Sub-process.

PROCESS FLOW:



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PROCESS FLOW NAME: Perform Coal Power Plant Boiler Engineering

BUSINESS OBJECTIVES:
Becoming a high performing organisation
Reducing our environmental footprint and pursuing low-carbon growth opportunities
Setting up for success

PROCESS OBJECTIVES:

- **Perform Coal Power Plant Boiler Engineering:** To ensure that energy generated from coal and oil combustion is transformed to steam in the boiler to a requirement suitable for turbine generation and to treat the flue gas generated from burning the fuels to comply to environmental requirements.
    - **Perform Flue Gas Desulphurisation Process Design:** To ensure the design of the process for the flue gas desulphurisation system with optimised mass and energy balances, process flow designs and process flow models to produce an effective and efficient condensing system, taking the various flue gas cleaning possibilities into consideration and minimise material and energy waste.
    - **Perform Boiler Process Design:** The objective of this process is to provide a complete and effective design of a boiler process for converting coal into steam that is used for driving turbines.
    - **Perform Computational Fluid Dynamics (CFD) Analysis:** To find the most cost effective fit-for-purpose process designs for component level flow phenomena, heat transfer and species conservation.
    - **Perform Air Heater System Concept Design:** To ensure an adequate (complete), efficient conceptual design for an air heater system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.
    - **Perform Air Heater System Basic Design:** To ensure an adequate (complete), efficient design for the air heater system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.
    - **Perform Boiler Cleaning Equipment Concept Design:** To ensure an adequate (complete), efficient conceptual design for the boiler cleaing equipment, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.
    - **Perform Boiler Cleaning Equipment Basic Design:** To ensure an adequate (complete), efficient design for boiler cleaning equipment that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design or as input into an internally developed detail design.
    - **Perform Boiler Cleaning Equipment Detail Design:** To ensure an adequate (complete), efficient design for the manufacturing, fabrication, construction and commissioning of the boiler cleaning equipment that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system.
    - **Perform Duct System Concept Design:** To ensure an adequate (complete), efficient conceptual design for the duct system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.
    - **Perform Duct System Basic Design:** To ensure an adequate (complete), efficient design for the duct system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.
    - **Perform Electrostatic Precipitator System Concept Design:** To ensure an adequate (complete), efficient conceptual design for the electrostatic precipitator system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.
    - **Perform Electrostatic Precipitator System Basic Design:** To ensure an adequate (complete), efficient design for the electrostatic precipitator system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.
    - **Perform Fabric Filter Plant Concept Design:** To ensure an adequate (complete), efficient conceptual design for the fabric filter plant, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.

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- **Perform Fabric Filter Plant Basic Design:** To ensure an adequate (complete), efficient design for the fabric filter plant that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.
- **Perform Fan System Concept Design:** To ensure an adequate (complete), efficient conceptual design for the fan system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.
- **Perform Fan System Basic Design:** To ensure an adequate (complete), efficient design for the fan system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.
- **Perform Flue Gas Desulphurisation System Concept Design:** To ensure an adequate (complete), efficient conceptual design for the flue gas desulphurisation system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.
- **Perform Flue Gas Desulphurisation System Basic Design:** To ensure an adequate (complete), efficient design for the flue gas desulphurisation system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.
- **Perform High Pressure Piping Concept Design:** To ensure an adequate (complete), efficient conceptual design for high pressure piping, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.
- **Perform High Pressure Piping Basic Design:** To ensure an adequate (complete), efficient design for the high pressure piping that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design or as input into an internally developed detail design.
- **Perform High Pressure Piping Detail Design:** To ensure an adequate (complete), efficient design for the manufacturing, fabrication, construction and commissioning of high pressure piping that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system.
- **Perform Lighting Up System Concept Design:** To ensure an adequate (complete), efficient conceptual design for the lighting up system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.
- **Perform Lighting Up System Basic Design:** To ensure an adequate (complete), efficient design for the lighting up system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.
- **Perform Milling System Concept Design:** To ensure an adequate (complete), efficient conceptual design for the milling system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.
- **Perform Milling System Basic Design:** To ensure an adequate (complete), efficient design for the milling system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.
- **Perform Main Firing System Concept Design:** To ensure an adequate (complete), efficient conceptual design for the main firing system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.
- **Perform Main Firing System Basic Design:** To ensure an adequate (complete), efficient design for the main firing system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design or as input into an internally developed detail design.
- **Perform Main Firing System Detail Design:** To ensure an adequate (complete), efficient design for the manufacturing, fabrication, construction and commissioning of the main firing system that will meet the

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specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system.

- **Perform Pressure Parts Concept Design:** To ensure an adequate (complete), efficient conceptual design for pressure parts, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.
- **Perform Pressure Parts Basic Design:** To ensure an adequate (complete), efficient design for the pressure parts that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design or as input into an internally developed detail design.
- **Perform Pressure Parts Detail Design:** To ensure an adequate (complete), efficient design for the manufacturing, fabrication, construction and commissioning of the pressure parts that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system.

RISKS (HIGH):

- Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice
- Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Turbine Engineering that is not aligned to engineering best practice

CRITICAL CONTROLS:

- Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

TOTAL: 1

KEY PERFORMANCE INDICATORS:

- Cost variations
- Design Rating
- Number of overdue actions
- Number of technical reworks
- Percentage compliance of technical requirements
- Percentage design non conformance
- Percentage design reviews failed

REFERENCES:

The following document(s) are referenced in this text and comprise requirements within this document. At the time of publication, the edition(s) indicated was (were) valid. These documents are subject to revision and users are responsible to ensure that the most recent edition(s) of the document(s) listed below are used/referenced.

Normative:

- 240-4332798: Engineering Policy
- 240-53114186: Document & Record Management Procedure
- 36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures
- 36-680: Fossil Fuel Firing Regulation
- 36-789: Specification For Tube Mill Grinding Media
- 36-796: Hollow Grinding Balls for B&W Mills
- 36-804: Specification for Tube Mill Girth & Pinion Lubrication
- 36-805: Specification for Tube Mill Liner Material
- 45-224: High Pressure Pipe Work Supports
- 474-1325: Design Review Procedure
- 474-XXX: Boiler MEB Manual (TBD)
- Burner Basic Design Manual (TBD)

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- Burner Operating & Control Philosophy (TBD)
- Eskom Bag Material Specification (TBD)
- FGD Eskom Specification (TBD)
- FGD Materials of Construction Guideline (TBD)
- GGL 361095: Vibration Base Condition Monitoring of Rotating Aux Plant Machinery (TBD)
- GGR 0568: PFFR
- GGR 0992: Plant Safety Regulation (PSR)
- GGS 0182: Process Flow Diagrams and Piping Instrumentation Diagrams
- GGSS 0667: Specification For Ceramic Lined Pulverised Fuel Pipework
- GGSS 0668: Specification for Grinding Elements for Loesche, Lopulco & PHI Mills
- GGSS 0669: Specification for Grinding Rings for E-Mills (TBD)
- GST 36-978: Thermal Insulation Standard
- Guideline for Maintenance of Mill Reducer Gearboxes (TBD)
- N.PSZ 45-223: High Pressure Pipework for Fossil Fired Power Stations
- NPMZ 45-392: Fire Protection Manual
- NWS 1414: Fuel oil plants for fossil fired power stations
- NWS 1454: Thermal Insulation At Power Stations
- Operating & Maintenance Philosophies (TBD)
- Operating and Control Philosophy (TBD)
- Pressure Parts Specification (TBD)
- Quality Assurance Plan (TBD)
- SANS 10086-1
- SANS 10108
- SANS 10119
- SANS 10140-3

Informative:

- None

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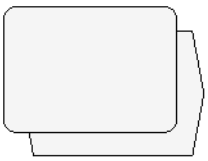
8 SYMBOL LEGEND



Process Interface
Represents the Upstream Or Down stream Process(es)

Process
Represents the sequential flow the value-adding functions of the Process and Sub-Process

Activity
Represents an activity, Which is executed In the business process

Event
Represents either the trigger or result from an activity / task

Inactive Process Interface
Represents the Upstream Or Down stream Process that is not defined in the interfaced process.

The 'C' indicates that the process is controlled. i.e. it is linked to a least one control

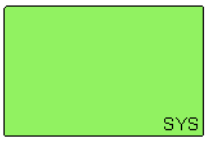
SAP Activity / Task
Represents an activity / tasks that are completed using the SAP System

Decisions:

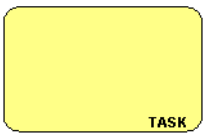
AND All process flow paths must be completed / followed

ANY One or more process flow paths must be completed / followed

OR Only one process flow path can be completed / followed



System Activity / Task
Represents an activity / tasks that are automated



Tasks
Represents a task which is executed

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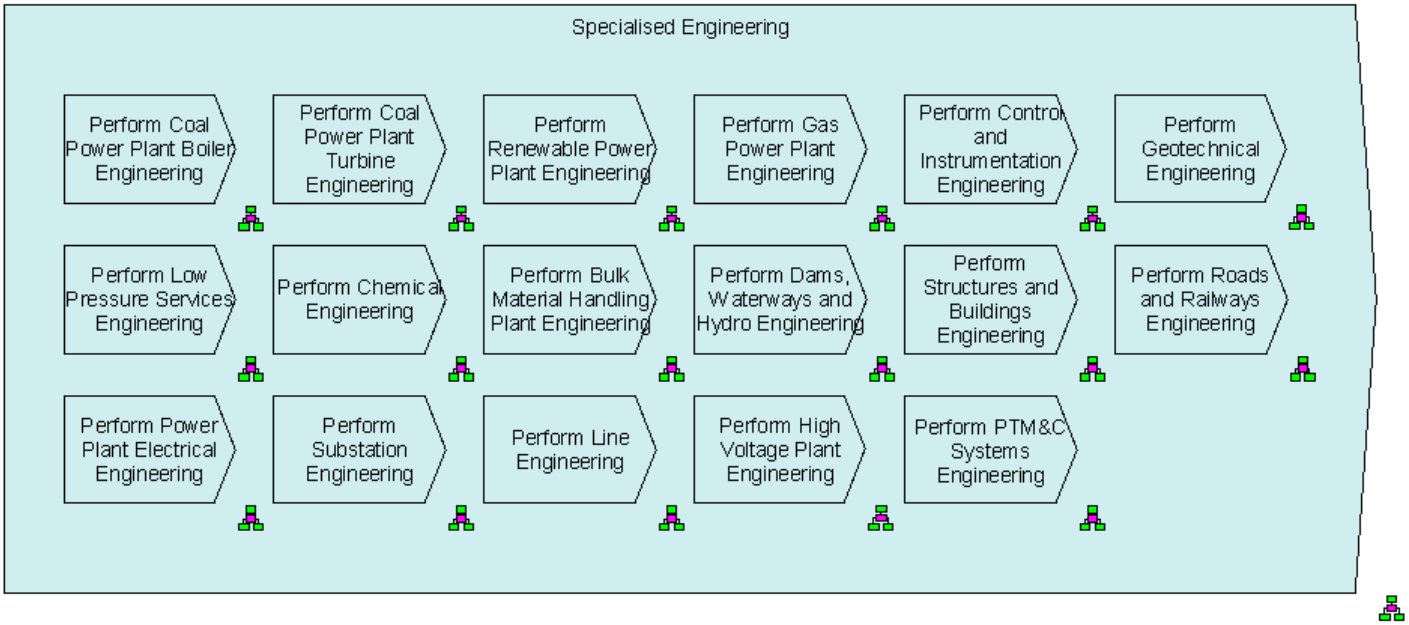
9 SPECIALISED ENGINEERING



L3
Name: Specialised Engineering
Status: Released
Released on: Nov 19, 2012
Release: 1

PROCESS FLOW: Perform Coal Power Plant Boiler Engineering

This addresses activities for specifying the fuel properties to be combusted, designing the necessary interface requirements to all subsystems which include mills for pulverising the fuel and draught groups for air injection for optimum fuel combustion.. Further specifying the requirements of the flue gas systems for reducing emissions to acceptable levels and finally specifying the High pressure parts requirements related to steam generation.

PROCESS OBJECTIVE:

To ensure that energy generated from coal and oil combustion is transformed to steam in the boiler to a requirement suitable for turbine generation and to treat the flue gas generated from burning the fuels to comply to environmental requirements.

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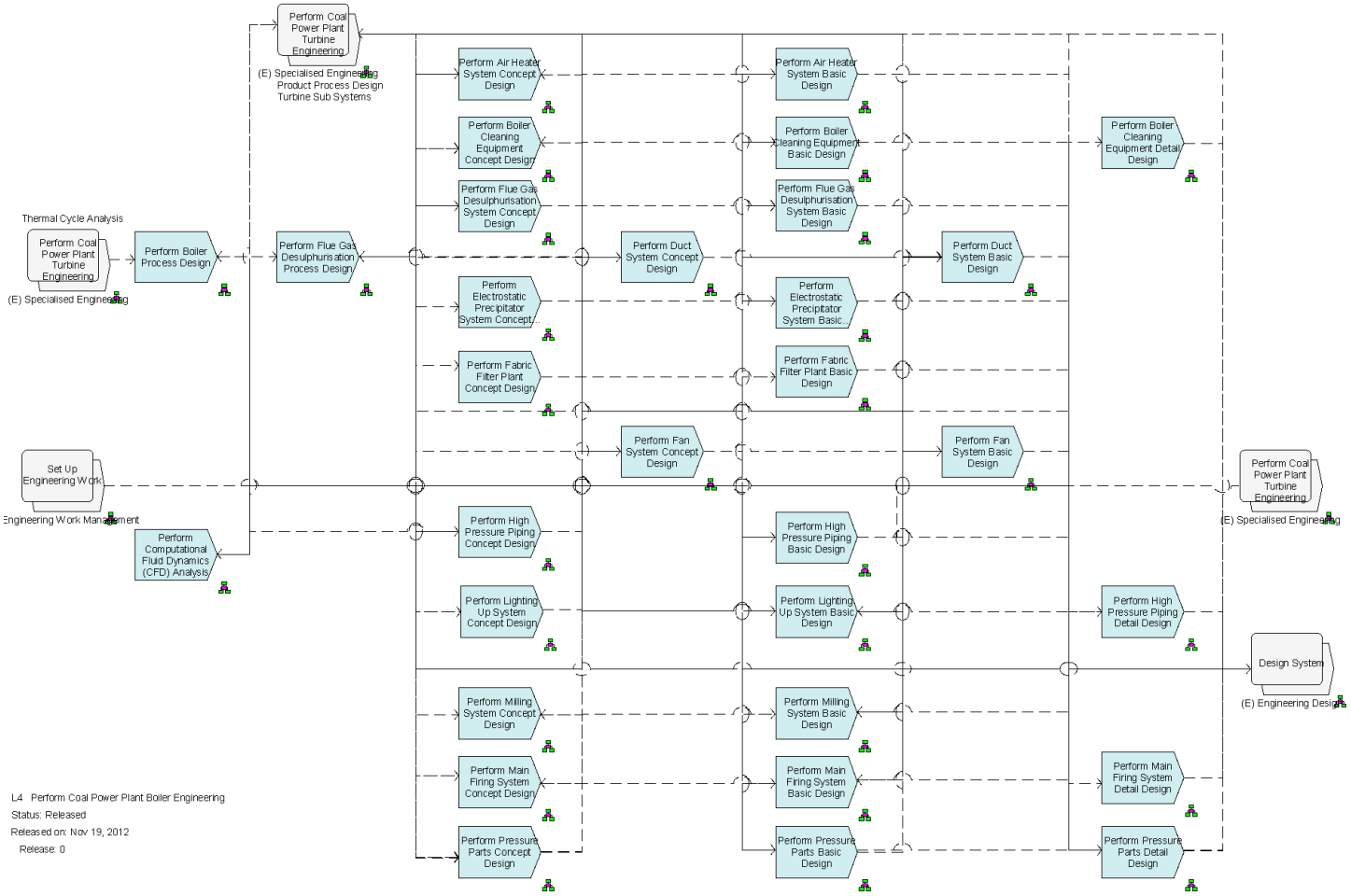
9.1 Perform Coal Power Plant Boiler Engineering



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ACTIVITY FLOW: Perform Flue Gas Desulphurisation Process Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements and a process flow model is developed.

PROCESS OBJECTIVE:

To ensure the design of the process for the flue gas desulphurisation system with optimised mass and energy balances, process flow designs and process flow models to produce an effective and efficient condensing system, taking the various flue gas cleaning possibilities into consideration and minimise material and energy waste.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Boiler Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the high-level process design of a complete boiler system. A mass and energy balance is performed and a boiler system process flow diagram is created during the execution of this capability.	* Boiler process design completed
Perform Computational Fluid Dynamics (CFD) Analysis	This activity flow provides a mechanism for flow and heat transfer simulation. It could be applied to any phase of design, different design options, plant life extension, outage support and maintenance planning. The transfer (flow) problem is formulated for which a model is developed. The boundary conditions are defined and the solver algorithm for the model performed to obtain simulated flow results as outcome. The outcome is used to inform the designer, to be used in technology selection and to facilitate mechanical design.	* Computational fluid dynamics analysis completed

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into	* Flue gas desulphurisation process design completed

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	consideration actual subsystem design data to: * verify and integrate the subsystem process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution design	
Perform Flue Gas Desulphurisation System Concept Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the concept design of a flue gas desulphurisation system for a boiler plant by providing FGD Input to the project design manual, participating in several analyses for a FGD retrofit (draught system analysis, chimney analysis, auxiliary power analysis, chemical analysis, C&I analysis, LPS analysis, constructability analysis). The main equipment as well as the balance of plant are sized, materials are selected, drawings and plot plans are developed, system description and philosophies are formulated, process information are developed and everything are presented in a design report.	* Flue gas desulphurisation process design completed
Perform Flue Gas Desulphurisation System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a flue gas desulphurisation system. The process design, main equipment and balance of plant mechanical designs are finalised, transient balance is performed as well as inputs from CFD calculations are obtained. Equipment geometries are modelled or obtained from catalogues and the system layout is described. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Flue gas desulphurisation process design completed

ACTIVITY FLOW: Perform Boiler Process Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the high-level process design of a complete boiler system. A mass and energy balance is performed and a boiler system process flow diagram is created during the execution of this capability.

PROCESS OBJECTIVE:

The objective of this process is to provide a complete and effective design of a boiler process for converting coal into steam that is used for driving turbines.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating

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Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Thermal Cycle Analysis	This activity flow describes the thermodynamic impact of the thermal cycle in the power plant, on plant and equipment design. The thermal cycle describes the process by which steam is used to generate electrical power. Heat cycles are described for different loading conditions typically leading to calculations of emergency capacity, heat balances, power consumptions, plant efficiency, water consumption, overall steam cycle diagrams and water cycle diagrams.	* Thermal Cycle Design Approved
Design System	Potential integration identified, the relevant process will be captured at a later date.	* Plant specific design criteria developed (To Be Confirmed)

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Perform Flue Gas Desulphurisation Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements and a process flow model is developed.	* Boiler process design completed
Perform Product Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements, a thermal cycle analysis (with its resulting heat balance diagram) or boiler process design or alternative power plant process design and a process flow model is developed.	* Boiler process design completed
Perform Boiler Cleaning Equipment Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of the boiler cleaning equipment.	* Boiler process design completed

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	Boiler cleaning equipment specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described, advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	
Perform High Pressure Piping Concept Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the concept design of high pressure piping for a boiler plant. The high level stakeholder requirements are interpreted and applied to the system, with its concept design as product, piping routes are developed and then finally presented in a design report.	* Boiler process design completed
Perform High Pressure Piping Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of boiler plant high pressure piping. System specific engineering calculations and evaluations, including a piping stress analysis, are done and drawings are developed. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Boiler process design completed
Perform Pressure Parts Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of boiler plant pressure parts. System specific engineering calculations and evaluations, that may include stress analysis, are done and drawings are developed. More often than not a Design-by-Rule (Design-by-Code) approach is followed instead of Design-by-Analysis. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report	* Boiler process design completed

ACTIVITY FLOW: Perform Computational Fluid Dynamics (CFD) Analysis

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This activity flow provides a mechanism for flow and heat transfer simulation. It could be applied to any phase of design, different design options, plant life extension, outage support and maintenance planning.

The transfer (flow) problem is formulated for which a model is developed. The boundary conditions are defined and the solver algorithm for the model performed to obtain simulated flow results as outcome.

The outcome is used to inform the designer, to be used in technology selection and to facilitate mechanical design.

PROCESS OBJECTIVE:
To find the most cost effective fit-for-purpose process designs for component level flow phenomena, heat transfer and species conservation.
KEY PERFORMANCE INDICATORS:
Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Flue Gas Desulphurisation Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements and a process flow model is developed.	* Computational fluid dynamics (CFD) analysis required
Perform Air Heater System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of an air heater system. The high level stakeholder requirements are interpreted and applied to the air heater system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Computational fluid dynamics (CFD) analysis required
Perform Boiler Cleaning Equipment Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of the boiler cleaning equipment. Boiler cleaning equipment specific engineering calculations and evaluations are done, equipment	* Computational fluid dynamics (CFD) analysis required

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	geometries are modelled or obtained from catalogues, the system layout is described, advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	
Perform Condensing System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a condensing system for a turbine plant. The high level stakeholder requirements are interpreted in order to facilitate an understanding of the design parameters and performance characteristics and a site footprint is described. If an air cooled condenser design is required a computational fluid dynamics (CFD) analysis is obtained. The result of these is finally presented in a design report.	* Computational fluid dynamics (CFD) analysis required
Perform Electrostatic Precipitator System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of an electrostatic precipitator system. System specific engineering calculations and evaluations are done, equipment geometries are modelled, the system layout is described, advanced engineering analyses are performed as well as a CFD Analysis is obtained and used to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Computational fluid dynamics (CFD) analysis required
Perform Fabric Filter Plant Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fabric filter plant. The high level stakeholder requirements are interpreted and applied to the fabric filter plant with its concept design as product, dampers are selected, the system layout is typically described a CFD analysis obtained and then finally presented in a design report.	* Computational fluid dynamics (CFD) analysis required
Perform Fabric Filter Plant Basic	This activity flow is where specific	* Computational fluid dynamics (CFD)

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Design	engineering expertise, methodologies and tools are applied to the design of fabric filter plant during the basic design phase by calculating the number of bags required, laser-scanning the existing plant, determining the number of compartments or the maximum number of compartments, describing the fabric filter plant footprint, designing the pulsing system, hoppers and refining the fabric filter design. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	analysis required
Perform Fan System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fan system. The high level stakeholder requirements are interpreted and applied to the fan system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Computational fluid dynamics (CFD) analysis required
Perform Main Firing System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a main firing system. Main firing system specific engineering calculations and evaluations are done, burner geometries are modelled or obtained from catalogues, materials characteristics are specified, the system layout is described, advanced engineering analyses, including CFD analysis, are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Computational fluid dynamics (CFD) analysis required

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Perform Flue Gas Desulphurisation Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a	* Computational fluid dynamics analysis completed

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	power plant. The operational requirements for the product are deduced from the stakeholder requirements and a process flow model is developed.	
Perform Air Heater System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of an air heater system. The high level stakeholder requirements are interpreted and applied to the air heater system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Computational fluid dynamics analysis completed
Perform Boiler Cleaning Equipment Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of the boiler cleaning equipment. Boiler cleaning equipment specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described, advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Computational fluid dynamics analysis completed
Perform Condensing System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a condensing system for a turbine plant. The high level stakeholder requirements are interpreted in order to facilitate an understanding of the design parameters and performance characteristics and a site footprint is described. If an air cooled condenser design is required a computational fluid dynamics (CFD) analysis is obtained. The result of these is finally presented in a design report.	* Computational fluid dynamics analysis completed
Perform Electrostatic Precipitator System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of an electrostatic precipitator system.	* Computational fluid dynamics analysis completed

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	System specific engineering calculations and evaluations are done, equipment geometries are modelled, the system layout is described, advanced engineering analyses are performed as well as a CFD Analysis is obtained and used to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	
Perform Fabric Filter Plant Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fabric filter plant. The high level stakeholder requirements are interpreted and applied to the fabric filter plant with its concept design as product, dampers are selected, the system layout is typically described a CFD analysis obtained and then finally presented in a design report.	* Computational fluid dynamics analysis completed
Perform Fan System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fan system. The high level stakeholder requirements are interpreted and applied to the fan system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Computational fluid dynamics analysis completed
Perform High Pressure Piping Concept Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the concept design of high pressure piping for a boiler plant. The high level stakeholder requirements are interpreted and applied to the system, with its concept design as product, piping routes are developed and then finally presented in a design report.	* Computational fluid dynamics analysis completed
Perform Lighting Up System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a lighting up system. Lighting up system specific	* Computational fluid dynamics analysis completed

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	engineering calculations and evaluations are done, equipment geometries are obtained from catalogues, and the lighting up system layout is described. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	
Perform Main Firing System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a main firing system. Main firing system specific engineering calculations and evaluations are done, burner geometries are modelled or obtained from catalogues, materials characteristics are specified, the system layout is described, advanced engineering analyses, including CFD analysis, are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Computational fluid dynamics analysis completed

ACTIVITY FLOW: Perform Air Heater System Concept Design

This activity flow applies specific engineering expertise, methodologies and tools to the concept design of an air heater system.

The high level stakeholder requirements are interpreted and applied to the air heater system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient conceptual design for an air heater system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT

CONTROLLED DISCLOSURE
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Perform Product Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements, a thermal cycle analysis (with its resulting heat balance diagram) or boiler process design or alternative power plant process design and a process flow model is developed.	* Product process design completed
Perform Computational Fluid Dynamics (CFD) Analysis	This activity flow provides a mechanism for flow and heat transfer simulation. It could be applied to any phase of design, different design options, plant life extension, outage support and maintenance planning. The transfer (flow) problem is formulated for which a model is developed. The boundary conditions are defined and the solver algorithm for the model performed to obtain simulated flow results as outcome. The outcome is used to inform the designer, to be used in technology selection and to facilitate mechanical design.	* Computational fluid dynamics analysis completed
Perform Boiler Cleaning Equipment Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of the boiler cleaning equipment. The high level stakeholder requirements are interpreted and applied to the boiler cleaning equipment with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Boiler cleaning equipment concept design completed
Perform Fan System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fan system. The high level stakeholder requirements are interpreted and applied to the fan system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally	* Fan system concept design completed

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	presented in a design report.	
Perform Milling System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a milling system. The high level stakeholder requirements are interpreted and applied to the milling system, with its concept design as product, the available technologies are investigated and selected, the system layout is typically described and finally presented in a design report.	* Milling system concept design completed
Perform Main Firing System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a main firing system. The high level stakeholder requirements are interpreted and applied to the main firing system, with its concept design as product, the available technologies for burners are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and the finally presented in a design report.	* Main firing system concept design completed
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass	* Project design manual issued

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	Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* Air heater system concept design completed
Perform Duct System Concept Design	This activity flow applies specific engineering expertise, methodologies	* Air heater system concept design completed

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	and tools to the concept design of a duct system. The high level stakeholder requirements are interpreted and applied to the duct system with its concept design as product, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	
Perform Milling System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a milling system. The high level stakeholder requirements are interpreted and applied to the milling system, with its concept design as product, the available technologies are investigated and selected, the system layout is typically described and finally presented in a design report.	* Air heater system concept design completed
Perform Main Firing System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a main firing system. The high level stakeholder requirements are interpreted and applied to the main firing system, with its concept design as product, the available technologies for burners are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and the finally presented in a design report.	* Air heater system concept design completed

ACTIVITY FLOW: Perform Air Heater System Basic Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of an air heater system.

System specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures, pressures and more.

Finally, a design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.

PROCESS OBJECTIVE:
To ensure an adequate (complete), efficient design for the air heater system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.

KEY PERFORMANCE INDICATORS:
Cost variations
Design Rating
Number of overdue actions
Number of technical reworks

CONTROLLED DISCLOSURE
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Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Product Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements, a thermal cycle analysis (with its resulting heat balance diagram) or boiler process design or alternative power plant process design and a process flow model is developed.	* Product process design completed
Perform Boiler Cleaning Equipment Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of the boiler cleaning equipment. Boiler cleaning equipment specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described, advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Boiler cleaning equipment basic design completed
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria,	* Project design manual issued

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	Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access	* Air heater system basic design completed

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	and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution design	* Air heater system basic design completed
Perform Duct System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a duct system. Duct system specific engineering calculations and evaluations are done, the duct system layout is described and duct system related engineering analyses are performed to determine loads, flows and temperatures. Finally, a product basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Air heater system basic design completed
Perform Fan System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a fan system. Fan system specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures and pressures.	* Air heater system basic design completed

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	Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	
Perform Milling System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a milling system. Milling system specific engineering calculations and evaluations are done, equipment geometries are obtained from catalogues, and the lighting up system layout is described, advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Air heater system basic design completed
Perform Main Firing System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a main firing system. Main firing system specific engineering calculations and evaluations are done, burner geometries are modelled or obtained from catalogues, materials characteristics are specified, the system layout is described, advanced engineering analyses, including CFD analysis, are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Air heater system basic design completed

ACTIVITY FLOW: Perform Boiler Cleaning Equipment Concept Design

This activity flow applies specific engineering expertise, methodologies and tools to the concept design of the boiler cleaning equipment.

The high level stakeholder requirements are interpreted and applied to the boiler cleaning equipment with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient conceptual design for the boiler cleaing equipment, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions

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Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire	* Project design manual issued

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	Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Perform Air Heater System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of an air heater system. The high level stakeholder requirements are interpreted and applied to the air heater system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Boiler cleaning equipment concept design completed
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* Boiler cleaning equipment concept design completed
Perform Pressure Parts Concept Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the concept	* Boiler cleaning equipment concept design completed

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	design of boiler plant pressure parts. The high level stakeholder requirements are interpreted and applied to the pressure parts, with its concept design as product and finally presented in a design report.	

ACTIVITY FLOW: Perform Boiler Cleaning Equipment Basic Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of the boiler cleaning equipment.

Boiler cleaning equipment specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described, advanced engineering analyses are performed to determine loads, flows, temperatures and pressures.

Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient design for boiler cleaning equipment that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design or as input into an internally developed detail design.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Product Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements, a thermal cycle analysis (with its resulting heat balance diagram) or boiler process design or alternative power plant process design and a process flow model is developed.	* Boiler process design completed
Perform Boiler Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the high-level process design of a complete boiler system. A mass and energy balance is performed and a boiler system process flow diagram is created	* Boiler process design completed

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	during the execution of this capability.	
Perform Boiler Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the high-level process design of a complete boiler design. A mass and energy balance is performed and a boiler system process flow diagram is created during the execution of this capability.	* Product process design completed
Perform Computational Fluid Dynamics (CFD) Analysis	This activity flow provides a mechanism for flow and heat transfer simulation. It could be applied to any phase of design, different design options, plant life extension, outage support and maintenance planning. The transfer (flow) problem is formulated for which a model is developed. The boundary conditions are defined and the solver algorithm for the model performed to obtain simulated flow results as outcome. The outcome is used to inform the designer, to be used in technology selection and to facilitate mechanical design.	* Computational fluid dynamics analysis completed
Perform Pressure Parts Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of boiler plant pressure parts. System specific engineering calculations and evaluations, that may include stress analysis, are done and drawings are developed. More often than not a Design-by-Rule (Design-by-Code) approach is followed instead of Design-by-Analysis. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report	* Pressure parts basic design compiled
Perform Pressure Parts Detail Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the detail design of boiler pressure parts where detailed design calculations are done and detail drawings are developed. The basic designs of the pressure parts are optimised as part of the process. Finally, a final design package is compiled containing manufacturing instructions.	* Concept System Design Completed
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will	* Project design manual issued

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	identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT

CONTROLLED DISCLOSURE
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Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* Boiler cleaning equipment basic design completed
Perform Air Heater System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of an air heater system. System specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures, pressures and more. Finally, a design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Boiler cleaning equipment basic design completed
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution	* Boiler cleaning equipment basic design completed

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	design	
Perform Duct System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a duct system. Duct system specific engineering calculations and evaluations are done, the duct system layout is described and duct system related engineering analyses are performed to determine loads, flows and temperatures. Finally, a product basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Boiler cleaning equipment basic design completed
Perform Fan System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a fan system. Fan system specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Boiler cleaning equipment basic design completed

ACTIVITY FLOW: Perform Boiler Cleaning Equipment Detail Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the detail design of the boiler cleaning equipment piping where detailed design calculations are done and detail drawings are developed.

Finally, a final design pack is compiled containing manufacturing instructions.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient design for the manufacturing, fabrication, construction and commissioning of the boiler cleaning equipment that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for

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correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Pressure Parts Detail Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the detail design of boiler pressure parts where detailed design calculations are done and detail drawings are developed. The basic designs of the pressure parts are optimised as part of the process. Finally, a final design package is compiled containing manufacturing instructions.	* Pressure parts detail design completed
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage	* Project design manual issued

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	Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution design	* Boiler cleaning equipment detail design completed

ACTIVITY FLOW: Perform Duct System Concept Design

This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a duct system.

The high level stakeholder requirements are interpreted and applied to the duct system with its concept design as product, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient conceptual design for the duct system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for

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correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Air Heater System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of an air heater system. The high level stakeholder requirements are interpreted and applied to the air heater system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Air heater system concept design completed
Perform Electrostatic Precipitator System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of an electrostatic precipitator system. The high level stakeholder requirements are interpreted and applied to the electrostatic precipitator system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Electrostatic precipitator system concept design completed
Perform Fabric Filter Plant Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fabric filter plant. The high level stakeholder requirements are interpreted and applied to the fabric filter plant with its concept design as product, dampers are selected, the system layout is typically described a CFD analysis obtained and then finally presented in a design report.	* Fabric filter plant concept design completed
Perform Fan System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fan system. The high level stakeholder requirements are interpreted and applied to the fan system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised	* Fan system concept design completed

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	analyses performed and then finally presented in a design report.	
Perform Flue Gas Desulphurisation System Concept Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the concept design of a flue gas desulphurisation system for a boiler plant by providing FGD Input to the project design manual, participating in several analyses for a FGD retrofit (draught system analysis, chimney analysis, auxiliary power analysis, chemical analysis, C&I analysis, LPS analysis, constructability analysis). The main equipment as well as the balance of plant are sized, materials are selected, drawings and plot plans are developed, system description and philosophies are formulated, process information are developed and everything are presented in a design report.	* Flue gas desulphurisation concept design completed
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories,	* Project design manual issued

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	Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* Duct system concept design complete
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem	* Duct system concept design complete

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	process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution design	

ACTIVITY FLOW: Perform Duct System Basic Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a duct system.

Duct system specific engineering calculations and evaluations are done, the duct system layout is described and duct system related engineering analyses are performed to determine loads, flows and temperatures.

Finally, a product basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient design for the duct system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Product Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements, a thermal cycle analysis (with its resulting heat balance diagram) or boiler process design or alternative power plant process design and a process flow model is developed.	* Product process design completed
Perform Air Heater System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of an air heater system. System specific engineering calculations and evaluations are done, equipment geometries are	* Air heater system basic design completed

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	modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures, pressures and more. Finally, a design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	
Perform Boiler Cleaning Equipment Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of the boiler cleaning equipment. Boiler cleaning equipment specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described, advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Boiler cleaning equipment basic design completed
Perform Electrostatic Precipitator System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of an electrostatic precipitator system. The high level stakeholder requirements are interpreted and applied to the electrostatic precipitator system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Electrostatic precipitator system concept design completed
Perform Electrostatic Precipitator System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of an electrostatic precipitator system. System specific engineering calculations and evaluations are done, equipment geometries are modelled, the system layout is described, advanced engineering analyses are performed as well as a CFD Analysis is obtained and used to determine loads, flows, temperatures	* Electrostatic precipitator definition completed

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	and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	
Perform Fabric Filter Plant Basic Design	This activity flow is where specific engineering expertise, methodologies and tools are applied to the design of fabric filter plant during the basic design phase by calculating the number of bags required, laser-scanning the existing plant, determining the number of compartments or the maximum number of compartments, describing the fabric filter plant footprint, designing the pulsing system, hoppers and refining the fabric filter design. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Fabric filter plant system design completed
Perform Feedwater System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a feedwater system. System specific engineering calculations and evaluations are done that are required to optimise the thermal performance and to produce a basic design for the feedwater system. Advanced engineering estimations/analyses are performed to determine amongst others, loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a basic design report.	* Feedwater system basic design completed
Perform Fan System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a fan system. Fan system specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures	* Fan system basic design complete

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	and drawings, is compiled as a sub-set of a design report.	
Perform Flue Gas Desulphurisation System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a flue gas desulphurisation system. The process design, main equipment and balance of plant mechanical designs are finalised, transient balance is performed as well as inputs from CFD calculations are obtained. Equipment geometries are modelled or obtained from catalogues and the system layout is described. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Flue gas desulphurisation basic design completed
Perform Lighting Up System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a lighting up system. Lighting up system specific engineering calculations and evaluations are done, equipment geometries are obtained from catalogues, and the lighting up system layout is described. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Lighting up system basic design completed
Perform Milling System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a milling system. Milling system specific engineering calculations and evaluations are done, equipment geometries are obtained from catalogues, and the lighting up system layout is described, advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Milling system basic design completed
Perform Main Firing System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a main firing system. Main firing system specific engineering calculations and evaluations are done, burner	* Main firing system basic design complete

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	geometries are modelled or obtained from catalogues, materials characteristics are specified, the system layout is described, advanced engineering analyses, including CFD analysis, are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	
Perform Pressure Parts Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of boiler plant pressure parts. System specific engineering calculations and evaluations, that may include stress analysis, are done and drawings are developed. More often than not a Design-by-Rule (Design-by-Code) approach is followed instead of Design-by-Analysis. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report	* Pressure parts basic design compiled
Perform Pressure Parts Detail Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the detail design of boiler pressure parts where detailed design calculations are done and detail drawings are developed. The basic designs of the pressure parts are optimised as part of the process. Finally, a final design package is compiled containing manufacturing instructions.	* Pressure parts detail design completed

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified	* Duct system basic design completed

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	hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution design	* Duct system basic design completed

ACTIVITY FLOW: Perform Electrostatic Precipitator System Concept Design

This activity flow applies specific engineering expertise, methodologies and tools to the concept design of an electrostatic precipitator system.

The high level stakeholder requirements are interpreted and applied to the electrostatic precipitator system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient conceptual design for the electrostatic precipitator system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by	* Project design manual issued

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	engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS	END EVENT

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	DESCRIPTION	
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* Electrostatic precipitator system concept design completed
Perform Duct System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a duct system. The high level stakeholder requirements are interpreted and applied to the duct system with its concept design as product, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Electrostatic precipitator system concept design completed
Perform Duct System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a duct system. Duct system specific engineering calculations and evaluations are done, the duct system layout is described and duct system related engineering analyses are performed to determine loads, flows and temperatures. Finally, a product basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Electrostatic precipitator system concept design completed
Perform Fan System Concept Design	This activity flow applies specific engineering expertise, methodologies	* Electrostatic precipitator system concept design completed

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	and tools to the concept design of a fan system. The high level stakeholder requirements are interpreted and applied to the fan system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	

ACTIVITY FLOW: Perform Electrostatic Precipitator System Basic Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of an electrostatic precipitator system.

System specific engineering calculations and evaluations are done, equipment geometries are modelled, the system layout is described, advanced engineering analyses are performed as well as a CFD Analysis is obtained and used to determine loads, flows, temperatures and pressures.

Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient design for the electrostatic precipitator system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Product Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements, a thermal cycle analysis (with its resulting heat balance diagram) or boiler process design or alternative power plant process design and a process flow model is developed.	* Product process design completed
Perform Computational Fluid Dynamics (CFD) Analysis	This activity flow provides a mechanism for flow and heat transfer	* Computational fluid dynamics analysis completed

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	simulation. It could be applied to any phase of design, different design options, plant life extension, outage support and maintenance planning. The transfer (flow) problem is formulated for which a model is developed. The boundary conditions are defined and the solver algorithm for the model performed to obtain simulated flow results as outcome. The outcome is used to inform the designer, to be used in technology selection and to facilitate mechanical design.	
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery	* Project design manual issued

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	System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* Electrostatic precipitator system basic design completed
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution	* Electrostatic precipitator system basic design completed

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	design	
Perform Duct System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a duct system. Duct system specific engineering calculations and evaluations are done, the duct system layout is described and duct system related engineering analyses are performed to determine loads, flows and temperatures. Finally, a product basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Electrostatic precipitator system basic design completed
Perform Fan System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a fan system. Fan system specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Electrostatic precipitator system basic design completed

ACTIVITY FLOW: Perform Fabric Filter Plant Concept Design

This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fabric filter plant.

The high level stakeholder requirements are interpreted and applied to the fabric filter plant with its concept design as product, dampers are selected, the system layout is typically described a CFD analysis obtained and then finally presented in a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient conceptual design for the fabric filter plant, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and

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regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Computational Fluid Dynamics (CFD) Analysis	This activity flow provides a mechanism for flow and heat transfer simulation. It could be applied to any phase of design, different design options, plant life extension, outage support and maintenance planning. The transfer (flow) problem is formulated for which a model is developed. The boundary conditions are defined and the solver algorithm for the model performed to obtain simulated flow results as outcome. The outcome is used to inform the designer, to be used in technology selection and to facilitate mechanical design.	* Computational fluid dynamics analysis completed
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping,	* Project design manual issued

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	Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* Fabric filter plant concept design completed
Perform Duct System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a duct system. The high level stakeholder requirements are interpreted and	* Fabric filter plant concept design completed

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	applied to the duct system with its concept design as product, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	
Perform Fan System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fan system. The high level stakeholder requirements are interpreted and applied to the fan system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Fabric filter plant concept design completed

ACTIVITY FLOW: Perform Fabric Filter Plant Basic Design

This activity flow is where specific engineering expertise, methodologies and tools are applied to the design of fabric filter plant during the basic design phase by calculating the number of bags required, laser-scanning the existing plant, determining the number of compartments or the maximum number of compartments, describing the fabric filter plant footprint, designing the pulsing system, hoppers and refining the fabric filter design.

Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient design for the fabric filter plant that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Product Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements, a thermal cycle	* Product process design completed

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	analysis (with its resulting heat balance diagram) or boiler process design or alternative power plant process design and a process flow model is developed.	
Perform Computational Fluid Dynamics (CFD) Analysis	This activity flow provides a mechanism for flow and heat transfer simulation. It could be applied to any phase of design, different design options, plant life extension, outage support and maintenance planning. The transfer (flow) problem is formulated for which a model is developed. The boundary conditions are defined and the solver algorithm for the model performed to obtain simulated flow results as outcome. The outcome is used to inform the designer, to be used in technology selection and to facilitate mechanical design.	* Computational fluid dynamics analysis completed
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories,	* Project design manual issued

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	Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* Fabric filter plant system design completed
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem	* Fabric filter plant system design completed

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	process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution design	
Perform Duct System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a duct system. Duct system specific engineering calculations and evaluations are done, the duct system layout is described and duct system related engineering analyses are performed to determine loads, flows and temperatures. Finally, a product basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Fabric filter plant system design completed
Perform Fan System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a fan system. Fan system specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Fabric filter plant system design completed

ACTIVITY FLOW: Perform Fan System Concept Design

This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fan system.

The high level stakeholder requirements are interpreted and applied to the fan system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.

PROCESS OBJECTIVE:
To ensure an adequate (complete), efficient conceptual design for the fan system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.

KEY PERFORMANCE INDICATORS:
Cost variations
Design Rating
Number of overdue actions
Number of technical reworks

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Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Computational Fluid Dynamics (CFD) Analysis	This activity flow provides a mechanism for flow and heat transfer simulation. It could be applied to any phase of design, different design options, plant life extension, outage support and maintenance planning. The transfer (flow) problem is formulated for which a model is developed. The boundary conditions are defined and the solver algorithm for the model performed to obtain simulated flow results as outcome. The outcome is used to inform the designer, to be used in technology selection and to facilitate mechanical design.	* Computational fluid dynamics (CFD) required
Perform Electrostatic Precipitator System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of an electrostatic precipitator system. The high level stakeholder requirements are interpreted and applied to the electrostatic precipitator system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Electrostatic precipitator system concept design completed
Perform Fabric Filter Plant Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fabric filter plant. The high level stakeholder requirements are interpreted and applied to the fabric filter plant with its concept design as product, dampers are selected, the system layout is typically described a CFD analysis obtained and then finally presented in a design report.	* Fabric filter plant concept design completed
Perform Flue Gas Desulphurisation System Concept Design	This is the activity flow where specific engineering expertise, methodologies	* Flue gas desulphurisation concept design completed

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	and tools are applied to the concept design of a flue gas desulphurisation system for a boiler plant by providing FGD Input to the project design manual, participating in several analyses for a FGD retrofit (draught system analysis, chimney analysis, auxiliary power analysis, chemical analysis, C&I analysis, LPS analysis, constructability analysis). The main equipment as well as the balance of plant are sized, materials are selected, drawings and plot plans are developed, system description and philosophies are formulated, process information are developed and everything are presented in a design report.	
Perform Milling System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a milling system. The high level stakeholder requirements are interpreted and applied to the milling system, with its concept design as product, the available technologies are investigated and selected, the system layout is typically described and finally presented in a design report.	* Milling system concept design completed
Perform Main Firing System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a main firing system. The high level stakeholder requirements are interpreted and applied to the main firing system, with its concept design as product, the available technologies for burners are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and the finally presented in a design report.	* Main firing system concept design completed
Perform Pressure Parts Concept Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the concept design of boiler plant pressure parts. The high level stakeholder requirements are interpreted and applied to the pressure parts, with its concept design as product and finally presented in a design report.	* Pressure parts concept design completed
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design	* Project design manual issued

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	aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Perform Air Heater System Concept	This activity flow applies specific	* Fan system concept design

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Design	engineering expertise, methodologies and tools to the concept design of an air heater system. The high level stakeholder requirements are interpreted and applied to the air heater system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	completed
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* Fan system concept design completed
Perform Duct System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a duct system. The high level stakeholder requirements are interpreted and applied to the duct system with its concept design as product, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Fan system concept design completed
Perform Main Firing System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a main firing system. The high level stakeholder	* Fan system concept design completed

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	requirements are interpreted and applied to the main firing system, with its concept design as product, the available technologies for burners are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and the finally presented in a design report.	
Perform Pressure Parts Concept Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the concept design of boiler plant pressure parts. The high level stakeholder requirements are interpreted and applied to the pressure parts, with its concept design as product and finally presented in a design report.	* Fan system concept design completed

ACTIVITY FLOW: Perform Fan System Basic Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a fan system.

Fan system specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures and pressures.

Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient design for the fan system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Product Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements, a thermal cycle analysis (with its resulting heat	* Product process design completed

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	balance diagram) or boiler process design or alternative power plant process design and a process flow model is developed.	
Perform Air Heater System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of an air heater system. System specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures, pressures and more. Finally, a design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Air heater system basic design completed
Perform Boiler Cleaning Equipment Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of the boiler cleaning equipment. Boiler cleaning equipment specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described, advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Boiler cleaning equipment basic design completed
Perform Electrostatic Precipitator System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of an electrostatic precipitator system. System specific engineering calculations and evaluations are done, equipment geometries are modelled, the system layout is described, advanced engineering analyses are performed as well as a CFD Analysis is obtained and used to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures	* Electrostatic precipitator system basic design completed

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	and drawings, is compiled as a sub-set of a design report.	
Perform Fabric Filter Plant Basic Design	This activity flow is where specific engineering expertise, methodologies and tools are applied to the design of fabric filter plant during the basic design phase by calculating the number of bags required, laser-scanning the existing plant, determining the number of compartments or the maximum number of compartments, describing the fabric filter plant footprint, designing the pulsing system, hoppers and refining the fabric filter design. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Fabric filter plant system design completed
Perform Flue Gas Desulphurisation System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a flue gas desulphurisation system. The process design, main equipment and balance of plant mechanical designs are finalised, transient balance is performed as well as inputs from CFD calculations are obtained. Equipment geometries are modelled or obtained from catalogues and the system layout is described. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Flue gas desulphurisation basic design completed
Perform Lighting Up System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a lighting up system. Lighting up system specific engineering calculations and evaluations are done, equipment geometries are obtained from catalogues, and the lighting up system layout is described. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Lighting up system basic design completed
Perform Milling System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a milling system. Milling system specific engineering calculations and evaluations are	* Milling system basic design completed

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	done, equipment geometries are obtained from catalogues, and the lighting up system layout is described, advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	
Perform Main Firing System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a main firing system. Main firing system specific engineering calculations and evaluations are done, burner geometries are modelled or obtained from catalogues, materials characteristics are specified, the system layout is described, advanced engineering analyses, including CFD analysis, are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Main firing system basic design complete
Perform Pressure Parts Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of boiler plant pressure parts. System specific engineering calculations and evaluations, that may include stress analysis, are done and drawings are developed. More often than not a Design-by-Rule (Design-by-Code) approach is followed instead of Design-by-Analysis. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report	* Pressure parts basic design compiled
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an	* Project design manual issued

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	Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to	* Fan system basic design complete

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	identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution design	* Fan system basic design complete
Perform Duct System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a duct system. Duct system specific engineering calculations and evaluations are done, the duct system layout is described and duct system related engineering analyses are performed to determine loads, flows and temperatures. Finally, a product basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Fan system basic design complete
Perform Feedwater System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a feedwater system. System specific engineering calculations and evaluations are done that are required to optimise the thermal performance and to produce	* Fan system basic design complete

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	a basic design for the feedwater system. Advanced engineering estimations/analyses are performed to determine amongst others, loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a basic design report.	

ACTIVITY FLOW: Perform Flue Gas Desulphurisation System Concept Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the concept design of a flue gas desulphurisation system for a boiler plant by providing FGD Input to the project design manual, participating in several analyses for a FGD retrofit (draught system analysis, chimney analysis, auxiliary power analysis, chemical analysis, C&I analysis, LPS analysis, constructability analysis).

The main equipment as well as the balance of plant are sized, materials are selected, drawings and plot plans are developed, system description and philosophies are formulated, process information are developed and everything are presented in a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient conceptual design for the flue gas desulphurisation system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Flue Gas Desulphurisation Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements and a process flow model is developed.	* Responsibilities approved
Perform Flue Gas Desulphurisation Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements and a process flow model is developed.	* Responsibilities approved
Perform Reliability Engineering	This refers to reliability engineering	* Special FMEA, HAZOP & IRM

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Analysis	analyses performed during the life cycle of the system. It includes component reliability analysis, system RAM analysis, FMEA, life data analysis and life cycle cost analysis.	Analysis Required
Perform Design Analysis	Potential integration identified, the relevant process will be captured at a later date.	* Special RAM Analysis Required (To Be Confirmed)
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control	* Project design manual issued

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	Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* Flue gas desulphurisation concept design completed
Perform Duct System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a duct system. The high level stakeholder requirements are interpreted and applied to the duct system with its concept design as product, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Flue gas desulphurisation concept design completed
Perform Fan System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fan system. The high level stakeholder requirements are interpreted and applied to the fan system with its concept design as product, the	* Flue gas desulphurisation concept design completed

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	available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	

ACTIVITY FLOW: Perform Flue Gas Desulphurisation System Basic Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a flue gas desulphurisation system. The process design, main equipment and balance of plant mechanical designs are finalised, transient balance is performed as well as inputs from CFD calculations are obtained. Equipment geometries are modelled or obtained from catalogues and the system layout is described.

Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient design for the flue gas desulphurisation system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Flue Gas Desulphurisation Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements and a process flow model is developed.	* Responsibilities approved
Perform Flue Gas Desulphurisation Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements and a process flow model is developed.	* Responsibilities approved
Perform Reliability Engineering Analysis	This refers to reliability engineering analyses performed during the life cycle of the system. It includes component reliability analysis, system RAM analysis, FMEA, life data analysis and life cycle cost analysis.	* Special FMEA, HAZOP & IRM Analysis Required

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Perform Design Analysis	Potential integration identified, the relevant process will be captured at a later date.	* Special RAM Analysis Required (To Be Confirmed)
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document	* Project design manual issued

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	revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design System	Potential integration identified, the relevant process will be captured at a later date.	* Flue gas desulphurisation basic design completed (To Be Confirmed)
Perform Duct System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a duct system. Duct system specific engineering calculations and evaluations are done, the duct system layout is described and duct system related engineering analyses are performed to determine loads, flows and temperatures. Finally, a product basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Flue gas desulphurisation basic design completed
Perform Fan System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a fan system. Fan system specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Flue gas desulphurisation basic design completed

ACTIVITY FLOW: Perform High Pressure Piping Concept Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the concept design of high pressure piping for a boiler plant.

The high level stakeholder requirements are interpreted and applied to the system, with its concept design as product, piping routes are developed and then finally presented in a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient conceptual design for high pressure piping, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions

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Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Boiler Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the high-level process design of a complete boiler system. A mass and energy balance is performed and a boiler system process flow diagram is created during the execution of this capability.	* Boiler process design completed
Perform Computational Fluid Dynamics (CFD) Analysis	This activity flow provides a mechanism for flow and heat transfer simulation. It could be applied to any phase of design, different design options, plant life extension, outage support and maintenance planning. The transfer (flow) problem is formulated for which a model is developed. The boundary conditions are defined and the solver algorithm for the model performed to obtain simulated flow results as outcome. The outcome is used to inform the designer, to be used in technology selection and to facilitate mechanical design.	* Computational fluid dynamics analysis completed
Perform Pressure Parts Concept Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the concept design of boiler plant pressure parts. The high level stakeholder requirements are interpreted and applied to the pressure parts, with its concept design as product and finally presented in a design report.	* Pressure parts concept design completed
Perform Vessel Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a vessel for a turbine plant. The high level stakeholder requirements are interpreted in order to facilitate an understanding of the design parameters and sizing are described, where necessary additional specialised analyses are performed and then finally presented	* Vessel design concept completed

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	in a design report.	

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Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	* Project design manual issued

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OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* High pressure piping concept design completed
Perform Pressure Parts Concept Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the concept design of boiler plant pressure parts. The high level stakeholder requirements are interpreted and applied to the pressure parts, with its concept design as product and finally presented in a design report.	* High pressure piping concept design completed
Perform Vessel Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a vessel for a turbine plant. The high level stakeholder requirements are interpreted in order to facilitate an understanding of the design parameters and sizing are described, where necessary additional specialised analyses are performed and then finally presented in a design report.	* High pressure piping concept design completed

ACTIVITY FLOW: Perform High Pressure Piping Basic Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of boiler plant high pressure piping.

System specific engineering calculations and evaluations, including a piping stress analysis, are done and drawings are developed.

Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a

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design report.

PROCESS OBJECTIVE:
To ensure an adequate (complete), efficient design for the high pressure piping that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design or as input into an internally developed detail design.

KEY PERFORMANCE INDICATORS:
Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Boiler Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the high-level process design of a complete boiler system. A mass and energy balance is performed and a boiler system process flow diagram is created during the execution of this capability.	* HP piping basic design initiated
Perform Lighting Up System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a lighting up system. Lighting up system specific engineering calculations and evaluations are done, equipment geometries are obtained from catalogues, and the lighting up system layout is described. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* HP piping basic design initiated
Perform Main Steam Turbine Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a main steam turbine. System specific engineering calculations and evaluations are done, equipment geometries are modelled or sketched, the system footprint is described and advanced engineering analyses are performed to determine amongst others, loads, flows, temperatures, speeds and	* HP piping basic design initiated

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	pressures. Finally, a design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a product basic design report.	
Perform Steam Feedpump Turbine Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a steam feedpump turbine. System specific engineering calculations and evaluations are done, equipment geometries are modelled, the system footprint is described and advanced engineering analyses are performed to determine amongst others, loads, flows, temperatures, speeds and pressures. Finally, a design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* HP piping basic design initiated
Perform Pressure Parts Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of boiler plant pressure parts. System specific engineering calculations and evaluations, that may include stress analysis, are done and drawings are developed. More often than not a Design-by-Rule (Design-by-Code) approach is followed instead of Design-by-Analysis. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report	* HP piping basic design initiated
Perform Vessel Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of the different vessels applicable to a turbine plant. System specific engineering calculations and evaluations, that may include stress analysis used in the detailed sizing of vessels, are done. More often than not a Design-by-Rule (Design-by-Code) approach is followed instead of Design-by-Analysis for these calculations. Costing information is obtained after the vessels are sized and the operating conditions are described. Finally, a report is developed that	* HP piping basic design initiated

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	typically contains design specifications for the different vessels.	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* High pressure piping basic design report compiled
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution design	* High pressure piping basic design report compiled
Perform Main Steam Turbine Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a main steam turbine. System specific engineering calculations and evaluations are done, equipment geometries are modelled or sketched, the system footprint is described and advanced engineering analyses are performed to determine amongst others, loads,	* High pressure piping basic design report compiled

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	flows, temperatures, speeds and pressures. Finally, a design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a product basic design report.	
Perform Steam Feedpump Turbine Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a steam feedpump turbine. System specific engineering calculations and evaluations are done, equipment geometries are modelled, the system footprint is described and advanced engineering analyses are performed to determine amongst others, loads, flows, temperatures, speeds and pressures. Finally, a design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* High pressure piping basic design report compiled
Perform Pressure Parts Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of boiler plant pressure parts. System specific engineering calculations and evaluations, that may include stress analysis, are done and drawings are developed. More often than not a Design-by-Rule (Design-by-Code) approach is followed instead of Design-by-Analysis. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report	* High pressure piping basic design report compiled
Perform Vessel Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of the different vessels applicable to a turbine plant. System specific engineering calculations and evaluations, that may include stress analysis used in the detailed sizing of vessels, are done. More often than not a Design-by-Rule (Design-by-Code) approach is followed instead of Design-by-Analysis for these calculations. Costing information is obtained after the vessels are sized and the operating conditions are described.	* High pressure piping basic design report compiled

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	Finally, a report is developed that typically contains design specifications for the different vessels.	

ACTIVITY FLOW: Perform High Pressure Piping Detail Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the detail design of high pressure piping where detailed design calculations are done and detail drawings are developed.

Finally, a final design pack is compiled containing manufacturing instructions.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient design for the manufacturing, fabrication, construction and commissioning of high pressure piping that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Configure software tools	Potential integration identified, the relevant process will be captured at a later date.	* High pressure piping detail design required (To Be Confirmed)
Perform Pressure Parts Detail Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the detail design of boiler pressure parts where detailed design calculations are done and detail drawings are developed. The basic designs of the pressure parts are optimised as part of the process. Finally, a final design package is compiled containing manufacturing instructions.	* Pressure parts detail design completed

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem process designs * verify system controllability and	* High pressure piping detail design completed

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	update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution design	

ACTIVITY FLOW: Perform Lighting Up System Concept Design

This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a lighting up system.

The high level stakeholder requirements are interpreted and applied to the lighting up system, with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and finally presented in a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient conceptual design for the lighting up system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Milling System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a milling system. The high level stakeholder requirements are interpreted and applied to the milling system, with its concept design as product, the available technologies are investigated and selected, the system layout is typically described and finally presented in a design report.	* Milling system concept design completed
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope	* Lighting Up System Concept Design Required

	of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that	* Lighting up system concept design complete

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	adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	

ACTIVITY FLOW: Perform Lighting Up System Basic Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a lighting up system.

Lighting up system specific engineering calculations and evaluations are done, equipment geometries are obtained from catalogues, and the lighting up system layout is described.

Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient design for the lighting up system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Product Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements, a thermal cycle analysis (with its resulting heat balance diagram) or boiler process design or alternative power plant	* Equipment Specification for Light Up System Required

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	process design and a process flow model is developed.	
Perform Computational Fluid Dynamics (CFD) Analysis	This activity flow provides a mechanism for flow and heat transfer simulation. It could be applied to any phase of design, different design options, plant life extension, outage support and maintenance planning. The transfer (flow) problem is formulated for which a model is developed. The boundary conditions are defined and the solver algorithm for the model performed to obtain simulated flow results as outcome. The outcome is used to inform the designer, to be used in technology selection and to facilitate mechanical design.	* Computational fluid dynamics (CFD) required
Perform Milling System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a milling system. Milling system specific engineering calculations and evaluations are done, equipment geometries are obtained from catalogues, and the lighting up system layout is described, advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Milling system basic design completed
Perform Main Firing System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a main firing system. Main firing system specific engineering calculations and evaluations are done, burner geometries are modelled or obtained from catalogues, materials characteristics are specified, the system layout is described, advanced engineering analyses, including CFD analysis, are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Main firing system basic design complete

OUTGOING PROCESS NAME	OUTGOING PROCESS	END EVENT

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	DESCRIPTION	
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* Lighting up system basic design completed
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution design	* Lighting up system basic design completed
Perform Duct System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a duct system. Duct system specific engineering calculations and evaluations are done, the duct system layout is described and duct system related engineering analyses are performed to determine loads, flows and temperatures. Finally, a product basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Lighting up system basic design completed

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Perform Fan System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a fan system. Fan system specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Lighting up system basic design completed
Perform High Pressure Piping Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of boiler plant high pressure piping. System specific engineering calculations and evaluations, including a piping stress analysis, are done and drawings are developed. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Lighting up system basic design completed
Perform Main Firing System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a main firing system. Main firing system specific engineering calculations and evaluations are done, burner geometries are modelled or obtained from catalogues, materials characteristics are specified, the system layout is described, advanced engineering analyses, including CFD analysis, are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Lighting up system basic design completed

ACTIVITY FLOW: Perform Milling System Concept Design

This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a milling system.

The high level stakeholder requirements are interpreted and applied to the milling system, with its concept design as

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product, the available technologies are investigated and selected, the system layout is typically described and finally presented in a design report.

PROCESS OBJECTIVE:
To ensure an adequate (complete), efficient conceptual design for the milling system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.
KEY PERFORMANCE INDICATORS:
Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Air Heater System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of an air heater system. The high level stakeholder requirements are interpreted and applied to the air heater system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Air heater system concept design completed
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards,	* Project design manual issued

	Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Perform Air Heater System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of an air heater system. The high level stakeholder requirements are interpreted and applied to the air heater system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Milling system concept design completed
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an	* Milling system concept design completed

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	optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	
Perform Fan System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fan system. The high level stakeholder requirements are interpreted and applied to the fan system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Milling system concept design completed
Perform Lighting Up System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a lighting up system. The high level stakeholder requirements are interpreted and applied to the lighting up system, with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and finally presented in a design report.	* Milling system concept design completed
Perform Main Firing System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a main firing system. The high level stakeholder requirements are interpreted and applied to the main firing system, with	* Milling system concept design completed

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	its concept design as product, the available technologies for burners are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and the finally presented in a design report.	

ACTIVITY FLOW: Perform Milling System Basic Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a milling system.

Milling system specific engineering calculations and evaluations are done, equipment geometries are obtained from catalogues, and the lighting up system layout is described, advanced engineering analyses are performed to determine loads, flows, temperatures and pressures.

Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient design for the milling system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Product Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements, a thermal cycle analysis (with its resulting heat balance diagram) or boiler process design or alternative power plant process design and a process flow model is developed.	* Product process design completed
Perform Air Heater System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of an air heater system. System specific engineering calculations and evaluations are done, equipment geometries are	* Air heater system basic design completed

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	modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures, pressures and more. Finally, a design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design	* Project design manual issued

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	Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* Milling system basic design completed
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution design	* Milling system basic design completed
Perform Duct System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a duct system.	* Milling system basic design completed

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	Duct system specific engineering calculations and evaluations are done, the duct system layout is described and duct system related engineering analyses are performed to determine loads, flows and temperatures. Finally, a product basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	
Perform Fan System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a fan system. Fan system specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Milling system basic design completed
Perform Lighting Up System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a lighting up system. Lighting up system specific engineering calculations and evaluations are done, equipment geometries are obtained from catalogues, and the lighting up system layout is described. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Milling system basic design completed
Perform Main Firing System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a main firing system. Main firing system specific engineering calculations and evaluations are done, burner geometries are modelled or obtained from catalogues, materials characteristics are specified, the system layout is described, advanced engineering analyses, including CFD	* Milling system basic design completed

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	analysis, are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	

ACTIVITY FLOW: Perform Main Firing System Concept Design

This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a main firing system.

The high level stakeholder requirements are interpreted and applied to the main firing system, with its concept design as product, the available technologies for burners are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and the finally presented in a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient conceptual design for the main firing system, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Air Heater System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of an air heater system. The high level stakeholder requirements are interpreted and applied to the air heater system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Air heater system concept design completed
Perform Air Heater System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of an air heater system. The high level stakeholder requirements are interpreted and applied to the air heater system with	* Air heater system concept design completed

	its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	
Perform Fan System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fan system. The high level stakeholder requirements are interpreted and applied to the fan system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Fan system concept design completed
Perform Milling System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a milling system. The high level stakeholder requirements are interpreted and applied to the milling system, with its concept design as product, the available technologies are investigated and selected, the system layout is typically described and finally presented in a design report.	* Milling system concept design completed
Perform Pressure Parts Concept Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the concept design of boiler plant pressure parts. The high level stakeholder requirements are interpreted and applied to the pressure parts, with its concept design as product and finally presented in a design report.	* Pressure parts concept design completed
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria,	* Main firing system concept design required

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	Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Perform Air Heater System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of an air heater system. The high level stakeholder requirements are interpreted and applied to the air heater system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised	* Main firing system concept design completed

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	analyses performed and then finally presented in a design report.	
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* Main firing system concept design completed
Perform Fan System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fan system. The high level stakeholder requirements are interpreted and applied to the fan system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Main firing system concept design completed

ACTIVITY FLOW: Perform Main Firing System Basic Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a main firing system.

Main firing system specific engineering calculations and evaluations are done, burner geometries are modelled or obtained from catalogues, materials characteristics are specified, the system layout is described, advanced engineering analyses, including CFD analysis, are performed to determine loads, flows, temperatures and pressures.

Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient design for the main firing system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design or as input into an internally developed detail design.

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KEY PERFORMANCE INDICATORS:
Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Product Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the process design for a specific product of a power plant. The operational requirements for the product are deduced from the stakeholder requirements, a thermal cycle analysis (with its resulting heat balance diagram) or boiler process design or alternative power plant process design and a process flow model is developed.	* Product process design completed
Perform Computational Fluid Dynamics (CFD) Analysis	This activity flow provides a mechanism for flow and heat transfer simulation. It could be applied to any phase of design, different design options, plant life extension, outage support and maintenance planning. The transfer (flow) problem is formulated for which a model is developed. The boundary conditions are defined and the solver algorithm for the model performed to obtain simulated flow results as outcome. The outcome is used to inform the designer, to be used in technology selection and to facilitate mechanical design.	* Computational fluid dynamics analysis completed
Perform Air Heater System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of an air heater system. System specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures, pressures	* Air heater system basic design completed

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	and more. Finally, a design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	
Perform Lighting Up System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a lighting up system. Lighting up system specific engineering calculations and evaluations are done, equipment geometries are obtained from catalogues, and the lighting up system layout is described. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Lighting up system basic design completed
Perform Milling System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a milling system. Milling system specific engineering calculations and evaluations are done, equipment geometries are obtained from catalogues, and the lighting up system layout is described, advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Milling system basic design completed
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards:	* Project design manual issued

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	Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks,	* Main firing system basic design complete

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	terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution design	* Main firing system basic design complete
Perform Duct System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a duct system. Duct system specific engineering calculations and evaluations are done, the duct system layout is described and duct system related engineering analyses are performed to determine loads, flows and temperatures. Finally, a product basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Main firing system basic design complete
Perform Fan System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a fan system. Fan system specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Main firing system basic design complete

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Perform Lighting Up System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a lighting up system. Lighting up system specific engineering calculations and evaluations are done, equipment geometries are obtained from catalogues, and the lighting up system layout is described. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Main firing system basic design complete
Perform Pressure Parts Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of boiler plant pressure parts. System specific engineering calculations and evaluations, that may include stress analysis, are done and drawings are developed. More often than not a Design-by-Rule (Design-by-Code) approach is followed instead of Design-by-Analysis. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report	* Main firing system basic design complete
Perform Pressure Parts Detail Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the detail design of boiler pressure parts where detailed design calculations are done and detail drawings are developed. The basic designs of the pressure parts are optimised as part of the process. Finally, a final design package is compiled containing manufacturing instructions.	* Main firing system basic design complete

ACTIVITY FLOW: Perform Main Firing System Detail Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the detail design of a main firing system where detailed design calculations are done and detail drawings are developed. The basic design of the main firing system is optimised as part of the process.

Finally, a final design package is compiled containing manufacturing Instructions.

PROCESS OBJECTIVE:
To ensure an adequate (complete), efficient design for the manufacturing, fabrication, construction and commissioning of the main firing system that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system.
KEY PERFORMANCE INDICATORS:
Cost variations

CONTROLLED DISCLOSURE
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Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Configure software tools	Potential integration identified, the relevant process will be captured at a later date.	* Main Firing System Detail Design Required (To Be Confirmed)
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including	* Project design manual issued

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	–Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution design	* Main firing system detail design completed
Perform Pressure Parts Detail Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the detail design of boiler pressure parts where detailed design calculations are done and detail drawings are developed. The basic designs of the pressure parts are optimised as part of the process. Finally, a final design package is compiled containing manufacturing instructions.	* Main firing system detail design completed

ACTIVITY FLOW: Perform Pressure Parts Concept Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the concept design of boiler plant pressure parts.

The high level stakeholder requirements are interpreted and applied to the pressure parts, with its concept design as product and finally presented in a design report.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient conceptual design for pressure parts, taking several design alternatives into consideration that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable

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standards as is requested by the stakeholders.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Boiler Cleaning Equipment Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of the boiler cleaning equipment. The high level stakeholder requirements are interpreted and applied to the boiler cleaning equipment with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Boiler cleaning equipment concept design completed
Perform Fan System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fan system. The high level stakeholder requirements are interpreted and applied to the fan system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Fan system concept design completed
Perform High Pressure Piping Concept Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the concept design of high pressure piping for a boiler plant. The high level stakeholder requirements are interpreted and applied to the system, with its concept design as product, piping routes are developed and then finally presented in a design report.	* High pressure piping concept design completed

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Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	* Project design manual issued

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OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* Pressure parts concept design completed
Perform Fan System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a fan system. The high level stakeholder requirements are interpreted and applied to the fan system with its concept design as product, the available technologies are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and then finally presented in a design report.	* Pressure parts concept design completed
Perform High Pressure Piping Concept Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the concept design of high pressure piping for a boiler plant. The high level stakeholder requirements are interpreted and applied to the system, with its concept design as product, piping routes are developed and then finally presented in a design report.	* Pressure parts concept design completed
Perform Main Firing System Concept Design	This activity flow applies specific engineering expertise, methodologies and tools to the concept design of a main firing system.	* Pressure parts concept design completed

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	The high level stakeholder requirements are interpreted and applied to the main firing system, with its concept design as product, the available technologies for burners are investigated and selected, the system layout is typically described, where necessary additional specialised analyses performed and the finally presented in a design report.	

ACTIVITY FLOW: Perform Pressure Parts Basic Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of boiler plant pressure parts.

System specific engineering calculations and evaluations, that may include stress analysis, are done and drawings are developed. More often than not a Design-by-Rule (Design-by-Code) approach is followed instead of Design-by-Analysis.

Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report

PROCESS OBJECTIVE:
To ensure an adequate (complete), efficient design for the pressure parts that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system and be as an input into the commercial acquisition for a detail design or as input into an internally developed detail design.

KEY PERFORMANCE INDICATORS:
Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Boiler Process Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the high-level process design of a complete boiler system. A mass and energy balance is performed and a boiler system process flow diagram is created during the execution of this capability.	* Boiler process design completed
Perform High Pressure Piping Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of boiler plant high pressure piping. System specific engineering calculations and evaluations, including a piping stress analysis, are done and drawings are developed.	* High pressure piping basic design report compiled

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	Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component	* Project design manual issued

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	Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Design Layout	This activity flow comprises of the activities for performing an integrated layout design that conforms to specific criteria and will result in an optimal constructible, operable and maintainable layout design. A layout design is performed to identify and resolve clashes and that adequate provisions are made for system maintenance, operational support, human factors, regulatory requirements and emergency access and prevent or mitigate identified hazards (fire hazard, environmental, process and other induced hazards). A site layout includes all earthworks, terracing, storm water, dams, sewerage, structures, electrical overhead and trenched reticulation, earth-mat, piping routes, roads, rail, conveyors, loading, unloading and storage facilities, buildings, fencing, raw material and waste holding areas and line profile as a topographical terrain model.	* Pressure parts basic design compiled
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution design	* Pressure parts basic design compiled
Perform Boiler Cleaning Equipment Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of the boiler cleaning equipment. Boiler cleaning equipment specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained	* Pressure parts basic design compiled

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	from catalogues, the system layout is described, advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	
Perform Duct System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a duct system. Duct system specific engineering calculations and evaluations are done, the duct system layout is described and duct system related engineering analyses are performed to determine loads, flows and temperatures. Finally, a product basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Pressure parts basic design compiled
Perform Fan System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a fan system. Fan system specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described and advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Pressure parts basic design compiled
Perform High Pressure Piping Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of boiler plant high pressure piping. System specific engineering calculations and evaluations, including a piping stress analysis, are done and drawings are developed. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Pressure parts basic design compiled

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Perform Main Firing System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a main firing system. Main firing system specific engineering calculations and evaluations are done, burner geometries are modelled or obtained from catalogues, materials characteristics are specified, the system layout is described, advanced engineering analyses, including CFD analysis, are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Pressure parts basic design compiled

ACTIVITY FLOW: Perform Pressure Parts Detail Design

This is the activity flow where specific engineering expertise, methodologies and tools are applied to the detail design of boiler pressure parts where detailed design calculations are done and detail drawings are developed. The basic designs of the pressure parts are optimised as part of the process.

Finally, a final design package is compiled containing manufacturing instructions.

PROCESS OBJECTIVE:

To ensure an adequate (complete), efficient design for the manufacturing, fabrication, construction and commissioning of the pressure parts that will meet the specific safety, compliance, legislative and design criteria and adhere to the applicable standards as is requested by the stakeholders for the specified system.

KEY PERFORMANCE INDICATORS:

Cost variations
Design Rating
Number of overdue actions
Number of technical reworks
Percentage compliance of technical requirements
Percentage design non conformance
Percentage design reviews failed

CONTROL SUMMARY
All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.
Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.

INCOMING PROCESS NAME	INCOMING PROCESS DESCRIPTION	TRIGGER EVENT
Perform Main Steam Turbine Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a main steam turbine. System specific engineering calculations and evaluations are done, equipment geometries are modelled or sketched, the system footprint is described and advanced engineering analyses are performed	* Pressure parts detail design required

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	to determine amongst others, loads, flows, temperatures, speeds and pressures. Finally, a design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a product basic design report.	
Perform Main Firing System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a main firing system. Main firing system specific engineering calculations and evaluations are done, burner geometries are modelled or obtained from catalogues, materials characteristics are specified, the system layout is described, advanced engineering analyses, including CFD analysis, are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Main firing system basic design complete
Perform Main Firing System Detail Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the detail design of a main firing system where detailed design calculations are done and detail drawings are developed. The basic design of the main firing system is optimised as part of the process. Finally, a final design package is compiled containing manufacturing Instructions.	* Main firing system detail design completed
Develop Project Design Manual	Develop the Project Design Manual (PDM) with input provided by engineering Disciplines. The PDM will identify the standard technical design aspects that must be followed by all engineering personnel involved in a project. The following typically applies as applicable per specific project namely: * A Project Description - Site-Specific Design Criteria: including an Engineering Project Overview, Scope of Facilities, Basic of Design, Design and performance criteria, Permits and Licenses, Site Investigations, Environment Design Criteria, Classification of hazardous areas, Soil Resistivity, Electrical Design Data, Temporary facilities, Fire	* Project design manual issued

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	Protection * Design Codes and Standards: Including- Codes and standards, Engineering Drawings and Data Content * Civil, Structural, and Architectural Design Criteria: including- Design loads, Architecture, Concrete, Steel structures, Site, Foundations, Space Conditioning; * Bulk Material Handling System Design Criteria: including-General, Belt Conveyors, Hoppers, Mass Meters, Dust Control, Gates, Chute work, Magnetic Separators, Instrumentation, Feeders; * Mechanical and Chemical Design Criteria: including –Piping, Components and Accessories, Valves, Insulation, Jacketing and Lagging, Bulk Chemical Storage, Freeze Protection, Hydrogen Piping-Blanketing Requirements; * Electrical Design Criteria: including –Electrical System and Voltage Levels, Electric Motors, DC/Battery System, Earthing, Lightning Protection, Lighting, Cabling and Racking, Power sources for Fire Pumps; * Controls and Instrument Design Criteria: including – Control Design Criteria, Control Hardware, Instruments and Final Control Devices, Plant Communication * Equipment Numbering and System Codes: including – Component Identification System; * General detail on document revisions, the document development team , acknowledgements and appendices	

OUTGOING PROCESS NAME	OUTGOING PROCESS DESCRIPTION	END EVENT
Integrate Design	This activity flow ensures functional coherence of the system and the consistency is verified across subsystem and component designs. This is achieved by taking into consideration actual subsystem design data to: * verify and integrate the subsystem process designs * verify system controllability and update control requirements * consolidate sizing, static and dynamic loading for civil and structural designs * integrate electrical distribution design	* Pressure parts detail design completed

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Perform Boiler Cleaning Equipment Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of the boiler cleaning equipment. Boiler cleaning equipment specific engineering calculations and evaluations are done, equipment geometries are modelled or obtained from catalogues, the system layout is described, advanced engineering analyses are performed to determine loads, flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Pressure parts detail design completed
Perform Boiler Cleaning Equipment Detail Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the detail design of the boiler cleaning equipment piping where detailed design calculations are done and detail drawings are developed. Finally, a final design pack is compiled containing manufacturing instructions.	* Pressure parts detail design completed
Perform Duct System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a duct system. Duct system specific engineering calculations and evaluations are done, the duct system layout is described and duct system related engineering analyses are performed to determine loads, flows and temperatures. Finally, a product basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a design report.	* Pressure parts detail design completed
Perform Feedwater System Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of a feedwater system. System specific engineering calculations and evaluations are done that are required to optimise the thermal performance and to produce a basic design for the feedwater system. Advanced engineering estimations/analyses are performed to determine amongst others, loads,	* Pressure parts detail design completed

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	flows, temperatures and pressures. Finally, a basic design pack, typically containing specifications, procedures and drawings, is compiled as a sub-set of a basic design report.	
Perform High Pressure Piping Detail Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the detail design of high pressure piping where detailed design calculations are done and detail drawings are developed. Finally, a final design pack is compiled containing manufacturing instructions.	* Pressure parts detail design completed
Perform Vessel Basic Design	This is the activity flow where specific engineering expertise, methodologies and tools are applied to the basic design of the different vessels applicable to a turbine plant. System specific engineering calculations and evaluations, that may include stress analysis used in the detailed sizing of vessels, are done. More often than not a Design-by-Rule (Design-by-Code) approach is followed instead of Design-by-Analysis for these calculations. Costing information is obtained after the vessels are sized and the operating conditions are described. Finally, a report is developed that typically contains design specifications for the different vessels.	* Pressure parts detail design completed

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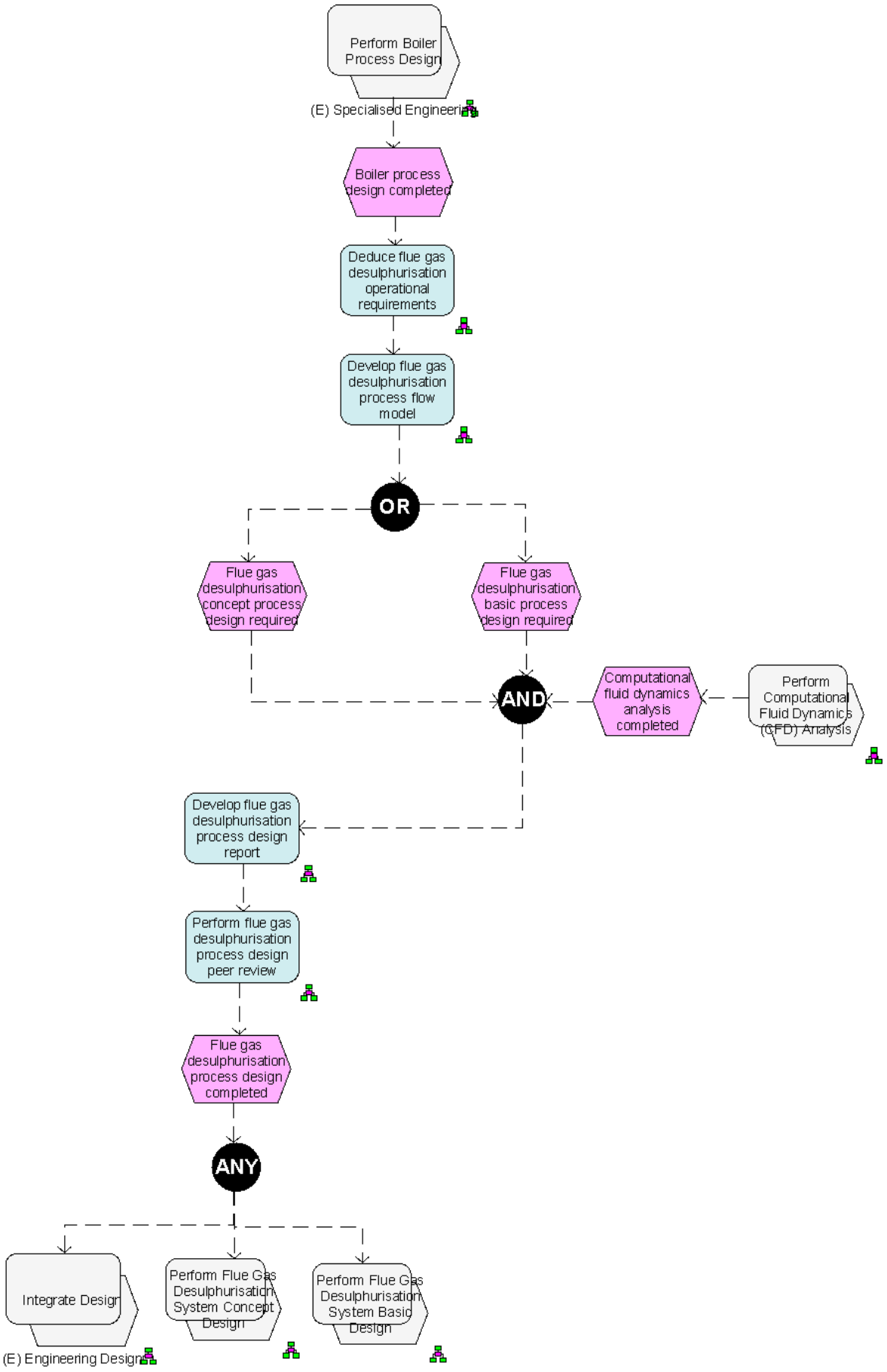
9.1.1 Perform Flue Gas Desulphurisation Process Design



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ACTIVITY: Deduce flue gas desulphurisation operational requirements

In this activity the stakeholder requirements are interpreted and applied to the flue gas desulphurisation system in order to determine the operational requirements for which a process should be developed.

The output of this activity is to produce a report typically containing the following:

* Mass and energy balance
* Flow rates
* Temperatures and pressures

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD Process Design Basis * Stakeholder Requirements Definition * System Requirements	* Operational Requirements Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop flue gas desulphurisation process flow model

This activity includes the engineering specific calculations in order to design the process for the desulphurisation of flue gas to be used in different design phases with the relevant diagrams and reports as outputs.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Mass and Energy Balance Template * P&ID Template * Process Flow Diagram Guideline * Process Flow Report Template * Transient Balance Report Template * FGD Process Data Report * Operational Requirements Report * Product Process Requirement Sheet * Project Design Manual	* FGD Process Flow Diagram * FGD Process Flow Model * Mass and Energy Balance * P&ID * Transient Balance Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
Flownex	
P&ID Software	
Process Calculation Sheets (Excel)	
Process Modelling Tool (TBA)	
Transient Modelling Tool (TBD)	

ACTIVITY: Develop flue gas desulphurisation process design report

The foregoing design related activities for FGD are summarized and explained in a process design report.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)

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* Process Flow Report Template * CFD Report * FGD Process Flow Diagram * FGD Process Flow Model * Mass and Energy Balance * P&ID * Transient Balance Report	* FGD Process Flow Diagram * FGD Process Flow Report * Mass and Energy Balance * P&ID

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	* Lead Discipline Engineering Practitioner (Business Role)	None

ACTIVITY: Perform flue gas desulphurisation process design peer review

This activity is concerned with the completeness and quality of the result of the design or analyses.
It involves having peers review the resulting engineering outputs.
It specifically has to:
* Ensure that the complete requirement has been addressed
* Ensure that the relevant standards and statutory requirements have been met
* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD Process Flow Diagram * FGD Process Flow Report * Mass and Energy Balance * P&ID	* FGD Process Flow Diagram * FGD Process Flow Report * Mass and Energy Balance * P&ID * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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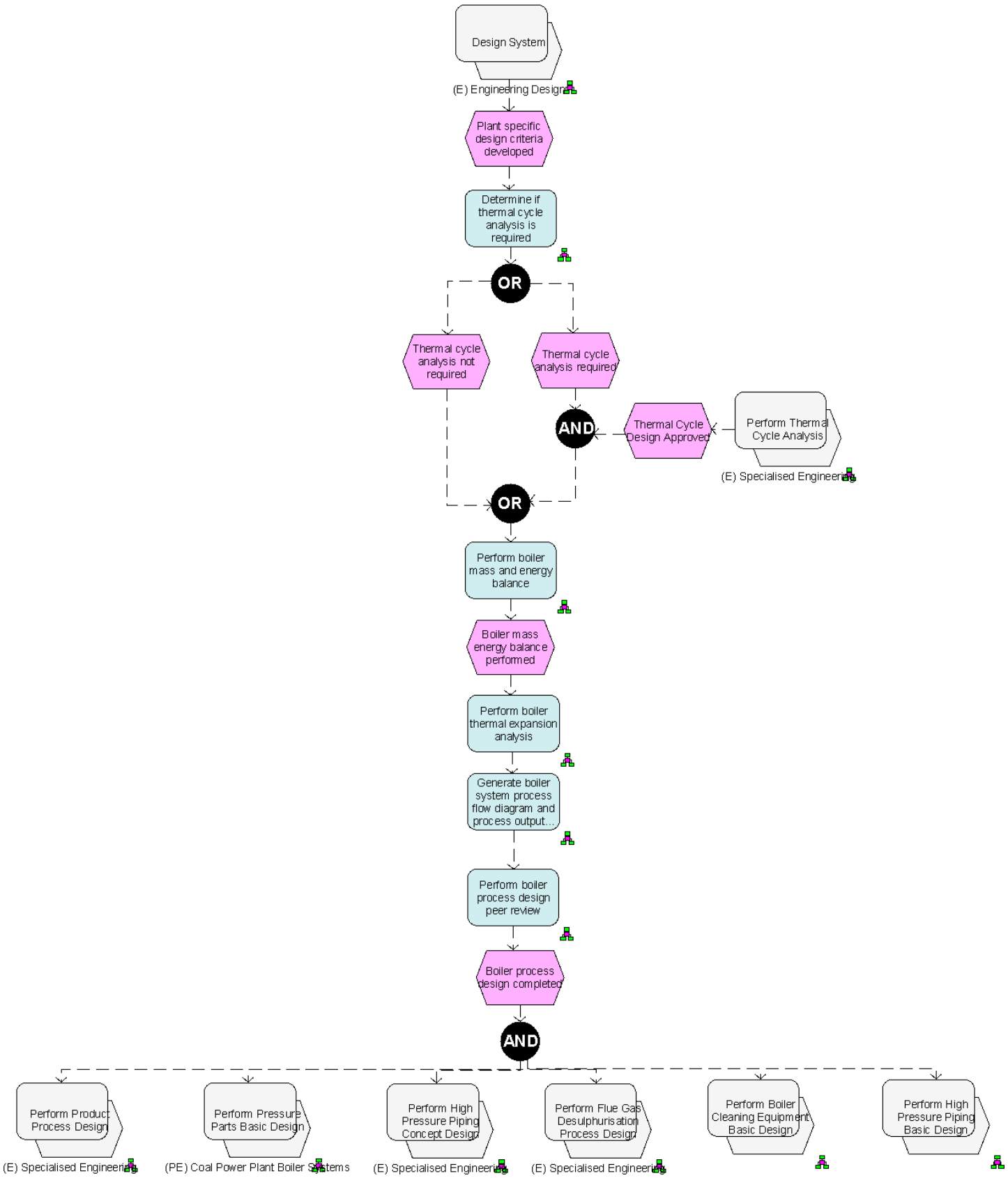
9.1.2 Perform Boiler Process Design



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ACTIVITY: Determine if thermal cycle analysis is required

Determine if a thermal cycle analysis is applicable or not. This is determined by both the intent of the design and whether it is a design for new built or a retrofit.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Project Design Manual * Stakeholder Requirements Definition * System Requirements	* Design Requirements Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Perform boiler mass and energy balance

The mass and energy balance over the boiler is calculated in this activity using licensed software applications and other calculation sheets.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-XXX: Boiler MEB Manual (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler System MEB Template * Design Requirements Report	* Boiler Efficiency Report * Boiler MEB Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Boiler MEB Software Tool	

ACTIVITY: Perform boiler thermal expansion analysis

A thermal expansions model is developed to calculate the resulting stresses, strains and displacements induced by the heating and cooling cycles.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Efficiency Report * Boiler MEB Report	* Boiler thermal expansion model

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Generate boiler system process flow diagram and process output sheet

The sizing for the boiler, burner, mill and draught group is done and a flow diagram connecting all the systems is generated. An output sheet is also produced containing process data to be used in the boiler sub-system designs.

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INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Process flow diagram template * Boiler Efficiency Report * Boiler MEB Report * Boiler thermal expansion model	* Boiler Process Output Sheet * Boiler System Process Flow Diagram

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	* Lead Discipline Engineering Practitioner (Business Role)

APPLICATIONS	SCREENS
DimBo	

ACTIVITY: Perform boiler process design peer review

This activity is concerned with the completeness and quality of the result of the design.
It involves having peers review the resulting engineering outputs.
It specifically has to:
* Ensure that the complete requirement has been addressed
* Ensure that the relevant standards and statutory requirements have been met
* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Process Output Sheet * Boiler System Process Flow Diagram * P&ID	* Boiler Process Output Sheet * Boiler System Process Flow Diagram * P&ID * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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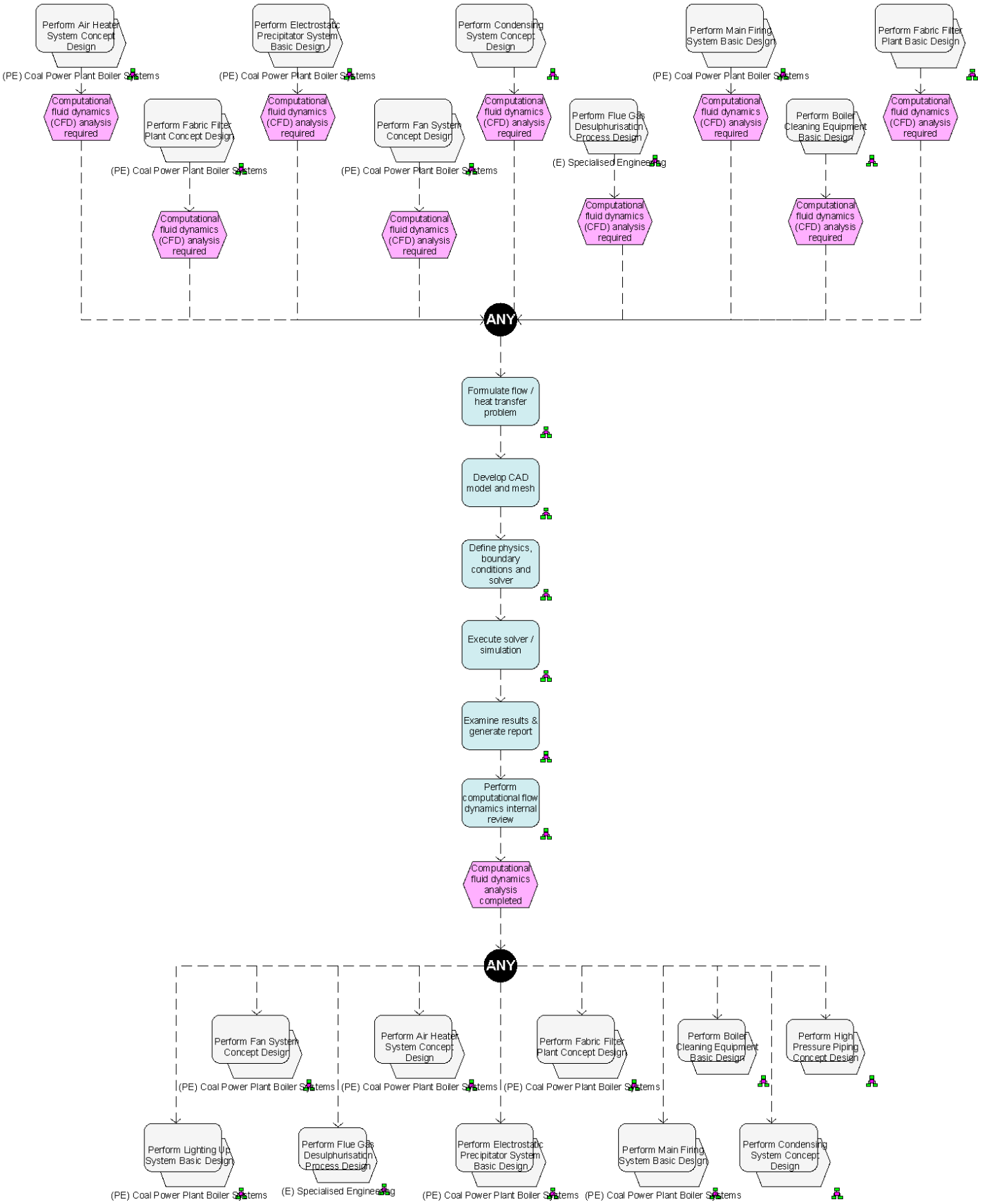
9.1.3 Perform Computational Fluid Dynamics (CFD) Analysis



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ACTIVITY: Formulate flow / heat transfer problem

A flow problem is formulated by the identification and clarification of the objectives and deliverables. The purpose of this activity is to establish the customer requirements / engineering problem and determine if CFD is the appropriate tool to be used and possible outputs that may be delivered by using this tool.

Based on the engineering problem the following has to be done:

* Define the Analysis Objective – each model is built for a specific purpose.
* Define the deliverables possible with CFD analyses
* Decide on the approach, domain (spatial and temporal) and appropriate physics to be applied.
* CFD analyses are based on numerous assumptions that needs to be discussed with the stakeholder.

Note: This is a generic guideline of process for a multi-discipline tool with multiple applications. A very brief description of CFD is a finite volume tool used to solve component level flow phenomena, heat transfer and specie conservation.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Engineering problem definition * Project Design Manual * Stakeholder Requirement Specification	* CFD Analyses Scope Of Work (SOW)

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop CAD model and mesh

A CAD model and mesh are developed by executing the following activities:

* Build a 3D CAD model inclusive of required regions (solids and or fluids)with relevant detail.
* Define connectivity, interfaces and decompose geometry into manageable chunks.
* Export from CAD tools to CFD tool.
* Build the numeric mesh to be used with the CFD tool

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Process Output Sheet * CFD Analyses Scope Of Work (SOW) * Detailed Drawings * P&ID * Point Data (DimBo, FlowNex, EtaPRO, Test Data)	* CFD Grid

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
Computational Fluid Dynamics Software	

ACTIVITY: Define physics, boundary conditions and solver

In this activity the physics, boundary conditions and solver settings, and monitor locations/local reports are defined. This is achieved by executing the following tasks:

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* Define and describe the applicable physics. This essentially is input into the CFD tool to define what needs to be solved, for example continuity, momentum, energy, turbulence, radiation, etc. This is based on the nature of the solution required.
* Define the flow domain boundaries. Typically the plant data (P&IDs, C schedules, etc.) are used to define conditions such as inlet and outlet boundaries within the CFD tool. Typical data required will include information such as pressure, temperature, mass flow rates, etc.
* Depending on the analyses and approach further details may be required. For example boiler tube dimensions and spacing, pressure drop/heat transfer across bundles etc.
* Define the solver settings. The purpose of this activity is to define the discretization to be performed by the CFD tool and specify the solution criteria.
* Depending on the objectives of the analyses, certain parameters may require monitoring/reporting, these need to be defined within the CFD tool.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Process Output Sheet * CFD Analyses Scope Of Work (SOW) * CFD Grid * P&ID * Plant C Schedules * Point Data (DimBo, FlowNex, EtaPRO, Test Data)	* CFD Model with case definition

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Execute solver / simulation

Once the model has been defined, the solver needs to be executed. This activity may comprise numerous tasks based on the complexity of the solution.

* The hardware to be used and the number of computational nodes needs to be defined.
* User coding if applicable may need to be compiled for computational hardware.
* Depending on the physics applied the solution may require a staged approach to introduce the solver.
* The converged solution created contains a CFD model with solution data file/s.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* CFD Model with case definition	* Converged Solution

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Examine results & generate report

In this activity the results are examined, decisions are made regarding performing sensitivity analyses and/or generate the outputs required. Sensitivity analyses may include testing physics or refinement of the numeric mesh. Once a solution is obtained the results need to be examined for convergence and stability.

A decision is made on the solution and if required the initial case becomes the base case to test sensitivity to input or comparison to a change in parameter/design or used for purposes of validation & verification.

Repetitive unknown quantities/physics may be nominated for future research topics.

On obtaining a suitable solution outputs are generated and the CFD process is concluded.

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The process described if for CFD analyses only, this tool may be coupled with multi physics tools such as finite element analyses (FEA) tools, electrical magnetic field tools etc.

A CFD Report containing flow video output, topology graphics and monitor data (if required) is produced.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Converged Solution	* CFD Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Perform computational flow dynamics internal review

This activity is concerned with the accuracy and applicability of the analyses to the relevant case.

It involves reviewing the resulting outputs of the analysis by the CFD specialist and the applicable design and/or consulting engineers.

It specifically has to:
* Ensure that the complete requirements has been addressed
* Ensure that the relevant standards and statutory requirements have been met
* Ensure that the analysis is valid and accurate

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* CFD Model with case definition * CFD Report	* CFD Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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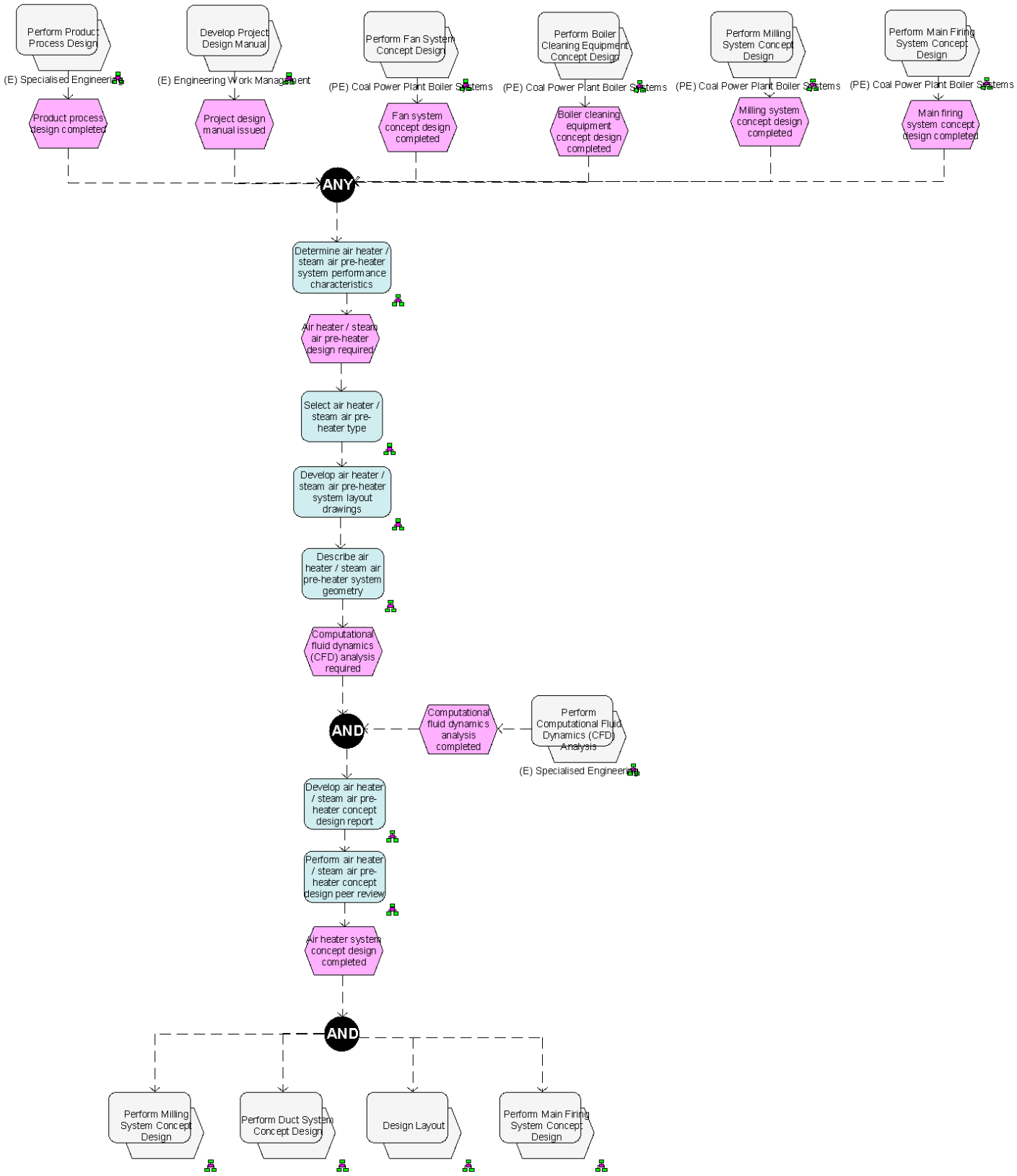
9.1.4 Perform Air Heater System Concept Design



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ACTIVITY: Determine air heater / steam air pre-heater system performance characteristics

The air heater / steam air pre-heater performance characteristics are determined from the boiler process design, project design information and the product process flow. Typically the following is required:

* Coal and ash composition
* Air and gas temperatures
* Air and gas pressures
* Air and gas volume flow rates
* Required steam volume, pressure- and temperature for steam air pre-heaters

The output of this activity is the air heater / steam air pre-heater system performance characteristics containing the following information for different boiler conditions:

* Air and gas mass flows
* Air and gas temperatures
* Air and gas pressures
* Required steam volume, pressure and temperature for steam air pre-heaters

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Process Output Sheet * Product Process Flow Diagram * Product Process Flow Report * Project Design Manual * Stakeholder Requirements Definition	* Air Heater / Steam Air Pre-Heater Performance Characteristics Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Select air heater / steam air pre-heater type

In this activity engineering evaluations based on the stakeholder requirements are made in order to select from a catalogue and specify the air heater / steam air pre-heater type.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Air Heater / Steam Air Pre-Heater Performance Characteristics Report	* Air Heater / Steam Air Pre-Heater Selection Report * Air Heater / Steam Air Pre-Heater Specification

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Air Heater Calculation Sheet (Excel)	

ACTIVITY: Develop air heater / steam air pre-heater system layout drawings

In this activity the air heater / steam air pre-heater layout drawings are developed.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Air Heater / Steam Air Pre-Heater Selection Report * Air Heater / Steam Air Pre-Heater Specification	* System & Layout Drawings

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Air Heater Calculation Sheet (Excel)	
CAD	

ACTIVITY: Describe air heater / steam air pre-heater system geometry

This activity describes the total plant layout in three dimensions of an air heater and steam air pre-heater system in relation to other systems.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Air Heater / Steam Air Pre-Heater Equipment Drawings * Air Heater / Steam Air Pre-Heater Performance Characteristics Report * System & Layout Drawings	* General Arrangement Drawings * P&ID

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Develop air heater / steam air pre-heater concept design report

This activity will consolidate all design activities carried out during the concept design within a single design report, with a concise delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level concept design report.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* System Design Report (TBD) * Air Heater / Steam Air Pre-Heater Selection Report * Air Heater / Steam Air Pre-Heater Specification * General Arrangement Drawings * P&ID	* Product Concept Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Air Heater Calculation Sheet (Excel)	

ACTIVITY: Perform air heater / steam air pre-heater concept design peer review

This activity is concerned with the completeness and quality of the result of the design.
It involves having peers review the resulting engineering outputs.

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When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

It specifically has to:
* Ensure that the complete requirement has been addressed
* Ensure that the relevant standards and statutory requirements have been met
* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report	* Product Concept Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

CONTROLLED DISCLOSURE
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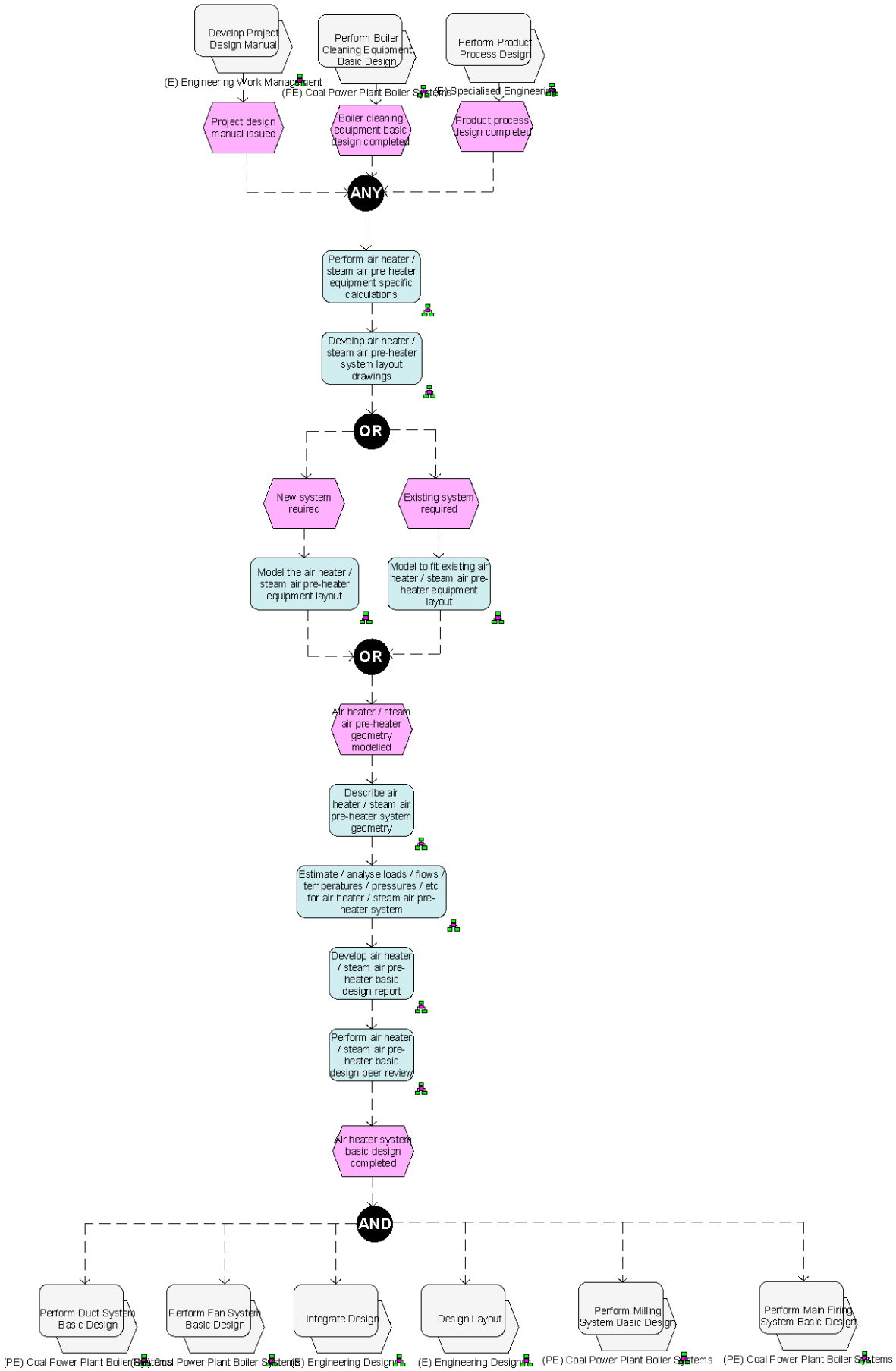
9.1.5 Perform Air Heater System Basic Design



CONTROLLED DISCLOSURE

When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

ACTIVITY: Perform air heater / steam air pre-heater equipment specific calculations

This activity describes the equipment engineering specific calculations required for the air heaters / steam air pre-heater system basic design.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report * Stakeholder Requirements Definition	* Air Heater / Steam Air Pre-Heater System Description

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Air Heater / Steam Air Pre-Heater Calculation Tool (Excel)	

ACTIVITY: Develop air heater / steam air pre-heater system layout drawings

In this activity the air heater / steam air pre-heater layout drawings are developed.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Air Heater / Steam Air Pre-Heater Selection Report * Air Heater / Steam Air Pre-Heater Specification	* System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Air Heater Calculation Sheet (Excel)	
CAD	

ACTIVITY: Model the air heater / steam air pre-heater equipment layout

This activity uses the description resulting from the engineering calculations and the system layout drawings to develop a geometric model of the air heater / steam air pre-heater equipment from basic principles.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Air Heater / Steam Air Pre-Heater System Description * Civil Calculations * Civil Drawings * System & Layout Drawings	* Air Heater / Steam Air Pre-Heater Equipment Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS

CONTROLLED DISCLOSURE
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CAD	

ACTIVITY: Model to fit existing air heater / steam air pre-heater equipment layout

This activity uses the description resulting from the engineering calculations and the system layout drawings to develop a geometric model of the air heater / steam air pre-heater system equipment from basic principles, taking the existing plant into consideration.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Air Heater / Steam Air Pre-Heater Equipment Drawings * Air Heater / Steam Air Pre-Heater System Description * Civil Calculations * Civil Drawings * System & Layout Drawings	* Air Heater / Steam Air Pre-Heater Equipment Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Describe air heater / steam air pre-heater system geometry

This activity describes the total plant layout in three dimensions of an air heater and steam air pre-heater system in relation to other systems.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Air Heater / Steam Air Pre-Heater Equipment Drawings * Air Heater / Steam Air Pre-Heater Performance Characteristics Report * System & Layout Drawings	* General Arrangement Drawings * P&ID

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Estimate / analyse loads / flows / temperatures / pressures / etc for air heater / steam air pre-heater system

This activity represents all the engineering technical calculations and evaluations executed during the basic design of an air heater / steam air pre-heater system.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
GGR 0568: PFFR
NPMZ 45-392: Fire Protection Manual

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Air Heater / Steam Air Pre-Heater System Description * General Arrangement Drawings * P&ID * System & Layout Drawings	* Air Heater / Steam Air Pre-Heater Analysis Report

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RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Air Heater Calculation Sheet (Excel)	

ACTIVITY: Develop air heater / steam air pre-heater basic design report

This activity will consolidate all design activities carried out during the basic design within a single design report, with a detailed delineation of the process-,
functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level basic design report.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Basic design report template * Air Heater / Steam Air Pre-Heater Analysis Report * Air Heater / Steam Air Pre-Heater Equipment Drawings * Air Heater / Steam Air Pre-Heater System Description * General Arrangement Drawings * P&ID * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report * System & Layout Drawings	* P&ID * Product Basic Design Pack * Product Basic Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Air Heater Calculation Tool (Excel)	
CAD	

ACTIVITY: Perform air heater / steam air pre-heater basic design peer review

This activity is concerned with the completeness and quality of the result of the design.
It involves having peers review the resulting engineering outputs.
It specifically has to:
* Ensure that the complete requirement has been addressed
* Ensure that the relevant standards and statutory requirements have been met
* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* P&ID * Product Basic Design Pack * Product Basic Design Report	* P&ID * Product Basic Design Pack * Product Basic Design Report * Record of Decision

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When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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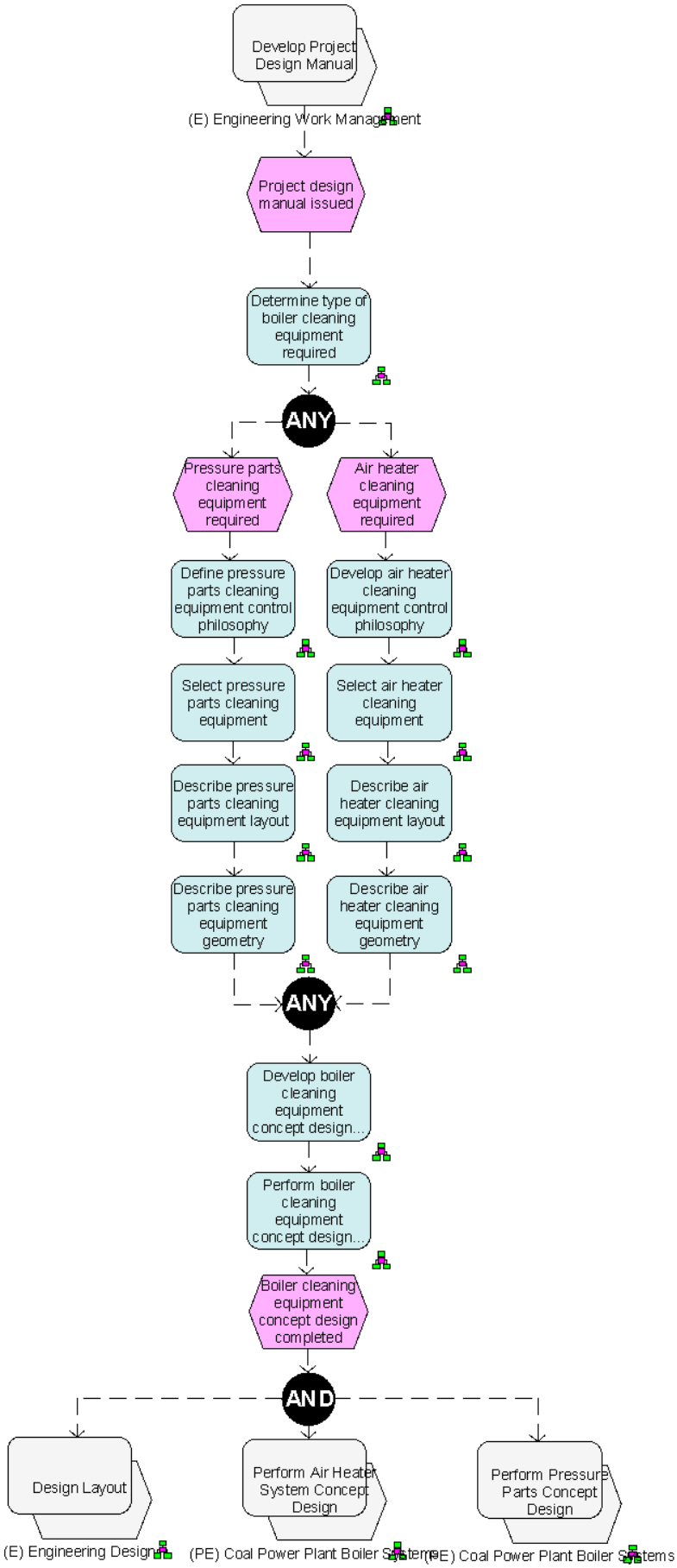
9.1.6 Perform Boiler Cleaning Equipment Concept Design



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ACTIVITY: Determine type of boiler cleaning equipment required

The type of boiler cleaning equipment is determined based on the product process design that in turn resulted from an interpretation and application for the stakeholder requirements for boiler cleaning equipment.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Process Flow Diagram * Product Process Flow Report * Project Design Manual * Stakeholder Requirements Definition	* Boiler cleaning equipment type report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Define pressure parts cleaning equipment control philosophy

In this activity the control philosophy to satisfy the pressure parts cleaning equipment operation requirements and the definition of the control strategies to be implemented that is used to control the process, unit supervision, and safety protection, is defined.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler cleaning equipment type report * Pressure parts cleaning equipment control philosophy	* Pressure parts cleaning equipment control philosophy

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Boiler cleaning equipment calculation Sheet	

ACTIVITY: Select pressure parts cleaning equipment

In this activity the furnace cleaning equipment, the superheater and reheater cleaning equipment and the economiser cleaning equipment is selected from a suppliers catalogue.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler cleaning equipment type report * Pressure parts cleaning equipment catalogue * Pressure parts cleaning equipment control philosophy * Pressure parts cleaning equipment selection report	* Pressure parts cleaning equipment selection report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Describe pressure parts cleaning equipment layout

In this activity the layout of the furnace cleaning equipment, the superheater and reheater cleaning equipment and the economiser cleaning equipment is described.

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Pressure parts cleaning equipment selection report * System & Layout Drawings	* System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Describe pressure parts cleaning equipment geometry

This activity describes the layout of the furnace cleaning equipment, the superheater and reheater cleaning equipment and the economiser cleaning equipment in relation to other systems.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawings * System & Layout Drawings	* General Arrangement Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Develop air heater cleaning equipment control philosophy

In this activity the control philosophy to satisfy the air heater cleaning equipment operation requirements and the definition of the control strategies to be implemented that is used to control the process, unit supervision, and safety protection, is defined.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Air heater cleaning equipment control philosophy * Boiler cleaning equipment type report	* Air heater cleaning equipment control philosophy

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Boiler cleaning equipment calculation Sheet	

ACTIVITY: Select air heater cleaning equipment

In this activity the air heater cleaning equipment (sootblower) is selected from a suppliers catalogue.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

* Air heater cleaning equipment catalogue * Air heater cleaning equipment control philosophy * Air heater cleaning equipment selection report * Boiler cleaning equipment type report	* Air heater cleaning equipment selection report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Describe air heater cleaning equipment layout

In this activity the layout of the air heater cleaning equipment (sootblower) is described.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Air heater cleaning equipment selection report * System & Layout Drawings	* System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Develop boiler cleaning equipment concept design report

This activity will consolidate all design activities carried out during the concept design within a single design report, with a concise delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level concept design report.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* System Design Report (TBD) * Air heater cleaning equipment control philosophy * Air heater cleaning equipment selection report * General Arrangement Drawings * Pressure parts cleaning equipment control philosophy * Pressure parts cleaning equipment selection report * System & Layout Drawings	* Product Concept Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Describe air heater cleaning equipment geometry

This activity describes the layout of the sootblower in relation to other systems.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawings * System & Layout Drawings	* General Arrangement Drawings

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Perform boiler cleaning equipment concept design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report	* Product Concept Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

CONTROLLED DISCLOSURE
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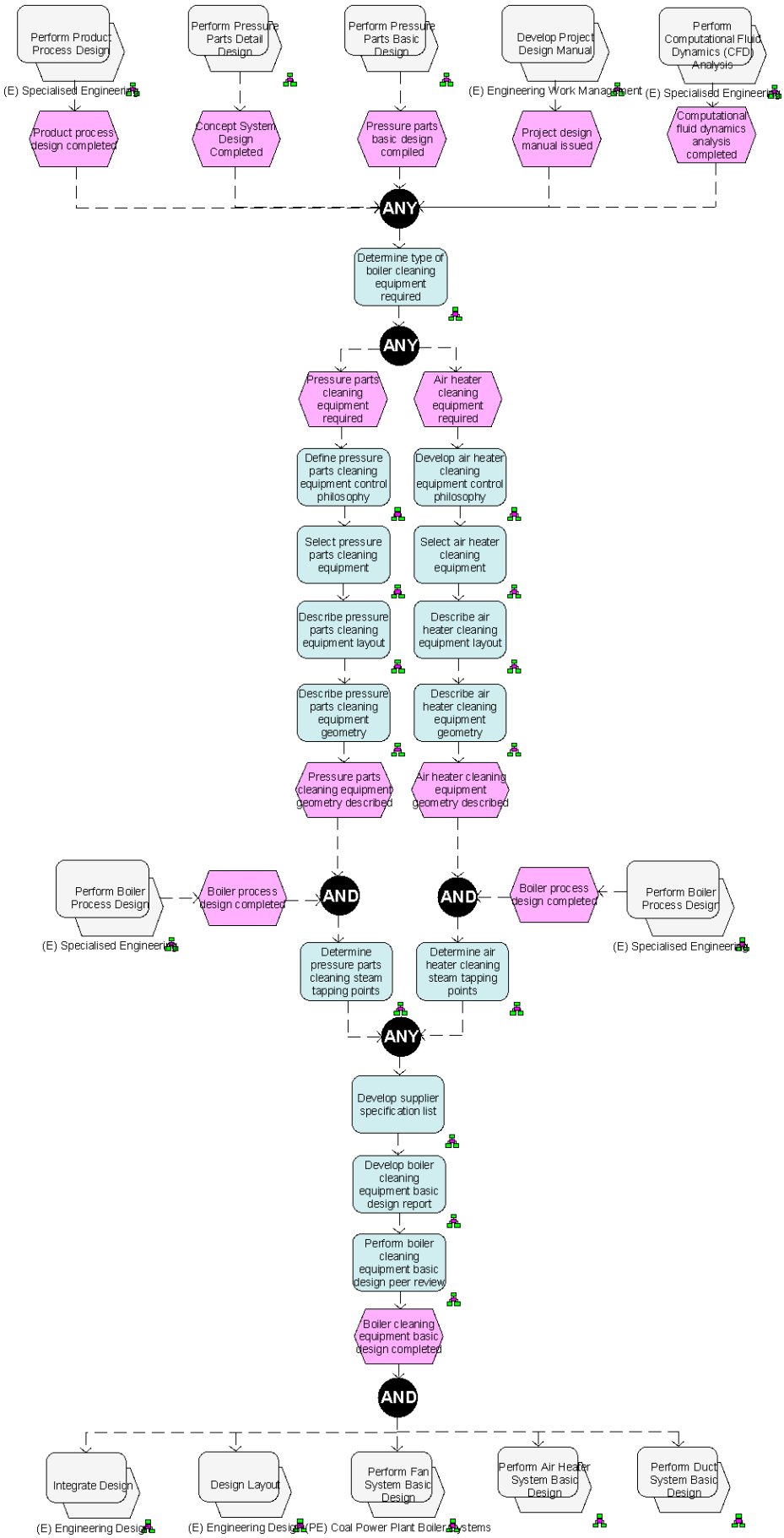
9.1.7 Perform Boiler Cleaning Equipment Basic Design



CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

ACTIVITY: Determine type of boiler cleaning equipment required

The type of boiler cleaning equipment is determined based on the product process design that in turn resulted from an interpretation and application for the stakeholder requirements for boiler cleaning equipment.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Process Flow Diagram * Product Process Flow Report * Project Design Manual * Stakeholder Requirements Definition	* Boiler cleaning equipment type report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Define pressure parts cleaning equipment control philosophy

In this activity the control philosophy to satisfy the pressure parts cleaning equipment operation requirements and the definition of the control strategies to be implemented that is used to control the process, unit supervision, and safety protection, is defined.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler cleaning equipment type report * Pressure parts cleaning equipment control philosophy	* Pressure parts cleaning equipment control philosophy

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Boiler cleaning equipment calculation Sheet	

ACTIVITY: Select pressure parts cleaning equipment

In this activity the furnace cleaning equipment, the superheater and reheater cleaning equipment and the economiser cleaning equipment is selected from a suppliers catalogue.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler cleaning equipment type report * Pressure parts cleaning equipment catalogue * Pressure parts cleaning equipment control philosophy * Pressure parts cleaning equipment selection report	* Pressure parts cleaning equipment selection report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Describe pressure parts cleaning equipment layout

In this activity the layout of the furnace cleaning equipment, the superheater and reheater cleaning equipment and the economiser cleaning equipment is described.

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Pressure parts cleaning equipment selection report * System & Layout Drawings	* System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Describe pressure parts cleaning equipment geometry

This activity describes the layout of the furnace cleaning equipment, the superheater and reheater cleaning equipment and the economiser cleaning equipment in relation to other systems.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawings * System & Layout Drawings	* General Arrangement Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Develop air heater cleaning equipment control philosophy

In this activity the control philosophy to satisfy the air heater cleaning equipment operation requirements and the definition of the control strategies to be implemented that is used to control the process, unit supervision, and safety protection, is defined.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Air heater cleaning equipment control philosophy * Boiler cleaning equipment type report	* Air heater cleaning equipment control philosophy

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Boiler cleaning equipment calculation Sheet	

ACTIVITY: Select air heater cleaning equipment

In this activity the air heater cleaning equipment (sootblower) is selected from a suppliers catalogue.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

* Air heater cleaning equipment catalogue * Air heater cleaning equipment control philosophy * Air heater cleaning equipment selection report * Boiler cleaning equipment type report	* Air heater cleaning equipment selection report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Describe air heater cleaning equipment layout

In this activity the layout of the air heater cleaning equipment (sootblower) is described.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Air heater cleaning equipment selection report * System & Layout Drawings	* System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Describe air heater cleaning equipment geometry

This activity describes the layout of the sootblower in relation to other systems.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawings * System & Layout Drawings	* General Arrangement Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Determine pressure parts cleaning steam tapping points

The furnace cleaning equipment, the superheater and reheater cleaning equipment and the economiser cleaning equipment steam supply needs to be tapped from various heaters depending on the location of the cleaning equipment. The exact headers need to be identified and the calculations for the stub design is to be carried out. The headers that are identified must be in conformance of the relevant standards. The thermal model that was developed as part of the boiler process design is used to aid in determining the locations of the tapping points.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
Pressure Parts Specification (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Process Output Sheet	* General Arrangement Drawings

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

* Boiler System Process Flow Diagram * General Arrangement Drawings * Product Concept Design Report	

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Determine air heater cleaning steam tapping points

The sootblower steam supply needs to be tapped from various heaters depending on the location of the cleaning equipment. The exact headers need to be identified and the calculations for the stub design is to be carried out. The headers that are identified must be in conformance of the relevant standards. The thermal model that was developed as part of the boiler process design is used to aid in determining the locations of the tapping points.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
Pressure Parts Specification (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Process Output Sheet * Boiler System Process Flow Diagram * General Arrangement Drawings * Product Concept Design Report	* General Arrangement Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Develop supplier specification list

A specification document needs to be generated for the supplier(s) of boiler cleaning equipment. The following needs to be added to the specification:

* Design pressure
* Design temperatures
* All codes and standards
* Electrical and C&I requirements (found in control philosophy)
* Boiler thermal model

This will enable the suppliers(s) to design the boiler cleaning equipment and to determine steam flow rate (required to size the piping).

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Air heater cleaning equipment control philosophy * Air heater cleaning equipment selection report * Boiler Process Output Sheet * Boiler System Process Flow Diagram * General Arrangement Drawings * Pressure parts cleaning equipment control philosophy	* Boiler cleaning equipment supplier specification list

CONTROLLED DISCLOSURE
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* Pressure parts cleaning equipment selection report * Product Concept Design Report	

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop boiler cleaning equipment basic design report

This activity will consolidate all design activities carried out during the basic design within a single design report, with a detailed delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level basic design report.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures
NPMZ 45-392: Fire Protection Manual

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Basic design report template * Air heater cleaning equipment control philosophy * Air heater cleaning equipment selection report * Boiler cleaning equipment supplier specification list * Boiler Process Output Sheet * Boiler System Process Flow Diagram * General Arrangement Drawings * Pressure parts cleaning equipment control philosophy * Pressure parts cleaning equipment selection report * Product Concept Design Report	* P&ID * Product Basic Design Pack * Product Basic Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Perform boiler cleaning equipment basic design peer review

This activity is concerned with the completeness and quality of the result of the design.
It involves having peers review the resulting engineering outputs.
It specifically has to:

* Ensure that the complete requirement has been addressed
* Ensure that the relevant standards and statutory requirements have been met
* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* P&ID * Product Basic Design Pack * Product Basic Design Report	* P&ID * Product Basic Design Pack * Product Basic Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline	* CoE Manager (Business	None	None

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Engineering Practitioner (Business Role)	Role)		

CONTROLLED DISCLOSURE
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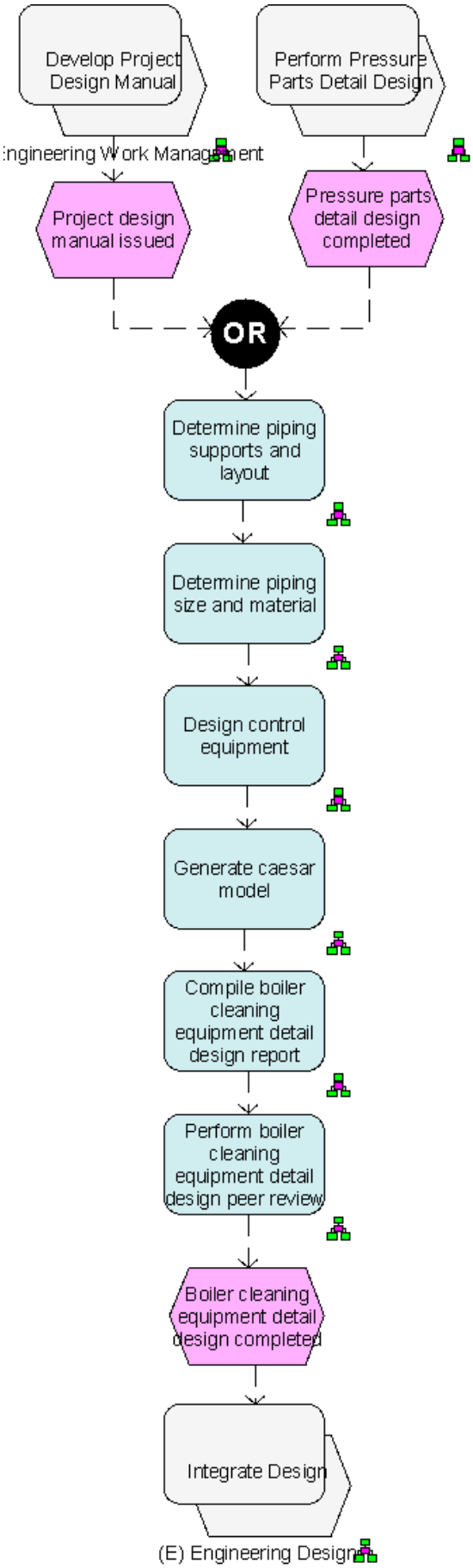
9.1.8 Perform Boiler Cleaning Equipment Detail Design



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ACTIVITY: Determine piping supports and layout

The steam supply piping layout for the boiler cleaning equipment needs to be determined. The piping route must not clash with any floors or platforms as well as cater for all valves and tapping points that will be installed on the line.

Piping supports also need to be calculated. Calculations need to be done to ensure that the floor or platform is adequately able to support the steam supply piping of the boiler cleaning equipment. Once the routing has been decided, the system can be modelled to verify the stresses and supports.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Civils Report * General Arrangement Drawings * P&ID * Product Basic Design Pack * Product Basic Design Report	* General Arrangement Drawings * Piping Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAESAR II	
Flownex	

ACTIVITY: Determine piping size and material

Once the routing of the piping is determined, the piping size and type of material needs to be selected based on the following:

- Design pressure and temperature
- Required flow rate (this is determined by the supplier of the boiler cleaning equipment)
- Design life
- Fatigue calculations
- Availability

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawings * Piping Analysis Report	* List of Materials * Piping Sizing

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAESAR II	
Flownex	

ACTIVITY: Design control equipment

The following items needs to be designed based on the piping arrangement and the list of materials:

* Steam supply stub
* Pressure and temperature tapping points
* Flow orifice

CONTROLLED DISCLOSURE
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After the above is designed the various loads of different components needs to be calculated such as:

* Valves
* Orifices
* Lagging
* Cladding
* Actuators

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawings * List of Materials * Piping Analysis Report	* Control Equipment Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAESAR II	
Flownex	

ACTIVITY: Generate caesar model

Using the control equipment design report, the list of materials and the routing of the piping, the system can be modelled to verify the following:

· Verify displacements, loads and stresses and terminal points (which must be within suppliers specifications, thus interfacing is required)
· Verify displacements, loads and stress of the entire piping system in accordance with code
· Verify that the slope is within code requirements in both hot and cold conditions
· Optimise piping design

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Control Equipment Design Report * General Arrangement Drawings * List of Materials * Piping Analysis Report	* Detailed Pipe and Welding Drawings * Equipment List * Hanger Schedule * Routing and Support Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAESAR II	
Flownex	

ACTIVITY: Compile boiler cleaning equipment detail design report

This activity will consolidate all design activities carried out during the detail design within a single design report, with a detailed delineation of the process-, functional- and layout design as well as equipment- and three dimensional drawings. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as the manufacturing manual.

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INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Control Equipment Design Report * Detailed Pipe and Welding Drawings * Equipment List * General Arrangement Drawings * Hanger Schedule * List of Materials * Piping Analysis Report * Routing and Support Drawings	* Detail design package * Product Detail Design Manual

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Perform boiler cleaning equipment detail design peer review

This activity is concerned with the completeness and quality of the result of the design.
It involves having peers review the resulting engineering outputs.
It specifically has to:
* Ensure that the complete requirement has been addressed
* Ensure that the relevant standards and statutory requirements have been met
* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Detail design package * Product Detail Design Manual	* Detail design package * Product Detail Design Manual * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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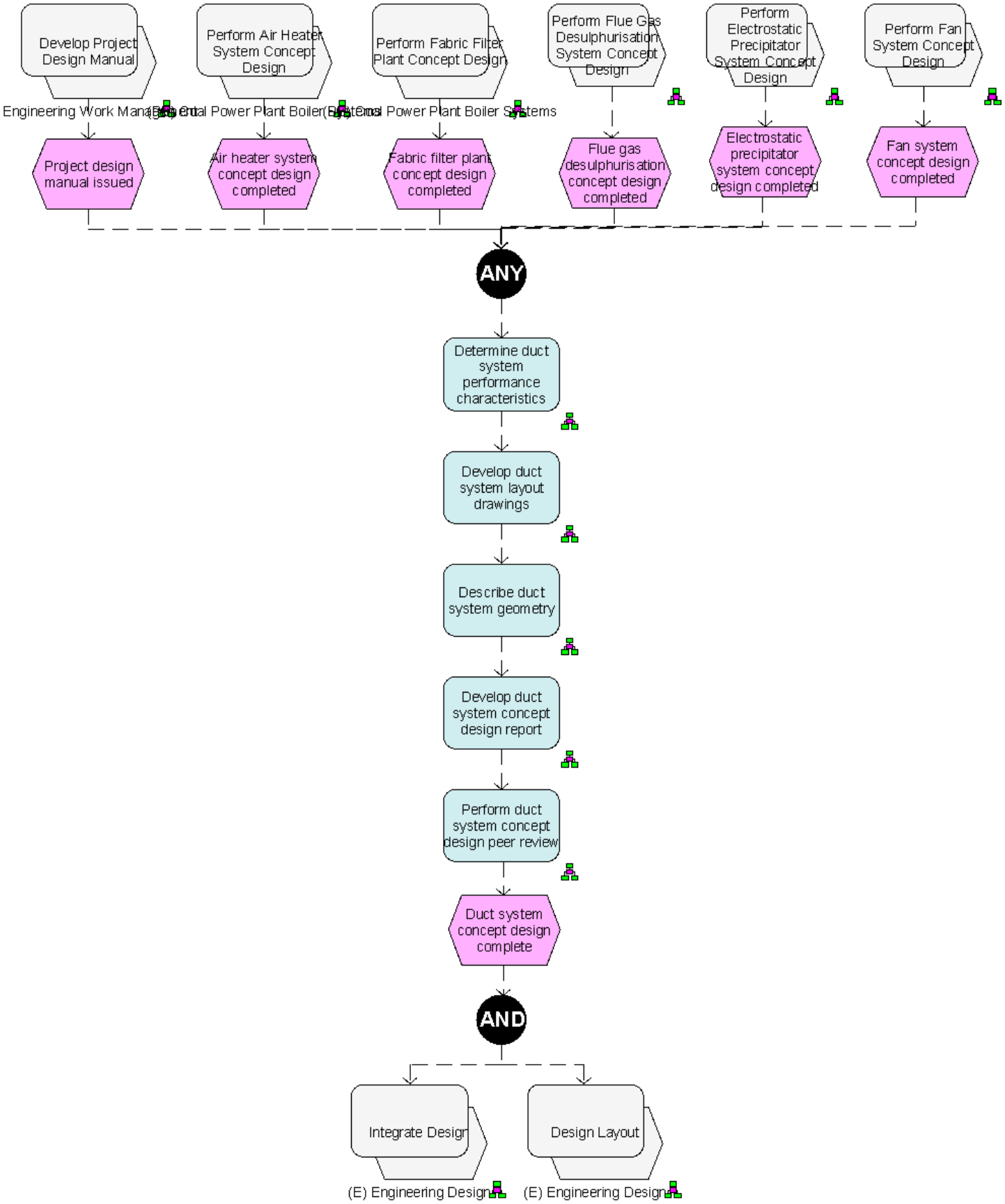
9.1.9 Perform Duct System Concept Design



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ACTIVITY: Determine duct system performance characteristics

The duct system's performance characteristics are determined from information obtained from the boiler process design, project parameters and product process flow. Typically the following is required:

* Fluid composition
* Air and gas temperatures
* Air and gas pressures
* Air and gas volume flow rates
* Erosion protection requirements
* Thermal insulation requirements

The output of this activity is to produce the performance requirement for a duct system containing the following information for different boiler conditions:

* Air and gas temperatures
* Air and gas pressures
* Air and gas volume flow rates
* Erosion protection requirements
* Thermal insulation requirements

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Process Output Sheet * Boiler System Process Flow Diagram * Project Design Manual * Stakeholder Requirements Definition	* Duct System Performance Characteristics Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop duct system layout drawings

In this activity the duct system layout drawings are developed during the concept design phase.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Duct System Performance Characteristics Report	* System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Describe duct system geometry

This activity describes the total plant layout of a duct system in relation to other systems and is developed. A geometric representation of the duct system in three dimensions is the result.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
NPMZ 45-392: Fire Protection Manual

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

* Duct System Equipment Drawings * Duct System Performance Characteristics Report * System & Layout Drawings	* General Arrangement Drawings * P&ID

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Develop duct system concept design report

This activity will consolidate all design activities within a single design report, with a concise delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level concept design report.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* System Design Report (TBD) * Duct System Performance Characteristics Report * General Arrangement Drawings * P&ID	* Product Concept Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Perform duct system concept design peer review

This activity is concerned with the completeness and quality of the result of the design.
It involves having peers review the resulting engineering outputs.
It specifically has to:

* Ensure that the complete requirement has been addressed
* Ensure that the relevant standards and statutory requirements have been met
* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report	* Product Concept Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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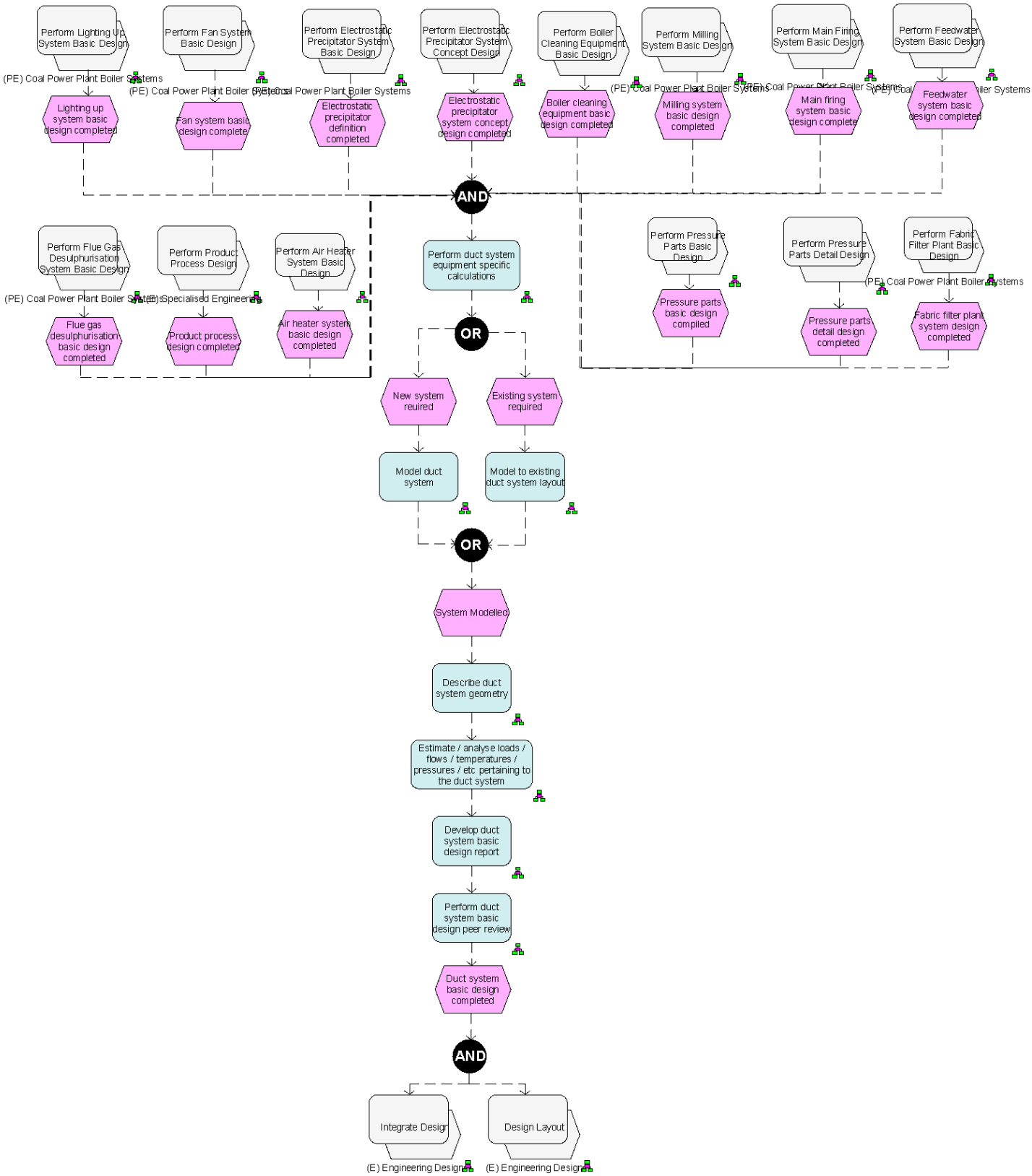
9.1.10 Perform Duct System Basic Design



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When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

ACTIVITY: Perform duct system equipment specific calculations

This activity describes the equipment engineering specific calculations required for the duct system.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Process Output Sheet * Boiler System Process Flow Diagram * Product Concept Design Report * Stakeholder Requirements Definition	* Duct System Description

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Model duct system

This activity uses the description resulting from the engineering calculations and the system layout drawings to develop a model of the duct system from basic principles.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Civil Calculations * Civil Drawings * Duct System Description * Duct System Performance Characteristics Report	* Duct System Equipment Drawings * System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Duct System Calculation Tool (Excel)	

ACTIVITY: Model to existing duct system layout

This activity uses the description resulting from the engineering calculations and the system layout drawings to develop a model of the duct system that takes the existing plant into consideration.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Civil Calculations * Civil Drawings * Duct System Description * Duct System Performance Characteristics Report	* Duct System Equipment Drawings * System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

CONTROLLED DISCLOSURE

When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

ACTIVITY: Describe duct system geometry

This activity describes the total plant layout of a duct system in relation to other systems and is developed. A geometric representation of the duct system in three dimensions is the result.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
NPMZ 45-392: Fire Protection Manual

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Duct System Equipment Drawings * Duct System Performance Characteristics Report * System & Layout Drawings	* General Arrangement Drawings * P&ID

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Estimate / analyse loads / flows / temperatures / pressures / etc pertaining to the duct system

This activity represents all the engineering technical calculations and evaluations executed during the basic design of a duct system.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
GGR 0568: PFFR
NPMZ 45-392: Fire Protection Manual

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Duct System Description * General Arrangement Drawings * P&ID * System & Layout Drawings	* Duct System Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Duct System Calculation Tool (Excel)	

ACTIVITY: Develop duct system basic design report

This activity will consolidate all design activities carried out during the basic design within a single design report, with a detailed delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level basic design report.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Basic design report template * Boiler Process Output Sheet * Boiler System Process Flow Diagram	* P&ID * Product Basic Design Pack * Product Basic Design Report

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

* Duct System Analysis Report * Duct System Description * Duct System Equipment Drawings * General Arrangement Drawings * P&ID * Product Concept Design Report * System & Layout Drawings	

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
Duct System Calculation Tool (Excel)	

ACTIVITY: Perform duct system basic design peer review

This activity is concerned with the completeness and quality of the result of the design.
It involves having peers review the resulting engineering outputs.
It specifically has to:
* Ensure that the complete requirement has been addressed
* Ensure that the relevant standards and statutory requirements have been met
* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* P&ID * Product Basic Design Pack * Product Basic Design Report	* P&ID * Product Basic Design Pack * Product Basic Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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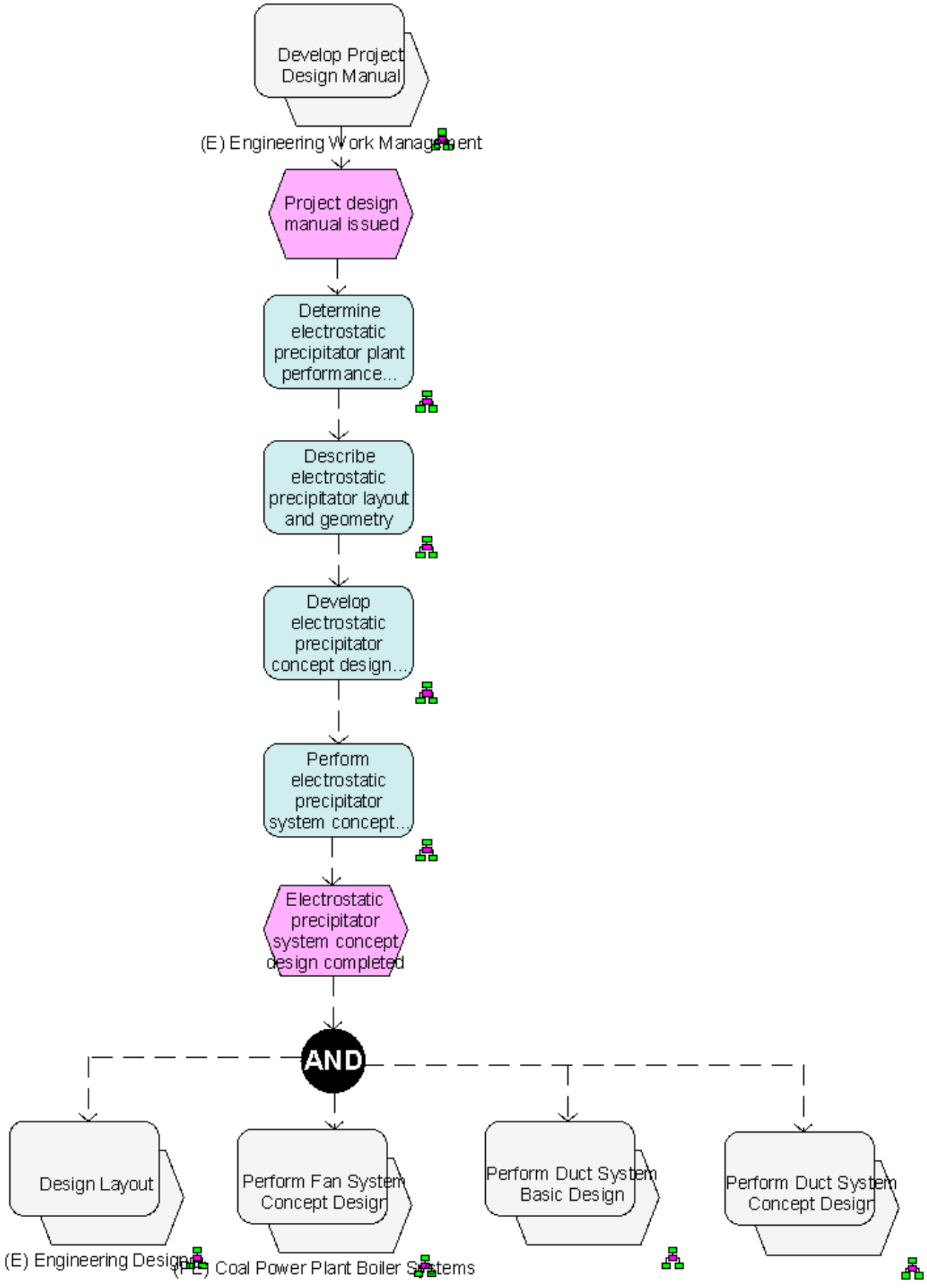
9.1.11 Perform Electrostatic Precipitator System Concept Design



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ACTIVITY: Determine electrostatic precipitator plant performance characteristics

Air quality targets are set by government through legislation. This activity is concerned with defining the design basis for the electrostatic precipitator. It is important to consider the air flow and temperature from the boiler as the performance characteristics should be based on a defined flue gas condition.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Process Flow Diagram * Project Design Manual * Stakeholder Requirement Specification	* Formalised Performance Requirement Record

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Describe electrostatic precipitator layout and geometry

This activity is concerned with preliminary plant sizing and performing layout and geometric designs based on the plant size.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Formalised Performance Requirement Record	* General Arrangement Drawings * System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
Eskom ESP Sizing Tool (Excel)	

ACTIVITY: Develop electrostatic precipitator concept design report

This activity will consolidate all design activities carried out during the concept design within a single design report, with a concise delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level concept design report.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawings * Process Flow Diagram * System & Layout Drawings	* Product Concept Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Perform electrostatic precipitator system concept design peer review

This activity is concerned with the completeness and quality of the result of the design.

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

It involves having peers review the resulting engineering outputs.
It specifically has to:
* Ensure that the complete requirement has been addressed
* Ensure that the relevant standards and statutory requirements have been met
* Ensure that the design is valid and of quality

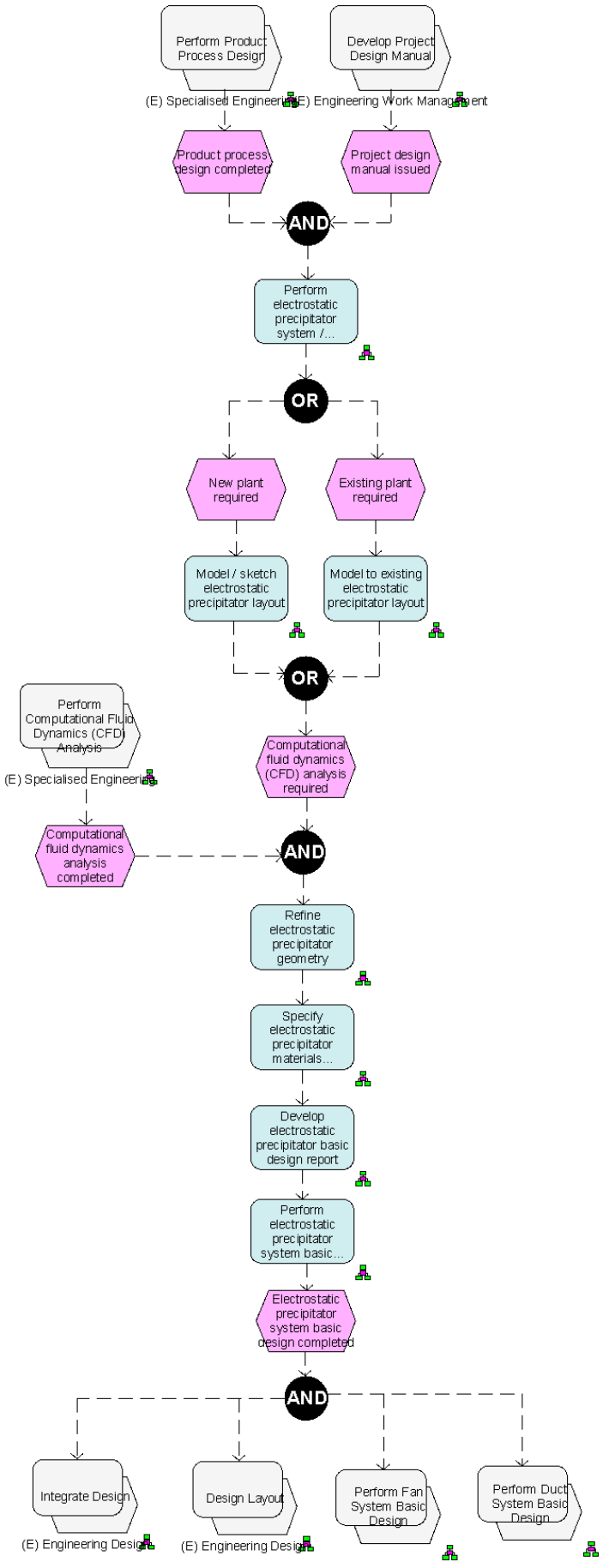
GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report	* Product Concept Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

9.1.12 Perform Electrostatic Precipitator System Basic Design



CONTROLLED DISCLOSURE

When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

ACTIVITY: Perform electrostatic precipitator system / equipment specific calculations

During the execution of this activity, the process design of the electrostatic precipitator is finalised. This will include design of migration velocity, specific collection area and transformer/rectifying sets. It involves the analysis of the process for the flue gas conditions used to formalise the sizing. The results of these calculations should be validated against the stakeholder requirements.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report * Product Process Flow Diagram * Project Design Manual * Stakeholder Requirement Specification	* Electrostatic Precipitator System Description

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Eskom ESP Sizing Tool (Excel)	

ACTIVITY: Model / sketch electrostatic precipitator layout

This activity is concerned with transforming the process design into a layout by positioning the system element as required in the process in a two dimensional space.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Electrostatic Precipitator System Description	* 2D System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Model to existing electrostatic precipitator layout

This activity is concerned with transforming the process design into a layout by positioning the system element as required in the process in a two dimensional space within the existing casing. Required extensions should be identified and indicated.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Electrostatic Precipitator System Description * General arrangement drawings * Layout drawings	* 2D System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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APPLICATIONS	SCREENS
CAD	

ACTIVITY: Refine electrostatic precipitator geometry

This activity considers the impact computational fluid dynamics analysis has on the process in terms the required equipment and sizes. This in turn may require the layout to be updated.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* CFD Report * General Arrangement Drawing * Process Flow Diagram * System & Layout Drawings	* 2D System & Layout Drawings * 3D General Arrangement Drawings * P&ID

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Specify electrostatic precipitator materials characteristics

This activity will define various materials utilised within the electrostatic precipitator. This will include insulating materials, rapping system materials and plate/electrode materials.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawing * Process Flow Diagram	* Material Selection Record

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop electrostatic precipitator basic design report

This activity will consolidate all design activities carried out during the basic design within a single design report, with a detailed delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level basic design report.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:

36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Basic design report template * 2D System & Layout Drawings * Electrostatic Precipitator System Description * General Arrangement Drawing * Material Selection Record * P&ID * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report	* P&ID * Product Basic Design Pack * Product Basic Design Report

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RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
Eskom ESP Sizing Tool (Excel)	

ACTIVITY: Perform electrostatic precipitator system basic design peer review

This activity is concerned with the completeness and quality of the result of the design.
It involves having peers review the resulting engineering outputs.
It specifically has to:
* Ensure that the complete requirement has been addressed
* Ensure that the relevant standards and statutory requirements have been met
* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* P&ID * Product Basic Design Pack * Product Basic Design Report	* P&ID * Product Basic Design Pack * Product Basic Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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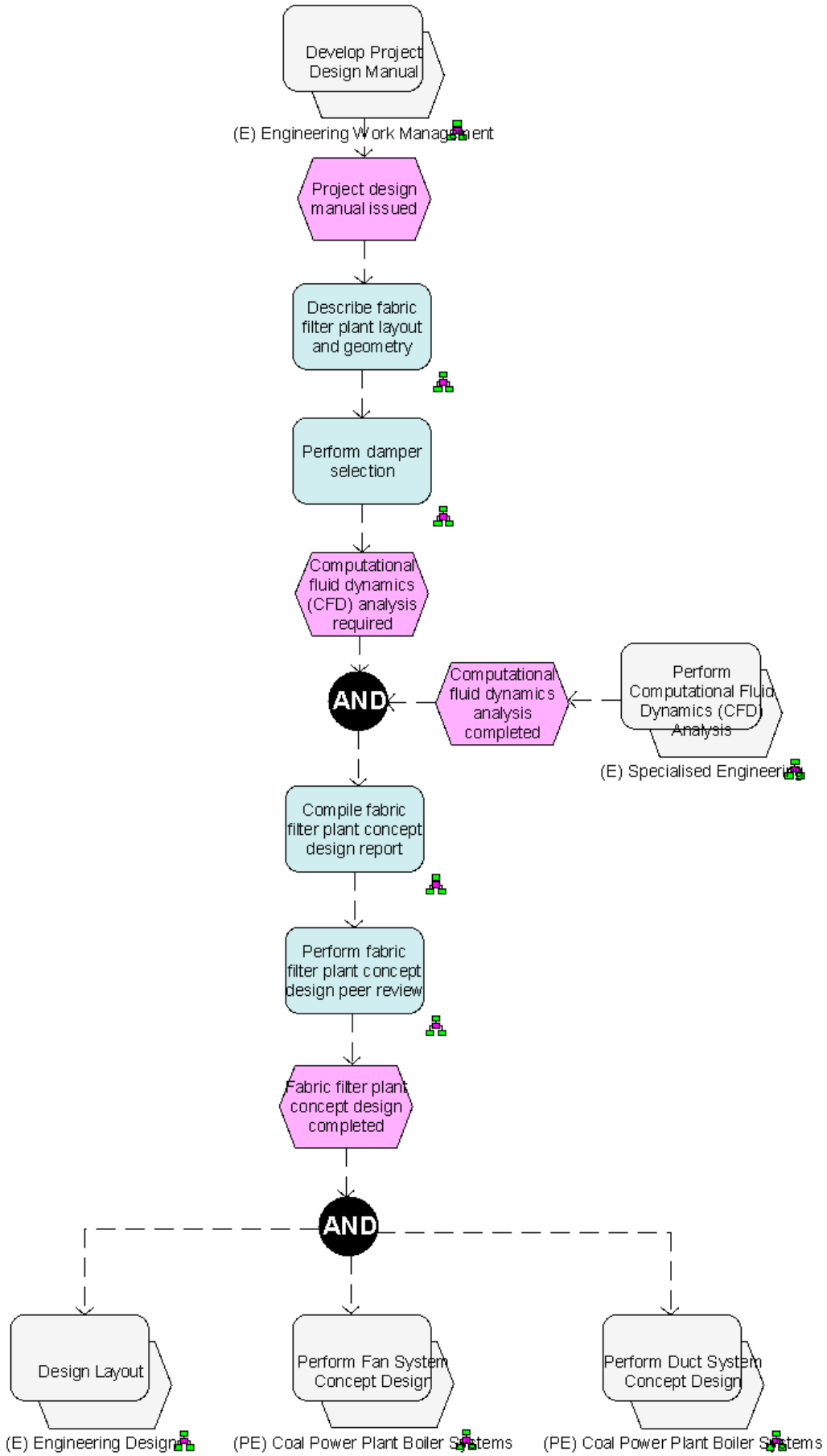
9.1.13 Perform Fabric Filter Plant Concept Design



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ACTIVITY: Describe fabric filter plant layout and geometry

This activity is concerned with performing the fabric filter compartment layout, defining the raw gas duct sizing and position and the clean gas duct and bag layout within the casing.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Process flow diagram * Process Flow Report * Project Design Manual	* General Arrangement Drawings * System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Perform damper selection

This activity is concerned with the selection of inlet, outlet, implosion, cross-over and bypass dampers (example, poppet type, louvre type, etc. considering the layout, pressure drop requirements and process conditions.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
Operating and Control Philosophy (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawings * Product Process Flow Report * System & Layout Drawings	* P&ID

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Compile fabric filter plant concept design report

This activity will consolidate all design activities carried out during the concept design within a single design report, with a concise delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level concept design report.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* System Design Report (TBD) * General Arrangement Drawings * P&ID * Process flow diagram * System & Layout Drawings	* Product Concept Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

ACTIVITY: Perform fabric filter plant concept design peer review

This activity is concerned with the completeness and quality of the result of the design.
It involves having peers review the resulting engineering outputs.
It specifically has to:
* Ensure that the complete requirement has been addressed
* Ensure that the relevant standards and statutory requirements have been met
* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report	* Product Concept Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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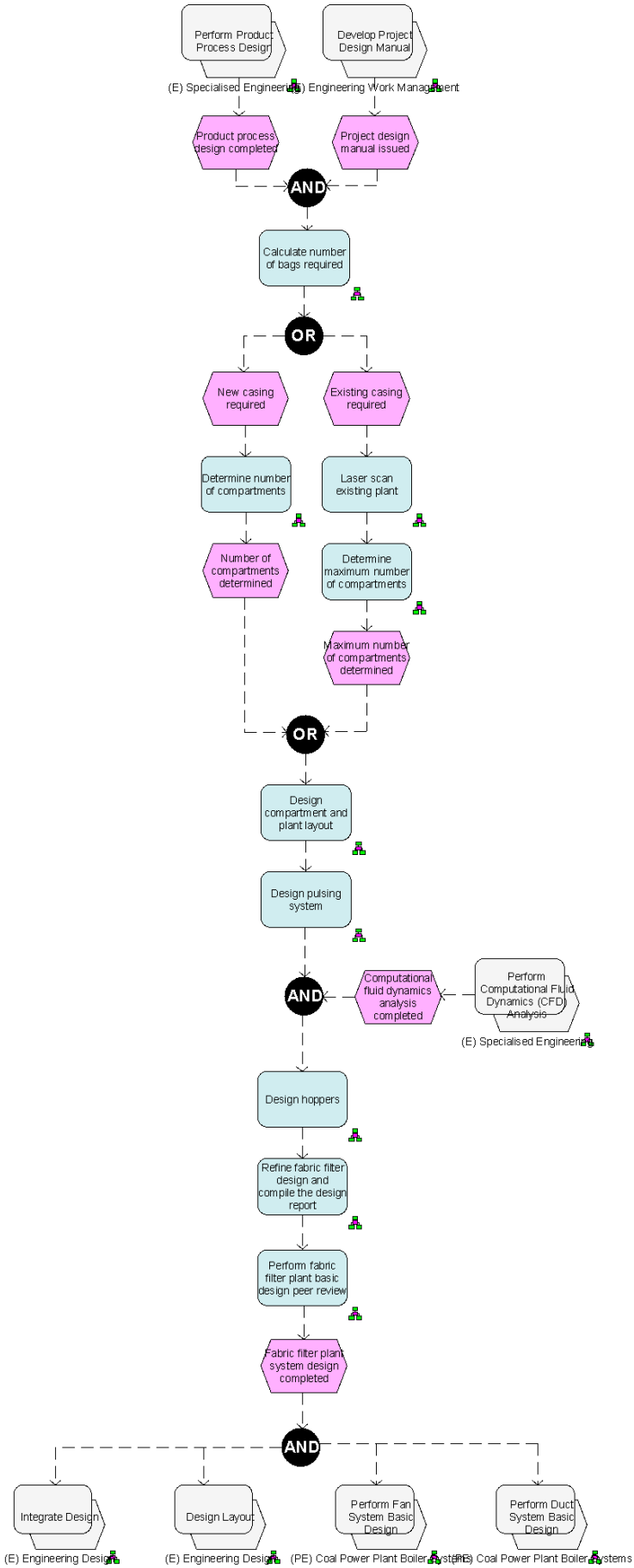
9.1.14 Perform Fabric Filter Plant Basic Design



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ACTIVITY: Calculate number of bags required

Based on the information obtained from the boiler process model, determine the number of bags required by utilising the predetermined air-to-cloth ratio, which should be found in the project design manual. At the end of this process, a confirmed minimum number of bags gets defined which will be used in designing the finalised plant layout.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Concept Product Design Report * Product Process Flow Diagram * Product Process Flow Report * Project Design Manual	* Product Process Flow Diagram

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Fabric Filter Plant Calculation Sheet	

ACTIVITY: Determine number of compartments

When designing a new plant, this activity will determine the maximum number of individually isolatable compartments based on predetermined turndown ratio and resolution requirements. This will further include the number of bags per compartment, based on the confirmed FFP process design as per the previous step.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
Operating & Maintenance Philosophies (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawings * Product Process Flow Diagram * Product Process Flow Report * Project Design Manual * Stakeholder Requirement Specification * System & Layout Drawings	* General Arrangement Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
Fabric Filter Plant Calculation Sheet	

ACTIVITY: Laser scan existing plant

This activity will perform a laser scan on the unit/plant to determine physical as-built dimensions and as a deliverable will provide a concise 3D model.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* System & Layout Drawings	* 3D Model

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED

CONTROLLED DISCLOSURE
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* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Determine maximum number of compartments

When designing a retrofit, whilst utilizing the existing casing, this activity will determine the maximum number of individually isolatable compartments that can be achieved within the current casing footprint bearing in mind the predetermined turndown ratio and resolution requirements. This will further include the number of bags per compartment, based on the confirmed FFP process design as per the previous step.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawings * Product Process Flow Diagram * Product Process Flow Report	* 3D Model * General arrangement drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Fabric Filter Plant Calculation Sheet	

ACTIVITY: Design compartment and plant layout

This activity flow will indicate the maximum number of bags per compartment with associated inlet, outlet, tube plate and damper design for each compartment as well as the central inlet and outlet plenum with associated inlet and outlet cones. This is the final step in the FFP compartment and layout design.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* CFD * System & Layout Drawings	* General Arrangement Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Design pulsing system

This activity flow will develop all air requirements for a fully functional pulsing system and prepare the related P&ID requirements. This can be low, medium or high pressure systems.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawings * Process flow diagram	* Equipment list * P&ID * Valve Lists

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RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
Fabric Filter Plant Calculation Sheet	

ACTIVITY: Design hoppers

Based on the distribution obtained from the plant footprint design and CFD analysis, this activity will design hoppers to assist with the dust removal based on the dust handling plant operating philosophy.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* CFD Report * General Arrangement Drawings * Process flow diagram * System & Layout Drawings	* General Arrangement Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Refine fabric filter design and compile the design report

This activity will consolidate all design activities carried out during the basic design within a single design report, with a detailed delineation of the process-,
functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level basic design report.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures
Eskom Bag Material Specification (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Basic design report template * Equipment list * General Arrangement Drawings * P&ID * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report * Valve Lists	* Design for Future Requirements * General Arrangement Drawings * Materials Alternatives * Mechanical Equipment Lists * P&ID * Product Basic Design Pack * Product Basic Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS

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Fabric Filter Plant Calculation Sheet	

ACTIVITY: Perform fabric filter plant basic design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* P&ID * Product Basic Design Pack * Product Basic Design Report	* P&ID * Product Basic Design Pack * Product Basic Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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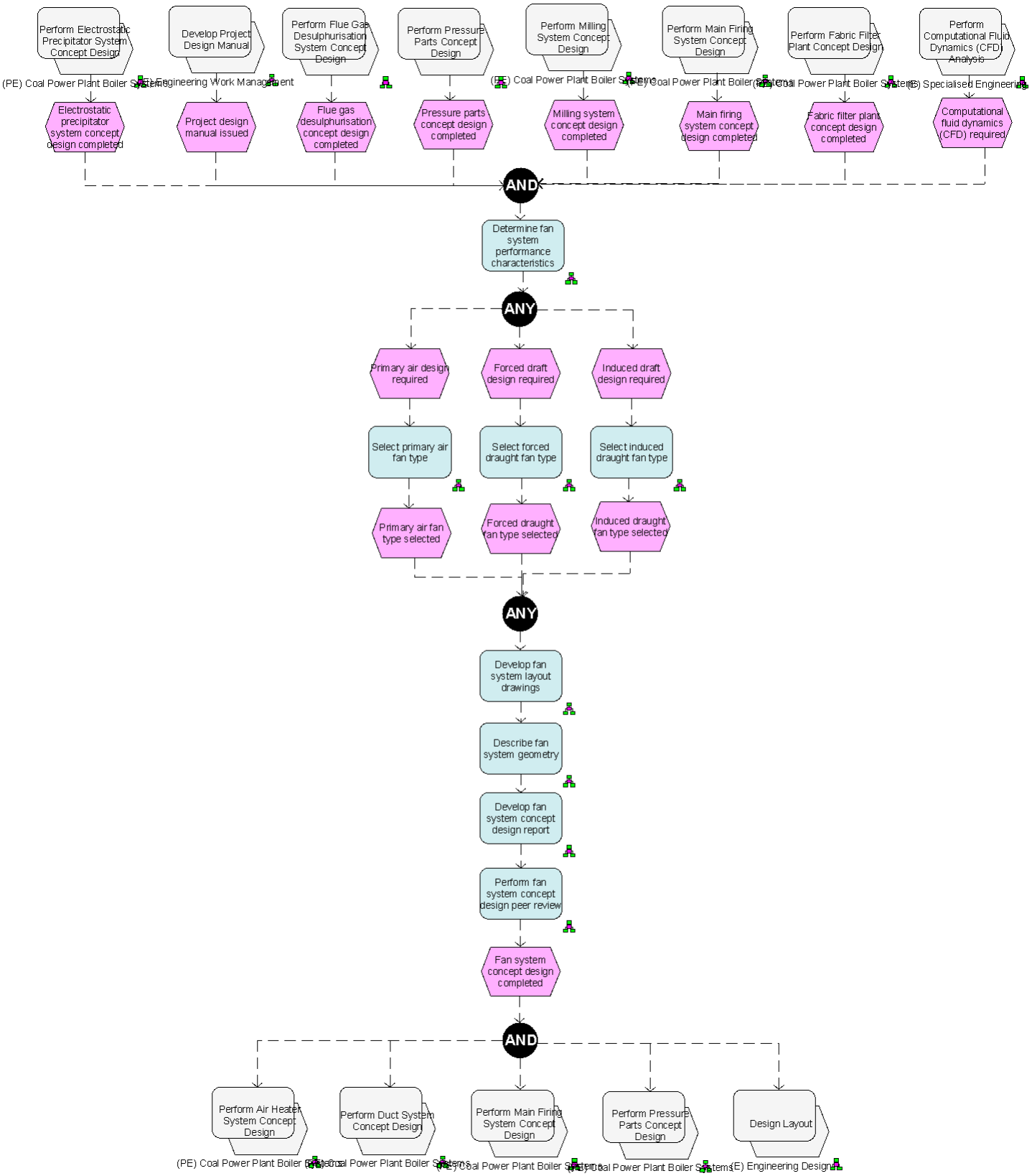
9.1.15 Perform Fan System Concept Design



CONTROLLED DISCLOSURE
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ACTIVITY: Determine fan system performance characteristics

The performance characteristics are determined from information contained in the relevant documentation. Typically the following is required:

* Coal and ash composition
* Air and gas temperatures
* Air and gas pressures
* Air and gas volume flow rates
* Erosion protection

The output of this activity is to produce a report containing the following information for different boiler conditions:

* Air and gas mass flows
* Air and gas temperatures
* Air and gas pressures
* Erosion protection requirements

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Process Output Sheet * Product Process Flow Diagram * Product Process Flow Report * Project Design Manual * Stakeholder Requirements Definition	* Fan System Performance Characteristics Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Select primary air fan type

In this activity engineering evaluations based on the stakeholder requirements are made in order to select from a catalogue and specify a primary air fan type.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Fan System Performance Characteristics Report	* Primary Air Fan Selection Report * Primary Air Fan Specification

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Primary Air Fan Calculation Sheet (Excel)	

ACTIVITY: Select forced draught fan type

In this activity engineering evaluations based on the stakeholder requirements are made in order to select from a catalogue and specify a forced draught fan type.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Fan System Performance Characteristics Report	* Forced Draught Fan Selection Report * Forced Draught Fan Specification

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Forced Draught Fan Calculation Sheet (Excel)	

ACTIVITY: Select induced draught fan type

In this activity engineering evaluations based on the stakeholder requirements are made in order to select from a catalogue and specify an induced draught fan type.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Fan System Performance Characteristics Report	* Induced Draught Fan Selection Report * Induced Draught Fan Specification

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Induced Draught Fan Calculation Sheet (Excel)	

ACTIVITY: Develop fan system layout drawings

In this activity the fan system layout drawings are developed.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Fan System Layout Drawings * Forced Draught Fan Selection Report * Forced Draught Fan Specification * Induced Draught Fan Selection Report * Induced Draught Fan Specification * Primary Air Fan Selection Report * Primary Air Fan Specification	* System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
Fan Calculation Sheet (Excel)	

ACTIVITY: Describe fan system geometry

This activity describes the total plant layout in three dimensions of a fan system in relation to other systems taking the fan equipment drawings into consideration.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

* Fan Equipment Drawings * Fan System Performance Characteristics Report * P&ID * System & Layout Drawings	* General Arrangement Drawings * P&ID

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Develop fan system concept design report

This activity will consolidate all design activities carried out during the concept design within a single design report, with a concise delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level concept design report.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* System Design Report (TBD) * Forced Draught Fan Selection Report * Forced Draught Fan Specification * General Arrangement Drawings * Induced Draught Fan Selection Report * Induced Draught Fan Specification * P&ID * Primary Air Fan Selection Report * Primary Air Fan Specification * System & Layout Drawings	* Product Concept Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
Forced Draught Fan Calculation Sheet (Excel)	
Induced Draught Fan Calculation Sheet (Excel)	
Primary Air Fan Calculation Sheet (Excel)	

ACTIVITY: Perform fan system concept design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

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GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report	* Product Concept Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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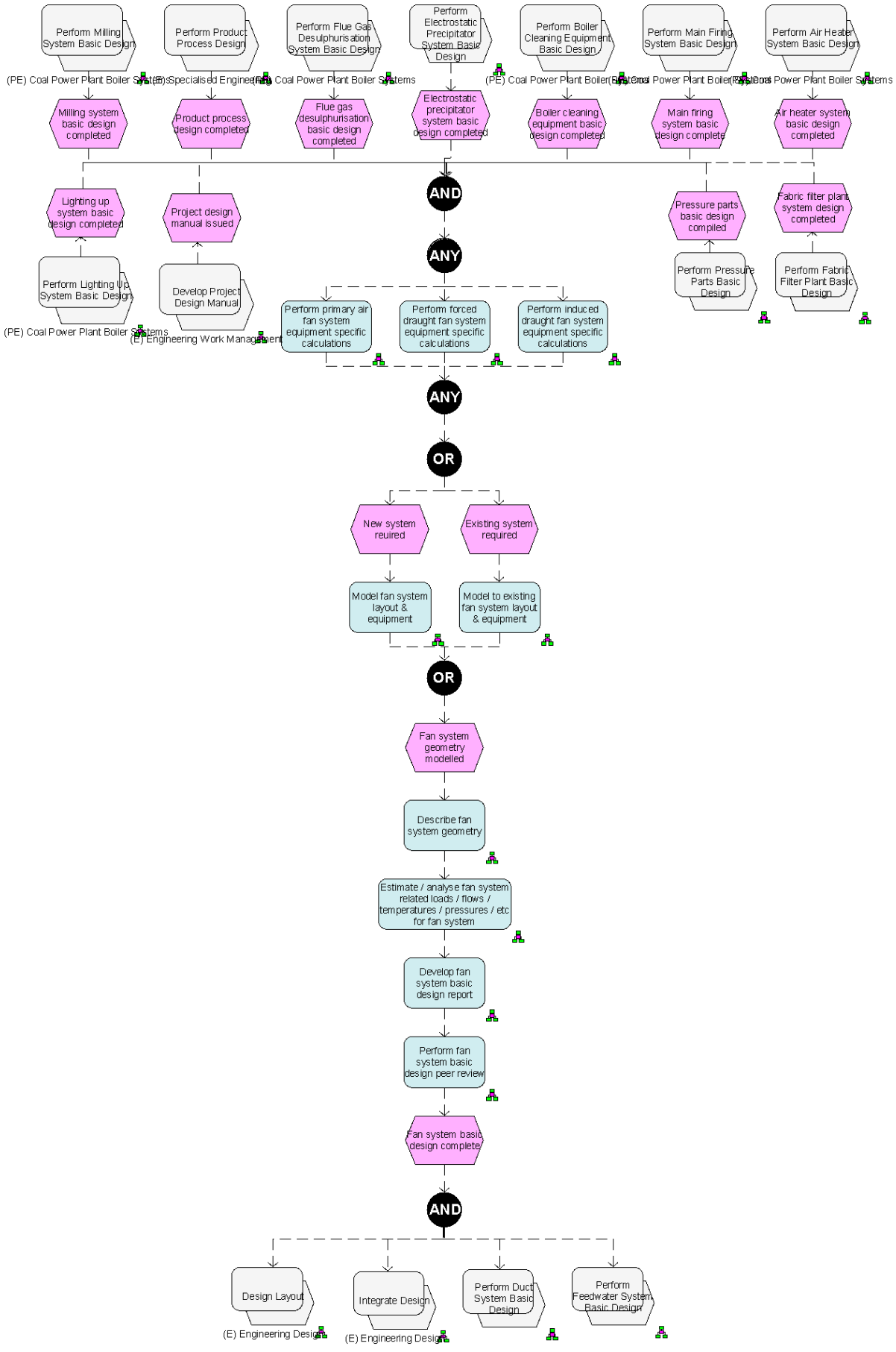
9.1.16 Perform Fan System Basic Design



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ACTIVITY: Perform primary air fan system equipment specific calculations

This activity describes the equipment specific calculations required for the primary air fan system basic design.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report * Project Design Manual * Stakeholder Requirements Definition	* Primary Air Fan System Description

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Primary Air Fan System Calculation Tool (Excel)	

ACTIVITY: Perform forced draught fan system equipment specific calculations

This activity describes the equipment specific calculations required for the forced draught fan system basic design.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report * Project Design Manual * Stakeholder Requirements Definition	* Forced Draught Fan System Description

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Forced Draught Fan System Calculation Tool (Excel)	

ACTIVITY: Perform induced draught fan system equipment specific calculations

This activity describes the equipment specific calculations required for the induced draught fan system basic design.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report * Project Design Manual * Stakeholder Requirements Definition	* Induced Draught Fan System Description

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

CONTROLLED DISCLOSURE
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APPLICATIONS	SCREENS
Induced Draught Fan System Calculation Tool (Excel)	

ACTIVITY: Model fan system layout & equipment

This activity uses the description resulting from the engineering calculations to develop a geometric model of the fan system from basic principles.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Fan System Layout Drawings * Forced Draught Fan System Description * Induced Draught Fan System Description * Primary Air Fan System Description * System & Layout Drawings	* Fan Equipment Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
Fan System Calculation Tool (Excel)	

ACTIVITY: Model to existing fan system layout & equipment

This activity uses the description resulting from the engineering calculations to develop a geometric model of the fan system that takes the existing plant into consideration.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Civil Calculations * Civil Drawings * Fan Equipment Drawings * Fan System Layout Drawings * Forced Draught Fan System Description * Induced Draught Fan System Description * Primary Air Fan System Description	* Fan Equipment Drawings * System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Describe fan system geometry

This activity describes the total plant layout in three dimensions of a fan system in relation to other systems taking the fan equipment drawings into consideration.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Fan Equipment Drawings * Fan System Performance Characteristics Report * P&ID	* General Arrangement Drawings * P&ID

CONTROLLED DISCLOSURE
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* System & Layout Drawings	

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Estimate / analyse fan system related loads / flows / temperatures / pressures / etc for fan system

This activity represents all the engineering technical calculations and evaluations executed during the basic design of the fan systems.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
GGR 0568: PFFR
NPMZ 45-392: Fire Protection Manual

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Fan System Calculation Sheet * Forced Draught Fan System Description * General Arrangement Drawings * Induced Draught Fan System Description * Primary Air Fan System Description * System & Layout Drawings	* Fan System Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop fan system basic design report

This activity will consolidate all design activities carried out during the basic design within a single design report, with a detailed delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level basic design report.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Basic design report template * Fan Equipment Drawings * Fan System Analysis Report * Fan System Layout Drawings * Forced Draught Fan System Description * General Arrangement Drawing * Induced Draught Fan System Description * P&ID * Primary Air Fan System Description * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report	* P&ID * Product Basic Design Pack * Product Basic Design Report

CONTROLLED DISCLOSURE
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RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
Fan System Calculation Tool (Excel)	

ACTIVITY: Perform fan system basic design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* P&ID * Product Basic Design Pack * Product Basic Design Report	* P&ID * Product Basic Design Pack * Product Basic Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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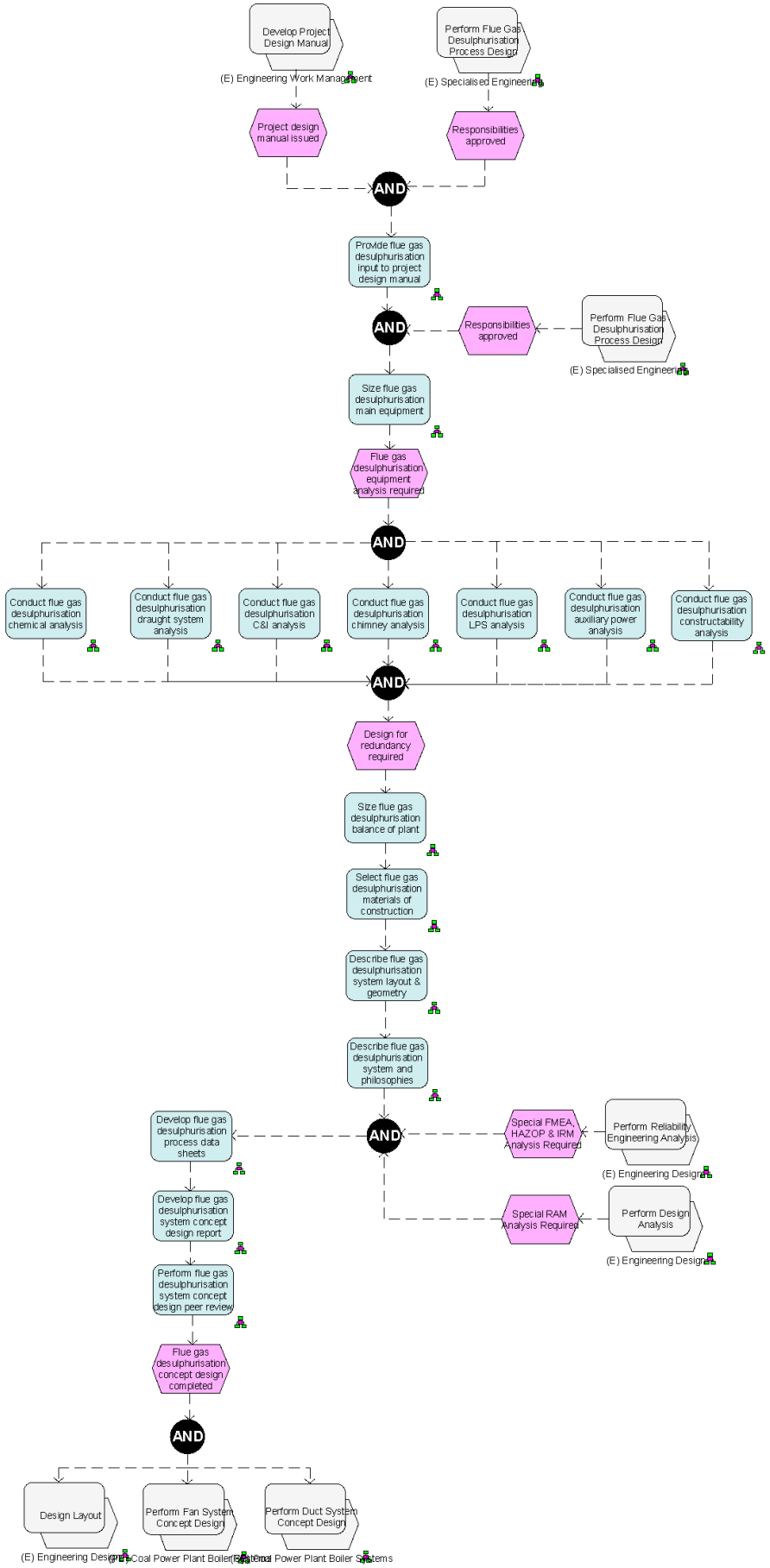
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

9.1.17 Perform Flue Gas Desulphurisation System Concept Design



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ACTIVITY: Provide flue gas desulphurisation input to project design manual

This activity incorporates all design criteria required to meet the objectives of the stakeholder requirements that forms the basis of the FGD project The relevant documentation contains information pertaining to the project scope and the project design basis is also defined in this activity. Discipline specific design criteria as per discipline are used to develop the design guidelines of the project, including the waste water treatment and storage. The system requirements as well as the stakeholder requirement specification provide the boundaries for the design.

During the design the FGD input is provided and the relevant documents are developed or updated to incorporate the design information.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
FGD Eskom Specification (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Discipline Specific Design Criteria * FGD Process Design Basis * FGD Process Flow Diagram * Product Concept Design Report * Project Design Manual * Site Specific Design Criteria * Stakeholder Requirements Definition * System Requirements * Waste Treatment or Disposal Criteria	* FGD Process Data Report * Project Design Manual

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Size flue gas desulphurisation main equipment

This activity sizes the FGD main equipment which includes absorbers, reagent / sorbent & by-product handling conveyors, tanks and pumps and heat exchangers. The sizes are reported in the FGD lists. after the main equipment sizing is done, the FGD auxiliary requirements (i.e. electrical and cooling water) are established.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* List's Template * FGD Process Flow Diagram * Mass and Energy Balance * P&ID * Project Design Manual	* FGD Auxiliary Requirements * FGD List

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Equipment Sizing Software Tools (TBA)	
FGD Calculation Spreadsheet	

ACTIVITY: Conduct flue gas desulphurisation chemical analysis

To determine the suitability of other water sources within the power plant for use within the FGD process, if needs be the water treatment methods have to be applied. The waste water treatment options are evaluated in this activity. Information from the raw water quality, FGD Lists and the relevant manuals are used to conduct the chemical analysis.

CONTROLLED DISCLOSURE
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INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD System Requirements Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report	* FDG Chemical Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Conduct flue gas desulphurisation draught system analysis

Establish FGD draught system requirements/ to evaluate the suitability of the existing fans' (especially ID fans) capacity in the case of a retrofit, accommodate the new operating conditions associated with the implementation of the new FGD retrofit. Information acquired from the relevant diagrams, ID fan design and operating conditions, and the documents depicting the stakeholder and system requirements are utilised to conduct the draught system analysis.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD System Requirements Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report	* FGD Draught System Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Conduct flue gas desulphurisation C&I analysis

To evaluate the existing C&I system's capacity to accommodate the new FGD retrofit. The C&I system is designed to enable from the control rooms the control of the main operating phases of each unit and common plant such as; start-up of the plant, normal operation, normal shut-down, emergency operations, monitoring or binary and numerical parameters. The I/O inputs, power plant DCS information including the main equipment conceptual configuration is utilised to conduct this analysis.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD System Requirements Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report	* FGD C&I Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Conduct flue gas desulphurisation chimney analysis

To evaluate the suitability of the existing chimney for new operating conditions associated with the implementation of the new FGD retrofit in terms of volume flow, temperature and moisture content. Flue gas velocities, flue gas duct requirements and the chimney requirement condition. Information from the FGD Lists and documents containing

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stakeholders and system requirements are utilised to conduct this study.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD System Requirements Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report	* FGD Chimney Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Conduct flue gas desulphurisation LPS analysis

Low Pressure System requirements' tie-in points are evaluated and an evaluation of the LPS system (i.e. fire water system, portable water system, and compressed air system) will be able to accommodate the new FGD utility requirements is also conducted. The LPS analysis is conducted by taking into account the applicable LPS systems (fire protection, compressed air and water supply among others) and incorporating information from the FGD Lists and documents containing the stakeholder and system requirements.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD System Requirements Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report	* FGD LPS Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Conduct flue gas desulphurisation auxiliary power analysis

To evaluate the existing auxiliary power system's capacity to accommodate extra loads associated with the new FGD retrofit. To determine the electrical loads associated with the addition of the FGD system to each of the units to the existing plant, the modifications take in to account the addition of oxidation air blowers, absorber recirculation pumps, vacuum pumps, dewatering filter pumps, ball mills, limestone handling and unloading equipment, gypsum handling equipment, zero liquid discharge system, and all other associated loads for proper functioning of the FGD system.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD System Requirements Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report	* FGD Auxiliary Power Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Conduct flue gas desulphurisation constructability analysis

To evaluate if the FGD will be able to be constructed and what the requirements are in terms of resources to facilitate the

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task and to evaluate the conceptual design for constructability and access and make recommendations to be considered during detailed design. The FGD Lists, Construction information available from site, as well as the information applicable information from the documents containing stakeholder and system requirments are used as supporting information for the analysis.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD System Requirements Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report	* FGD Constructability Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Size flue gas desulphurisation balance of plant

In this activity the balance of plant / common plant is sized to accommodate and support the FGD process operation, these include all the non-power island plant and equipment. Information from the FGD System requirements documents and FGD lists are the utilised as the design basis for the balance of plant.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD Balance of Plant Component List Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report * Project Design Manual	* FDD Balance of Plant P&IDs * FGD Balance of Plant Component List

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Select flue gas desulphurisation materials of construction

In this activity the materials on the basis of the chemical and thermal loads are defined by taking into account the MEB, the FGD Lists and information incorporated in the applicable manuals. Material selection guidelines are used as the basis for the material selection.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
FGD Materials of Construction Guideline (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD List * Mass and Energy Balance * Product Concept Design Report	* Materials Selection Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Describe flue gas desulphurisation system layout & geometry

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

In this activity FGD area arrangement drawings and plot plan are created by incorporating information from the PFDs, documents containing stakeholder and system requirements, P&IDs and other important information. An applicable CAD is used to develop the drawings.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Area Arrangement Template * FDD Balance of Plant P&IDs * FDG Chemical Analysis Report * FGD Auxiliary Power Analysis Report * FGD Auxiliary Requirements * FGD Balance of Plant Component List * FGD C&I Analysis Report * FGD Chimney Analysis Report * FGD Constructability Analysis Report * FGD Draught System Analysis Report * FGD List * FGD LPS Analysis Report * FGD Process Flow Diagram * P&ID * Product Concept Design Report * Project Design Manual	* FGD P&ID * FGD Plot Plan * General Arrangement Drawings * System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
P&ID Software	

ACTIVITY: Describe flue gas desulphurisation system and philosophies

In this activity FGD specific engineering evaluations are done and system descriptions formulated. The control descriptions are used to visualize the control philosophy that is used to control the process including all relevant systems. Information from the PFDs is used to develop the system descriptions, operating and control philosophies.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* System Philosophy Template * FGD Process Flow Diagram	* FGD Operating & Control Philosophy * FGD System Description

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop flue gas desulphurisation process data sheets

This activity process data sheets are developed, the process data sheets provide detailed information to each specific piece of equipment. The PFDs, P&IDs, material selection studies and MEB developed earlier are used to produce the process data sheets.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD Process Data Sheet Template * FDD Balance of Plant P&IDs	* FGD Process Data Sheets

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* FGD P&ID * FGD Process Flow Diagram * Mass and Energy Balance	

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop flue gas desulphurisation system concept design report

This activity will consolidate all design activities carried out during the concept design within a single design report, with a concise delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level concept design report.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
FGD Materials of Construction Guideline (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* 240-49910679: Concept Design Report Template (To be developed) * Constructability Analysis Report * FDD Balance of Plant P&IDs * FDG Chemical Analysis Report * FGD Auxiliary Power Analysis Report * FGD Balance of Plant Component List * FGD C&I Analysis Report * FGD Chimney Analysis Report * FGD Draught System Analysis Report * FGD LPS Analysis Report * FGD Operating & Control Philosophy * FGD P&ID * FGD Plot Plan * FGD Process Data Sheets * FGD System Description * General Arrangement Drawings * Materials Selection Report * System & Layout Drawings	* Product Concept Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Perform flue gas desulphurisation system concept design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

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GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report	* Product Concept Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

CONTROLLED DISCLOSURE
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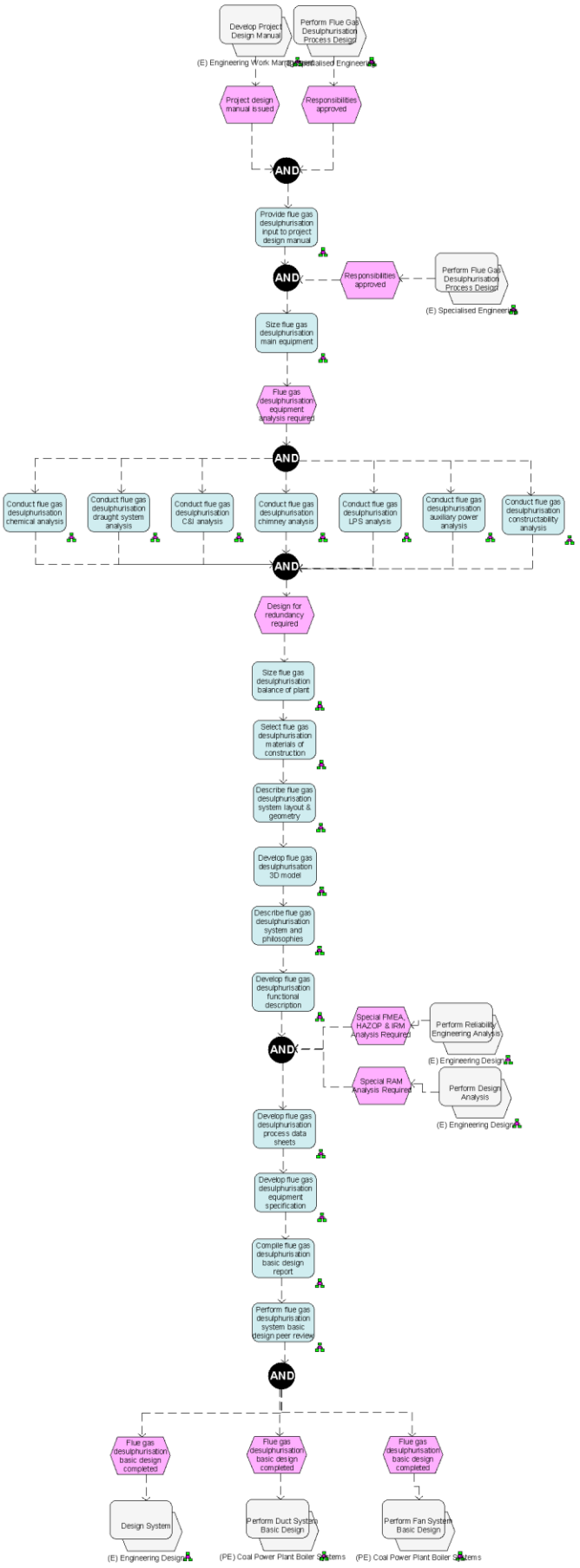
9.1.18 Perform Flue Gas Desulphurisation System Basic Design



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ACTIVITY: Provide flue gas desulphurisation input to project design manual

This activity incorporates all design criteria required to meet the objectives of the stakeholder requirements that forms the basis of the FGD project The relevant documentation contains information pertaining to the project scope and the project design basis is also defined in this activity. Discipline specific design criteria as per discipline are used to develop the design guidelines of the project, including the waste water treatment and storage. The system requirements as well as the stakeholder requirement specification provide the boundaries for the design.

During the design the FGD input is provided and the relevant documents are developed or updated to incorporate the design information.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
FGD Eskom Specification (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Discipline Specific Design Criteria * FGD Process Design Basis * FGD Process Flow Diagram * Product Concept Design Report * Project Design Manual * Site Specific Design Criteria * Stakeholder Requirements Definition * System Requirements * Waste Treatment or Disposal Criteria	* FGD Process Data Report * Project Design Manual

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Size flue gas desulphurisation main equipment

This activity sizes the FGD main equipment which includes absorbers, reagent / sorbent & by-product handling conveyors, tanks and pumps and heat exchangers. The sizes are reported in the FGD lists. after the main equipment sizing is done, the FGD auxiliary requirements (i.e. electrical and cooling water) are established.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* List's Template * FGD Process Flow Diagram * Mass and Energy Balance * P&ID * Project Design Manual	* FGD Auxiliary Requirements * FGD List

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Equipment Sizing Software Tools (TBA)	
FGD Calculation Spreadsheet	

ACTIVITY: Conduct flue gas desulphurisation chemical analysis

To determine the suitability of other water sources within the power plant for use within the FGD process, if needs be the water treatment methods have to be applied. The waste water treatment options are evaluated in this activity. Information from the raw water quality, FGD Lists and the relevant manuals are used to conduct the chemical analysis.

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INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD System Requirements Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report	* FDG Chemical Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Conduct flue gas desulphurisation draught system analysis

Establish FGD draught system requirements/ to evaluate the suitability of the existing fans' (especially ID fans) capacity in the case of a retrofit, accommodate the new operating conditions associated with the implementation of the new FGD retrofit. Information acquired from the relevant diagrams, ID fan design and operating conditions, and the documents depicting the stakeholder and system requirements are utilised to conduct the draught system analysis.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD System Requirements Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report	* FGD Draught System Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Conduct flue gas desulphurisation C&I analysis

To evaluate the existing C&I system's capacity to accommodate the new FGD retrofit. The C&I system is designed to enable from the control rooms the control of the main operating phases of each unit and common plant such as; start-up of the plant, normal operation, normal shut-down, emergency operations, monitoring or binary and numerical parameters. The I/O inputs, power plant DCS information including the main equipment conceptual configuration is utilised to conduct this analysis.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD System Requirements Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report	* FGD C&I Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Conduct flue gas desulphurisation chimney analysis

To evaluate the suitability of the existing chimney for new operating conditions associated with the implementation of the new FGD retrofit in terms of volume flow, temperature and moisture content. Flue gas velocities, flue gas duct requirements and the chimney requirement condition. Information from the FGD Lists and documents containing

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stakeholders and system requirements are utilised to conduct this study.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD System Requirements Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report	* FGD Chimney Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Conduct flue gas desulphurisation LPS analysis

Low Pressure System requirements' tie-in points are evaluated and an evaluation of the LPS system (i.e. fire water system, portable water system, and compressed air system) will be able to accommodate the new FGD utility requirements is also conducted. The LPS analysis is conducted by taking into account the applicable LPS systems (fire protection, compressed air and water supply among others) and incorporating information from the FGD Lists and documents containing the stakholder and system requirements.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD System Requirements Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report	* FGD LPS Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Conduct flue gas desulphurisation auxiliary power analysis

To evaluate the existing auxiliary power system's capacity to accommodate extra loads associated with the new FGD retrofit. To determine the electrical loads associated with the addition of the FGD system to each of the units to the existing plant, the modifications take in to account the addition of oxidation air blowers, absorber recirculation pumps, vacuum pumps, dewatering filter pumps, ball mills, limestone handling and unloading equipment, gypsum handling equipment, zero liquid discharge system, and all other associated loads for proper functioning of the FGD system.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD System Requirements Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report	* FGD Auxiliary Power Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Conduct flue gas desulphurisation constructability analysis

To evaluate if the FGD will be able to be constructed and what the requirements are in terms of resources to facilitate the

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task and to evaluate the conceptual design for constructability and access and make recommendations to be considered during detailed design. The FGD Lists, Construction information available from site, as well as the information applicable information from the documents containing stakeholder and system requirments are used as supporting information for the analysis.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD System Requirements Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report	* FGD Constructability Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Size flue gas desulphurisation balance of plant

In this activity the balance of plant / common plant is sized to accommodate and support the FGD process operation, these include all the non-power island plant and equipment. Information from the FGD System requirements documents and FGD lists are the utilised as the design basis for the balance of plant.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD Balance of Plant Component List Template * FGD Auxiliary Requirements * FGD List * Product Concept Design Report * Project Design Manual	* FDD Balance of Plant P&IDs * FGD Balance of Plant Component List

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Select flue gas desulphurisation materials of construction

In this activity the materials on the basis of the chemical and thermal loads are defined by taking into account the MEB, the FGD Lists and information incorporated in the applicable manuals. Material selection guidelines are used as the basis for the material selection.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
FGD Materials of Construction Guideline (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD List * Mass and Energy Balance * Product Concept Design Report	* Materials Selection Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Describe flue gas desulphurisation system layout & geometry

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When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

In this activity FGD area arrangement drawings and plot plan are created by incorporating information from the PFDs, documents containing stakeholder and system requirements, P&IDs and other important information. An applicable CAD is used to develop the drawings.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Area Arrangement Template * FDD Balance of Plant P&IDs * FDG Chemical Analysis Report * FGD Auxiliary Power Analysis Report * FGD Auxiliary Requirements * FGD Balance of Plant Component List * FGD C&I Analysis Report * FGD Chimney Analysis Report * FGD Constructability Analysis Report * FGD Draught System Analysis Report * FGD List * FGD LPS Analysis Report * FGD Process Flow Diagram * P&ID * Product Concept Design Report * Project Design Manual	* FGD P&ID * FGD Plot Plan * General Arrangement Drawings * System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
P&ID Software	

ACTIVITY: Develop flue gas desulphurisation 3D model

In this activity 3D model is created. Information from the developed area arrangement drawings and the plot plan is used to produce a 3D model of the FGD plant.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD Plot Plan * Process Area Arrangement Drawings * Product Concept Design Report	* FGD 3D Model

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
Smart Plant 3D	

ACTIVITY: Develop flue gas desulphurisation 3D model

In this activity 3D model is created. Information from the developed area arrangement drawings and the pilot plan is used to produce a 3D model of the FGD plant

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD Plot Plan * Process Area Arrangement Drawings * Product Concept Design Report	* FGD 3D Model

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
Smart Plant 3D	

ACTIVITY: Describe flue gas desulphurisation system and philosophies

In this activity FGD specific engineering evaluations are done and system descriptions formulated. The control descriptions are used to visualize the control philosophy that is used to control the process including all relevant systems. Information from the PFDs is used to develop the system descriptions, operating and control philosophies.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* System Philosophy Template * FGD Process Flow Diagram	* FGD Operating & Control Philosophy * FGD System Description

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Describe flue gas desulphurisation system and philosophies

In this activity FGD specific engineering evaluations are done and system descriptions formulated. The control descriptions are used to visualize the control philosophy that is used to control the process including all relevant systems. Information from the PFDs is used to develop the system descriptions, operating and control philosophies.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* System Philosophy Template * FGD Process Flow Diagram	* FGD Operating & Control Philosophy * FGD System Description

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop flue gas desulphurisation functional description

In this activity functional descriptions are developed. General functional descriptions including those of the absorber, makeup water supply, and flue gas path among others are done. Information acquired from the process control philosophies, operating philosophies, PFDs and FGD Lists are sued to develop the functional descriptions.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* TBD: Functional Description Template * FDD Balance of Plant P&IDs * FDG Chemical Analysis Report	* FGD Functional Description

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

* FGD Auxiliary Power Analysis Report * FGD Balance of Plant Component List * FGD C&I Analysis Report * FGD Chimney Analysis Report * FGD Constructability Analysis Report * FGD Draught System Analysis Report * FGD List * FGD LPS Analysis Report * FGD Operating & Control Philosophy * FGD P&ID * FGD Process Flow Diagram * FGD System Description	

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop flue gas desulphurisation functional description

In this activity functional descriptions are developed. General functional descriptions including those of the absorber, makeup water supply, and flue gas path among others are done. Information acquired from the process control philosophies, operating philosophies, PFDs and FGD Lists are sued to develop the functional descriptions.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* TBD: Functional Description Template * FDD Balance of Plant P&IDs * FDG Chemical Analysis Report * FGD Auxiliary Power Analysis Report * FGD Balance of Plant Component List * FGD C&I Analysis Report * FGD Chimney Analysis Report * FGD Constructability Analysis Report * FGD Draught System Analysis Report * FGD List * FGD LPS Analysis Report * FGD Operating & Control Philosophy * FGD P&ID * FGD Process Flow Diagram * FGD System Description	* FGD Functional Description

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop flue gas desulphurisation process data sheets

This activity process data sheets are developed, the process data sheets provide detailed information to each specific piece of equipment. The PFDs, P&IDs, material selection studies and MEB developed earlier are used to produce the process data sheets.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FGD Process Data Sheet Template * FDD Balance of Plant P&IDs * FGD P&ID * FGD Process Flow Diagram	* FGD Process Data Sheets

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

*Mass and Energy Balance	

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop flue gas desulphurisation equipment specification

In this activity the FGD specifications are developed. The information in the design report forms the basis for the specifications of the FGD.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* FDG Chemical Analysis Report * FGD Auxiliary Power Analysis Report * FGD Auxiliary Requirements * FGD Bill of Materials * FGD Bill of Quantities * FGD C&I Analysis Report * FGD Chimney Analysis Report * FGD Constructability Analysis Report * FGD Draught System Analysis Report * FGD General Arrangement Drawings * FGD List * FGD LPS Analysis Report * FGD System Description Report * P&ID * Process Area Arrangement Drawings * Product Concept Design Report * Project Design Manual	* FGD Equipment Specifications

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Compile flue gas desulphurisation basic design report

This activity will consolidate all design activities carried out during the basic design within a single design report, with a detailed delineation of the process-,
functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level basic design report.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Basic design report template * FGD Equipment Specifications * FGD Functional Description * FGD Operating & Control Philosophy * FGD Process Data Sheets * FGD System Description * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report	* P&ID * Product Basic Design Pack * Product Basic Design Report

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Perform flue gas desulphurisation system basic design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* P&ID * Product Basic Design Pack * Product Basic Design Report	* P&ID * Product Basic Design Pack * Product Basic Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

CONTROLLED DISCLOSURE
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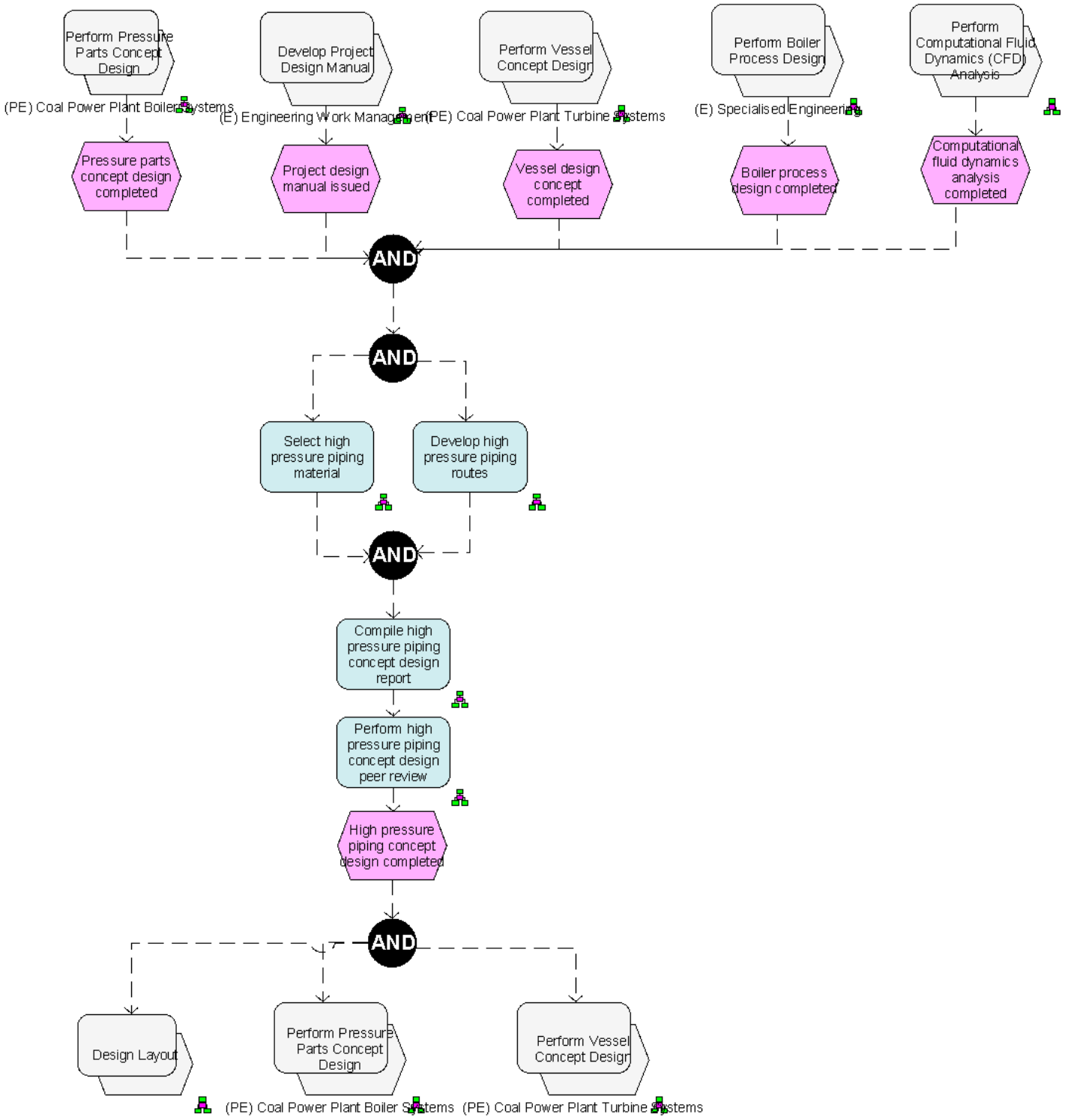
9.1.19 Perform High Pressure Piping Concept Design



CONTROLLED DISCLOSURE
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ACTIVITY: Select high pressure piping material

The material shall be selected to ensure that all service life and design requirements (Pressure/temperature rating, media, erosion and corrosion resistance, etc.) are met.

These requirements will be given in:

* Boiler mass and energy balance (MEB) report, or the boiler process output sheet
* Thermal cycle analysis report
* CFD report
* Relevant manuals & documentation containing stakeholder and system requirements

The piping material shall be determined by the relevant standards, described in the specification that governs high pressure pipework. Material that are subject to material loss, fatigue cracking and creep cracking mechanisms, should be chosen using the guidelines as described in the overarching piping specification to reduce or eliminate these mechanisms.

Note: Each concept may have a different material, and the material selection may change later as the design process is an iterative process; however it is generally the case that the material which will be used is predefined.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
N.PSZ 45-223: High Pressure Pipework for Fossil Fired Power Stations

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler MEB Report * Boiler Process Output Sheet * CFD Report * Preferred Materials Report (RT&D) * Project Design Manual * Thermal Cycle Analysis Report	* Code Compliance Report * Piping Material Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	* Lead Discipline Engineering Practitioner (Business Role)	None

APPLICATIONS	SCREENS
CAESAR II	

ACTIVITY: Develop high pressure piping routes

Using the information given by boiler, turbine, civil and structural engineering as presented in the relevant documents containing stakholder and system requirements the piping routes are planned. The piping routes shall be efficient, economical and systematic. All the prescribed standards shall be adhered to.

The concept design phase shall be done for multiple piping concepts.

The following are considered, but is not limited to, in the development of piping routes:
* plant layout
* specified terminal points
* pipe flexibility
* length of the piping
* welding of piping
* placement of supports
* placement of anchors
* minimization of stress intensified areas
* vertical stop on all major steam systems
* provision for bypass system
* provision for adequate drainage
* warming rates of the steam systems

CONTROLLED DISCLOSURE
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* maintaining hot conditions
* maintainability
* insulation thickness and density
* standard erection procedures
* on site constructability
* loads carried by supports
* facilities for easy monitoring of the different levels of the pipe system in service
* provision for primary measuring and control elements
* placement of isolating valves
* placement of drain valves
* placement of control valves
* price of piping

During the concept phase the above mentioned parameters are only considered during the phase where the piping routes are developed, detailed calculations are not required at this stage as it will be done during the basic and detail design phase.

The general arrangement drawings and scantlings will be an output of this process. Scantlings are documents that are compiled by the design engineer that indicates preliminary dimensions and layout of pipes.

When determining the route and number of pipes (piping arrangement) the following needs to be known:

* Preliminary P&ID
* Pressure
* Temperature
* Phase and medium flows through the piping system.

The influence of all piping components on the pressure drop shall be established when determining the number and sizes of pipes. The number of pipes shall be determined in such a way that the piping systems is efficient economical and systematic and code compliant, with pipe-flexibility, mass, price, safety and maintainability held in mind.

The P&ID shall be updated concurrently with this activity.
.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
45-224: High Pressure Pipe Work Supports
GGS 0182: Process Flow Diagrams and Piping Instrumentation Diagrams
N.PSZ 45-223: High Pressure Pipework for Fossil Fired Power Stations

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Project Design Manual	* Concept Piping ISO drawing * General arrangement drawings * Scantlings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Compile high pressure piping concept design report

This activity will consolidate all design activities carried out during the concept design within a single design report, with a concise delineation of the
process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level concept design report.

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* System Design Report (TBD) * Code Compliance Report * General Arrangement Drawings * Piping Material Report	* Product Concept Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Perform high pressure piping concept design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report	* Product Concept Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

CONTROLLED DISCLOSURE
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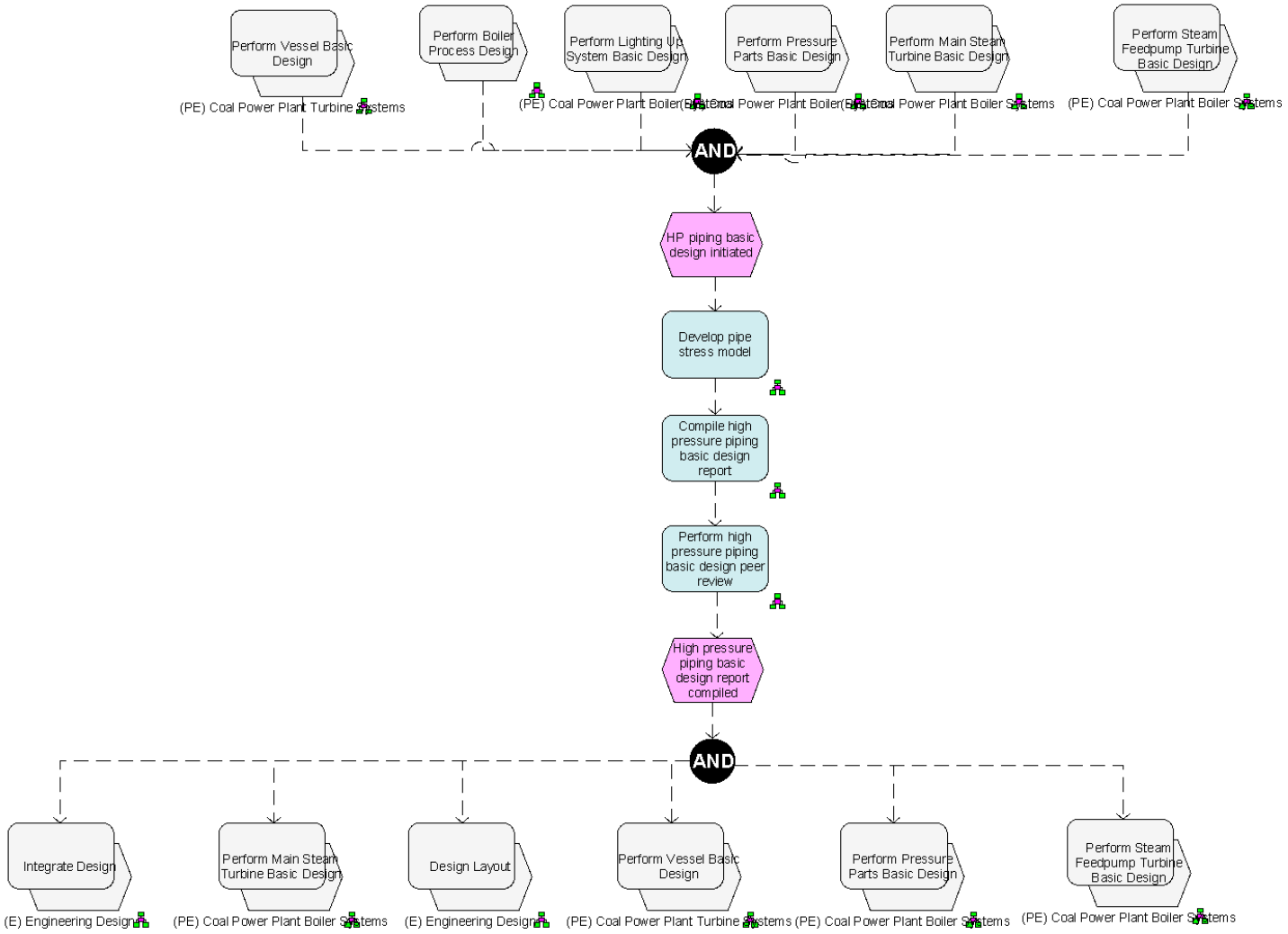
9.1.20 Perform High Pressure Piping Basic Design



CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

ACTIVITY: Develop pipe stress model

The material and pipe layout information that has been captured in the concept design report shall be used as starting parameters to the design.

During the basic design phase a detail piping stress model shall be created. The model shall include all conditions imposed on the piping systems e.g.:

* Terminal points
* Hanger locations.
* Pipe material,
* Pipe dimensions,
* Operating conditions (pressure and temperature)
* Installed stresses (e.g. cold pull),
* Valves and piping insulation weight and any other elements that might have a significant effect on the stress results of the piping model.
* External loading

The magnitude of forces and moments which will be applied to the concrete or steel structures and the maximum tolerance at the locations of hangers and terminal points will be determined to keep within the design intent. For small lines such as drains and vents a rudimentary flexibility analysis shall be sufficient. The effects of HP bypass piping, reheat safety line piping and IP/LP bypass piping shall be taken into account in the flexibility analysis.

From the pipe stress model the support schedule and pipe stress report shall can be created and recorded. The forces on the terminal points and pipe deflections shall also be recorded as part of the pipe stress report.The pipe stress report may also indicate if the piping system is code compliant.

Note: Components that have detailed stress distributions and stress concentration areas, such as T-pieces, Y-pieces, and spherical headers have to be manually checked for code compliance.

The ISO and layout drawings must be updated according to the changes that were made to the pipe stress model.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
240-53114186: Document & Record Management Procedure
45-224: High Pressure Pipe Work Supports
GST 36-978: Thermal Insulation Standard
N.PSZ 45-223: High Pressure Pipework for Fossil Fired Power Stations

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Concept Piping ISO drawing * Product Concept Design Report	* ISO and Layout Drawings * Pipe Stress Report * Piping Stress Model * Support Schedule

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAESAR II	
ROHR II	

ACTIVITY: Compile high pressure piping basic design report

This activity will consolidate all design activities carried out during the basic design within a single design report, with a detailed delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level basic design report.

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Basic design report template * ISO and Layout Drawings * Pipe Stress Report * Piping Stress Model * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report * Support Schedule	* P&ID * Product Basic Design Pack * Product Basic Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
CAESAR II	
ROHR II	

ACTIVITY: Perform high pressure piping basic design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

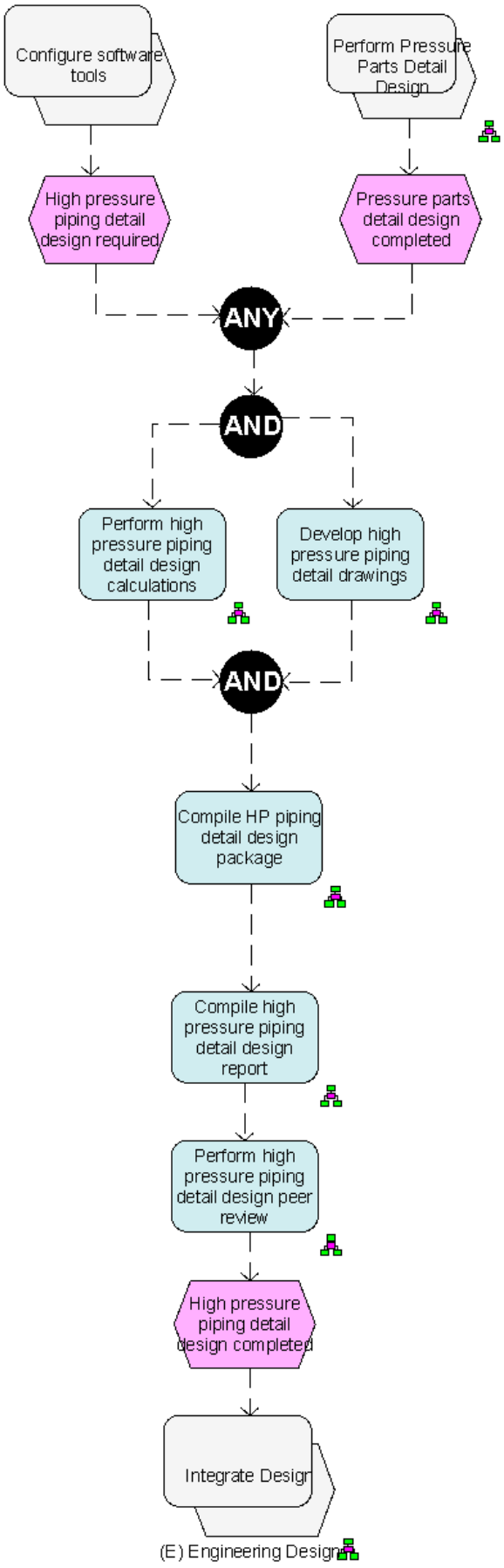
GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* P&ID * Product Basic Design Pack * Product Basic Design Report	* P&ID * Product Basic Design Pack * Product Basic Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

9.1.21 Perform High Pressure Piping Detail Design



CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

ACTIVITY: Perform high pressure piping detail design calculations

In this activity high pressure piping detail design calculations are done.

The input data for the detail design calculations are gathered from relevant drawings, stress related information, scheduled and reports'

Calculations that are done on all components are recorded, this included:

* Catalogue calculations,
* Code calculations
* First principle calculations
* Heat transfer calculations
* Fluid-dynamics calculations
* Stress calculations
* Creep strength calculations
* Other application specific or relevant calculations

These calculations are done to determine any of the following that is relevant to the applications:

* Service life of the components
* Stresses in the components
* Deformation of the components
* Forces applied to the components, or applied by the components
* Moments applied to the components
* Temperature and pressure applied to components
* Geometry of components
* Reaction forces at boundary conditions

The detail design calculations are done according to the relevant governance standard that describes the design procedure for high pressure pipework for fossil fired power stations. This document will reference international standards that shall be used for the design of high pressure piping. The document will also reference standards that have to be adhered to according to international and national legislation.

NOTE: The piping design procedure is an iterative procedure; this means that if some changes are made to the piping system at this stage the applicable pipe stress model has to be updated and all affected activities that are done with regards to pipe stress design have to be reviewed.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
N.PSZ 45-223: High Pressure Pipework for Fossil Fired Power Stations

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* ISO and Layout Drawings * P&ID * Pipe Stress Report * Piping Stress Model * Product Basic Design Pack * Product Basic Design Report * Support Schedule	* Detail Design Calculations Results

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAESAR II	
HP Piping Calculations Tool (Excel)	
ROHR II	

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

ACTIVITY: Develop high pressure piping detail drawings

In this activity high pressure piping detail drawings are developed using the final updated P&ID and product basic design report.

These drawings will contain detail dimensions that fully define the geometry of all the components. These drawings will be used as manufacturing, fabrication and construction drawings with the appropriate tolerances, welding and machining information indicated on the drawings.

Assembly drawings and isometric system drawings shall be created to indicate how the components and spools fit together.These drawings shall indicate the positions of support lugs, valves, orifices, welds, stubs, pipe guides, stop blocks, support cams, cams for creep measurement and any other information that is informative to the individual that will be using the drawing.

Sectionalised drawings shall be created to indicate more detailed information on the piping spools. These sectionalised drawings are typically specific to individual legs of the piping systems, or main spools.

A detailed method statement shall be compiled in conjunction with the detail drawings. This method statement shall be low level and shall describe the correct erection procedure for the piping system step by step.

The drawings shall be unit specific and revision controlled.

All the above mentioned drawings shall make part of the high pressure piping drawing package

Note: The drawing package is not limited to contain the above mentioned drawings only.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* P&ID * Product Basic Design Pack * Product Basic Design Report	* HP Piping Drawing Package

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Compile HP piping detail design package

A detail design package is compiled that includes instruction on the piping method, a manual explaining the detail design approach and fabrication method as well as all the necessary drawings that include fabrication drawings and workshop drawings.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* HP Piping Drawing Package	* Detail design package * Piping Method Statement * Product Detail Design Manual

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

ACTIVITY: Compile high pressure piping detail design report

This activity will consolidate all design activities carried out during the detail design within a single design report, with a detailed delineation of the process-, functional- and layout design as well as equipment- and three dimensional drawings. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as the manufacturing manual.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Detail Design Calculations Results * Detail design package * HP Piping Drawing Package * Piping Method Statement * Product Detail Design Manual	* HP Piping Detail Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
HP Piping Calculations Tool (Excel)	

ACTIVITY: Perform high pressure piping detail design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

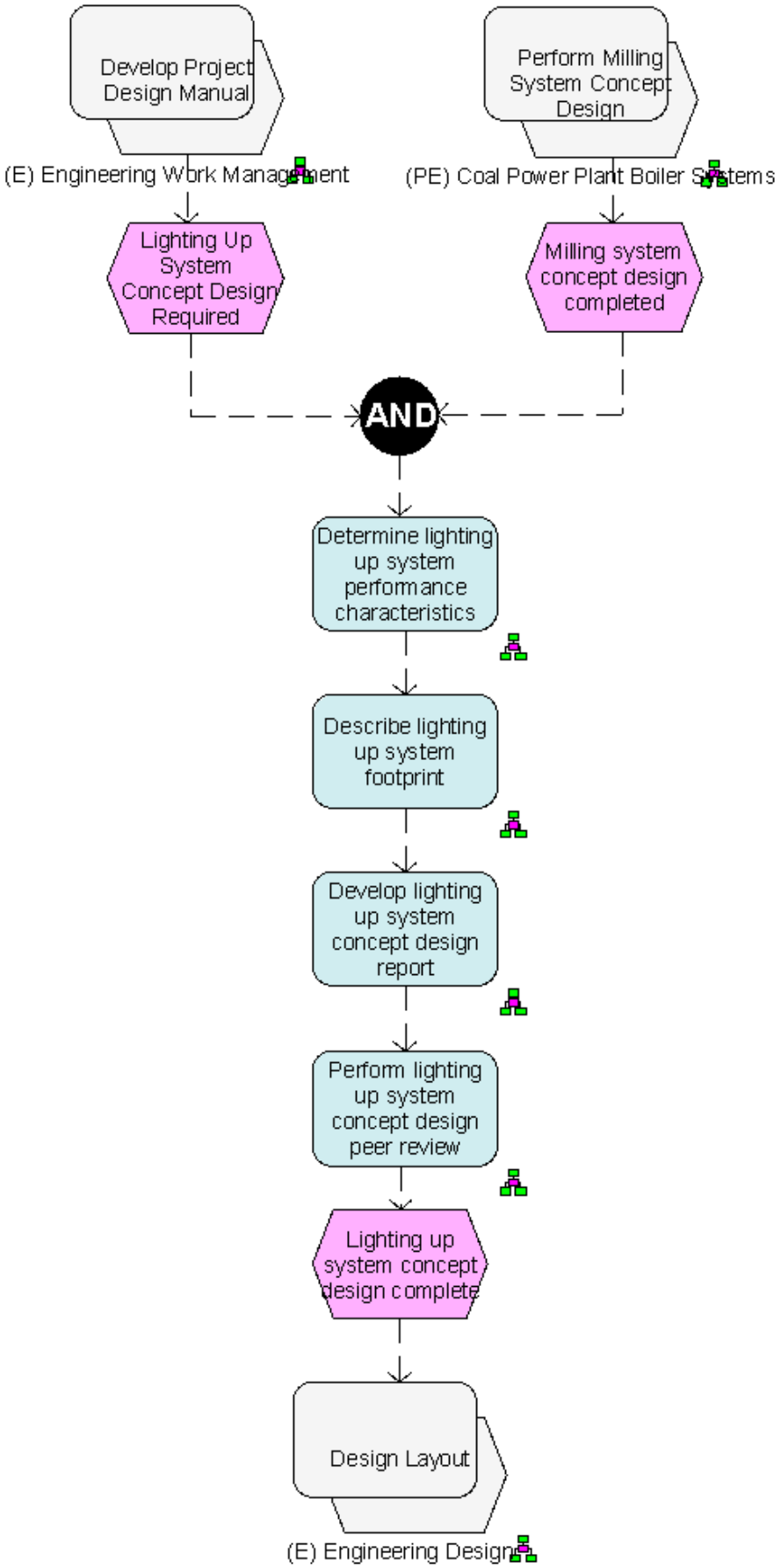
GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* HP Piping Detail Design Report	* HP Piping Detail Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

9.1.22 Perform Lighting Up System Concept Design



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When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

ACTIVITY: Determine lighting up system performance characteristics

In this activity the performance characteristics are determined. The typical input parameters are:

* The plant configuration.
* The type of fuel and its characteristics (i.e. viscosity, flash point and atomising point).

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
GGR 0568: PFFR
GGR 0992: Plant Safety Regulation (PSR)
NWS 1414: Fuel oil plants for fossil fired power stations
NWS 1454: Thermal Insulation At Power Stations
Quality Assurance Plan (TBD)
SANS 10086-1
SANS 10108
SANS 10119
SANS 10140-3

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Fuel Oil Specification * Product Process Flow Diagram * Product Process Flow Report * System Configuration Layout	* Lighting Up System Performance Characteristics Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Describe lighting up system footprint

In this activity the lighting up system footprint is described.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Lighting Up System Performance Characteristics Report	* General Arrangement Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Develop lighting up system concept design report

This activity will consolidate all design activities carried out during the concept design within a single design report, with a concise delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level concept design report.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* System Design Report (TBD) * General Arrangement Drawings * Lighting Up System Performance Characteristics Report	* Product Concept Design Report

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Perform lighting up system concept design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

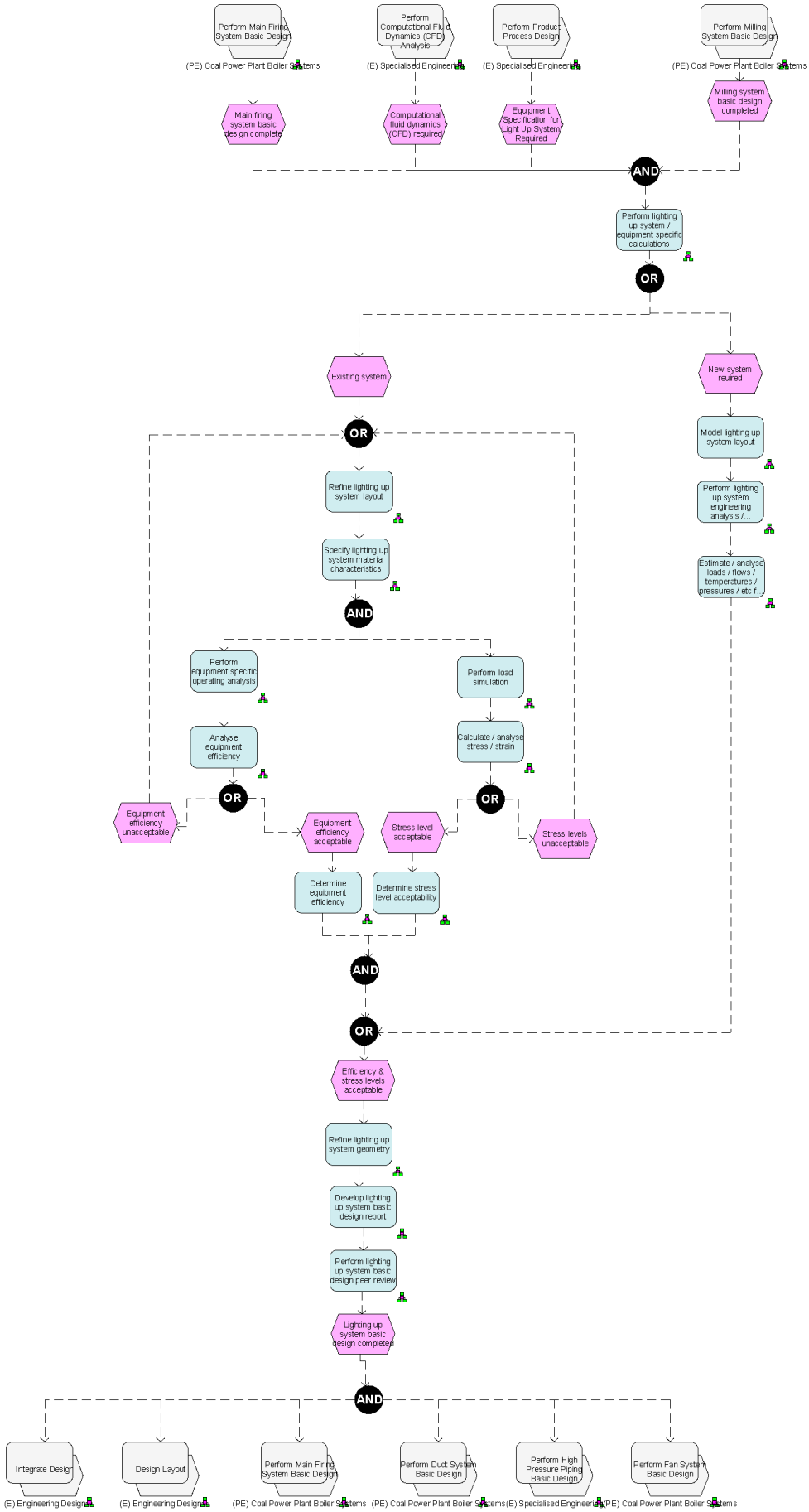
GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report	* Product Concept Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

9.1.23 Perform Lighting Up System Basic Design



CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

ACTIVITY: Perform lighting up system / equipment specific calculations

The energy requirements are calculated by taking the following input parameters into account:

* Boiler arrangement / layout (as well as the main firing system configuration and sequence of operation)
* Boiler process parameters (load conditions, coal and/or air mass flows, temperatures, pressures)

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
GGR 0568: PFFR
GGR 0992: Plant Safety Regulation (PSR)
NWS 1414: Fuel oil plants for fossil fired power stations
NWS 1454: Thermal Insulation At Power Stations
SANS 10086-1
SANS 10108
SANS 10119
SANS 10140-3

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Arrangement Drawing * Product Process Flow Diagram * Product Process Flow Report * Project Design Manual	* Lighting Up System Data Sheets

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Model lighting up system layout

In this activity the model and sketch of the lighting up system are done taking into account the following:

* Fuel flow requirements and characteristics
* The preliminary light-up system drawings are developed

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Lighting Up System Data Sheets	* System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Perform lighting up system engineering analysis / simulation

In this activity the lighting up system engineering analysis is done. Typical input parameters for different load conditions take into account are:

* Fuel characteristic
* Main firing system / boiler load requirements.

The output is the revised lighting-up system report.

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INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Lighting Up System Data Sheets	* Lighting Up System Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Lighting Up System Calculation Sheet	

ACTIVITY: Estimate / analyse loads / flows / temperatures / pressures / etc for lighting up system

In this activity estimations are done, loads analysed, flows and temperatures determined and the data sheets updated to reflect this information.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
36-680: Fossil Fuel Firing Regulation
NPMZ 45-392: Fire Protection Manual

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Lighting Up System Analysis Report * Lighting Up System Data Sheets * Preliminary Layout Drawings	* Lighting Up System Data Sheets

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Lighting Up System Calculation Sheet	

ACTIVITY: Refine lighting up system layout

In this activity the lighting up system's geometry is refined. Typical input required to refine the system geometry:

* Preliminary system geometry
* System requirements

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawings * Lighting Up System Data Sheets * P&ID	* General Arrangement Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Specify lighting up system material characteristics

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When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

In this activity the lighting up system's material characteristics are specified taking into account the following:

* Light-up system general arrangement drawings
* Light-up system geometry and system requirements.

From these, the bill of materials is established.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General arrangement drawings * Layout Drawings & Geometry * P&ID	* Bill of Materials

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Perform equipment specific operating analysis

In this activity equipment specific operating analysis is done. Typical input parameters are:

* Lighting-up system geometry and general arrangement drawings
* Bill of materials developed.
* P&IDs

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Bill of Materials * General arrangement drawings * Layout Drawings & Geometry * P&ID	* Operating Analysis & Sequencing Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Lighting Up System Analysis Tool (Excel)	

ACTIVITY: Analyse equipment efficiency

In this activity the equipment efficiency is analysed by comparing the system requirements against the actual load output of lighting-up system design.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Operating Analysis & Sequencing Report	* Efficiency Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS

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Lighting Up System Analysis Tool (Excel)	

ACTIVITY: Determine equipment efficiency

In this activity the equipment efficiency is determined taking into account the following;

* Lighting-up system configurations
* System load requirements.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Efficiency Report	* Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Perform load simulation

In this activity load simulations are performed for full load and part load simulations taking into account the following;

* Lighting-up system configurations
* System load requirements

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General arrangement drawings * Layout Drawings & Geometry * Lighting Up System Data Sheets * P&ID	* Load Simulation Data

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Load Simulation Excel Tool	

ACTIVITY: Calculate / analyse stress / strain

In this activity calculations are done to analyse stress and strain. Typical input parameters:

* Lighting up system general arrangement drawings
* Load simulation parameters

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General arrangement drawings * Layout Drawings & Geometry * Load Simulation Data * P&ID	* Stress Analysis Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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APPLICATIONS	SCREENS
Stress Analyses Excel Sheet	

ACTIVITY: Determine stress level acceptability

In this activity the acceptability of stress is determined.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Stress Analysis Report	* Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Refine lighting up system geometry

This activity describes the refinement during the basic design of the three dimensional layout of the lighting up system and corresponding equipment like the burners in relation to other systems initially done during the concept design.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawings * P&ID	* General Arrangement Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Develop lighting up system basic design report

This activity will consolidate all design activities carried out during the basic design within a single design report, with a detailed delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level basic design report.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:

36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Basic design report template * General Arrangement Drawings * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report * System & Layout Drawings	* P&ID * Product Basic Design Pack * Product Basic Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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ACTIVITY: Perform lighting up system basic design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* P&ID * Product Basic Design Pack * Product Basic Design Report	* P&ID * Product Basic Design Pack * Product Basic Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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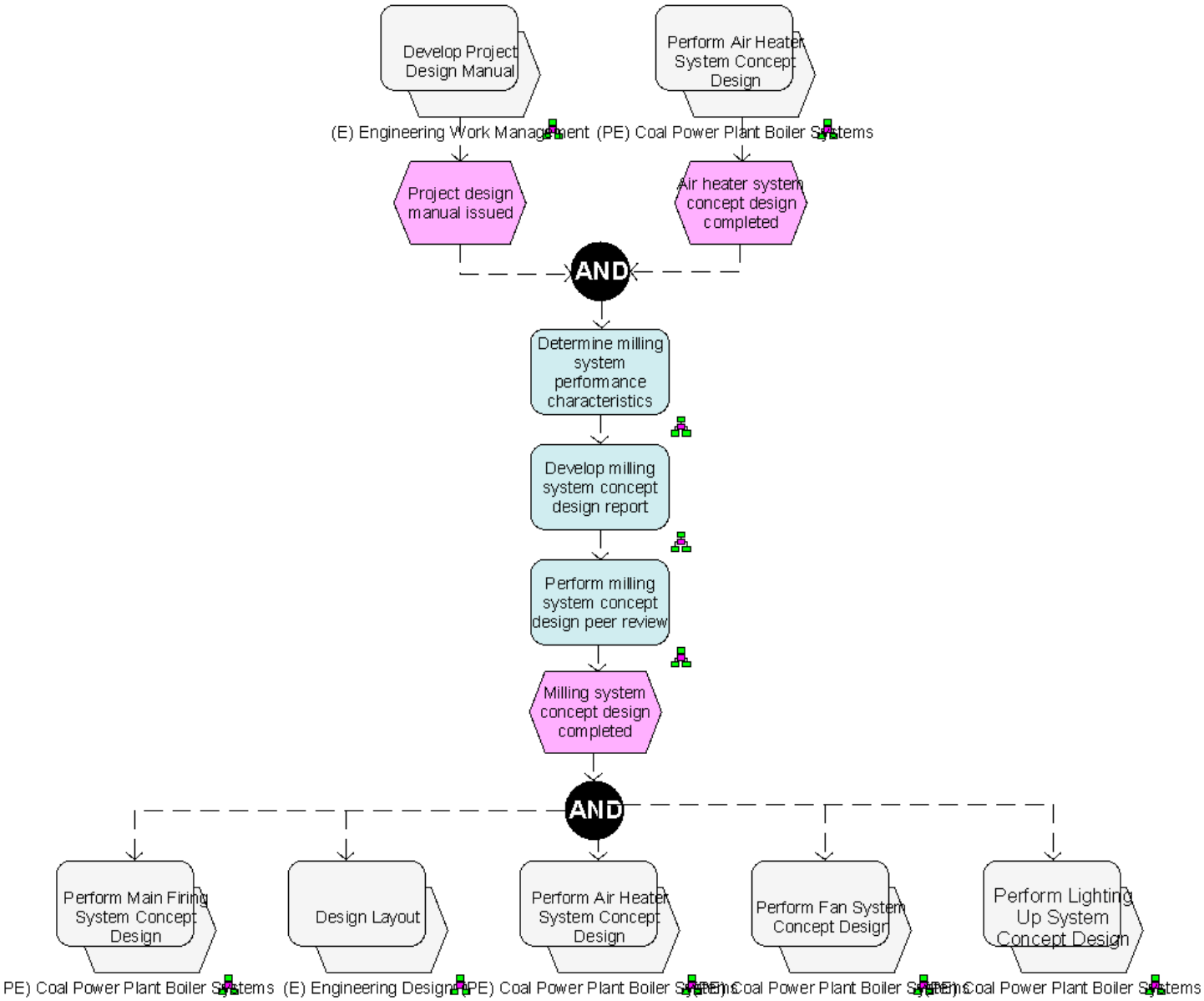
9.1.24 Perform Milling System Concept Design



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ACTIVITY: Determine milling system performance characteristics

The performance characteristics (operating conditions) are determined from information contained in the relevant PFDs as well as manuals and documents containing stakeholder and system requirements. Typically, the following is required:

* Design life for grinding material
* Temperatures
* Coal flows
* Primary air flow
* Product quality (particulate size distribution and mass distribution)
* Top size of raw coal
* Number of ills required for full load (n+1)
* Load factor of the mills

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Process Output Sheet * Product Process Flow Report * Project Design Manual * Stakeholder Requirements Definition	* Milling System Performance Characteristics Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop milling system concept design report

This activity will consolidate all design activities carried out during the concept design within a single design report, with a concise delineation of the
process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level concept design report.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Milling System Performance Characteristics Report	* Product Concept Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Perform milling system concept design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

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INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report	* Product Concept Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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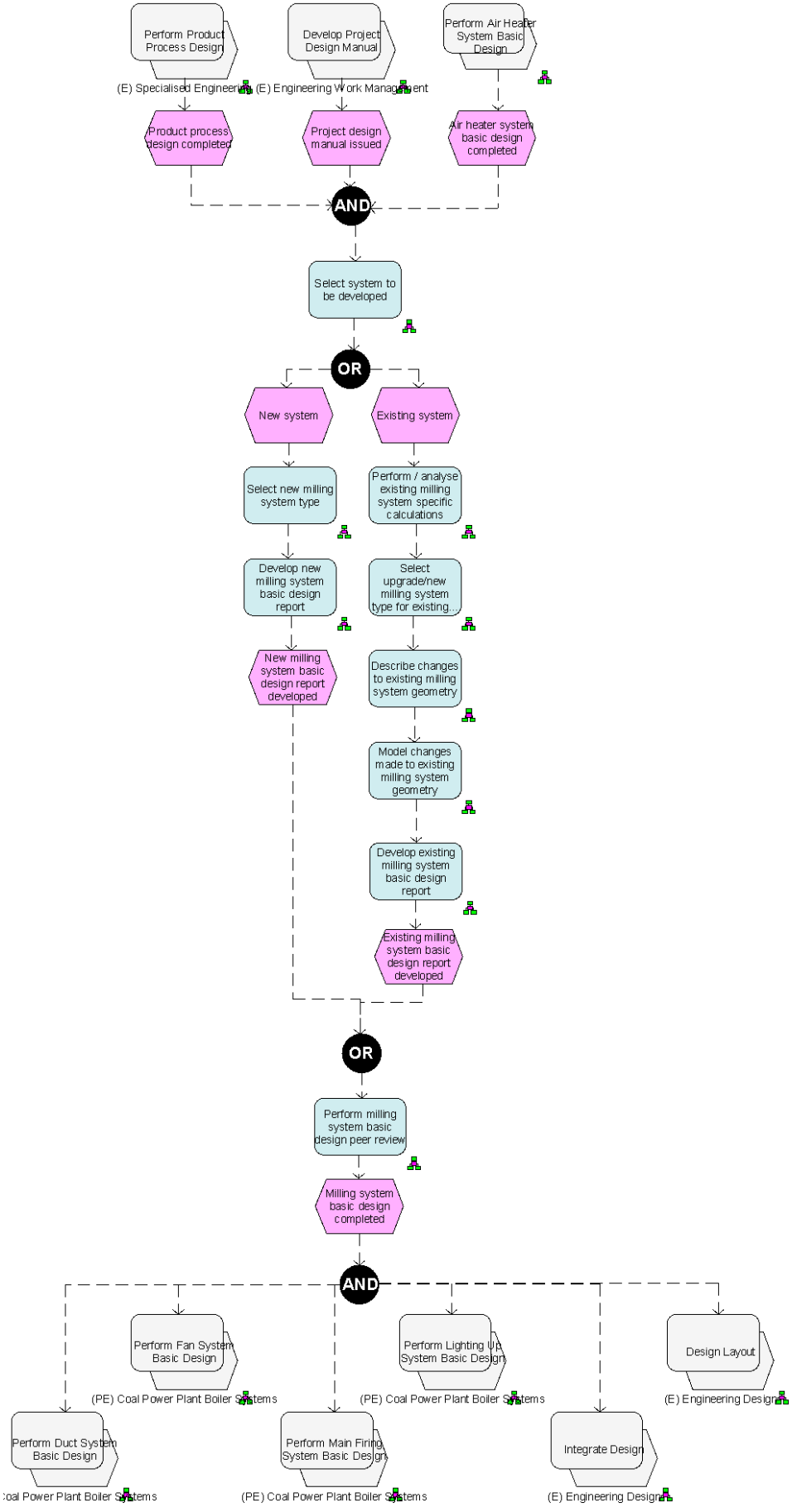
9.1.25 Perform Milling System Basic Design



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ACTIVITY: Select system to be developed

This entails the selection of whether the milling system will be a new one or the upgrading of an existing system.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Process Output Sheet * Product Concept Design Report * Product Process Flow Report * Project Design Manual * Stakeholder Requirements Definition * Tenderer Basic Design Report	* Record of Decision * Tenderer Basic Design Documents Evaluated

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Select new milling system type

This activity uses the basic design documents from tenderers to select a new milling system type for a new plant.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Tenderer Basic Design Documents	* Milling System Type Selection Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop new milling system basic design report

Develop new milling system basic design report

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:

36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures
36-789: Specification For Tube Mill Grinding Media
36-796: Hollow Grinding Balls for B&W Mills
36-804: Specification for Tube Mill Girth & Pinion Lubrication
36-805: Specification for Tube Mill Liner Material
GGL 361095: Vibration Base Condition Monitoring of Rotating Aux Plant Machinery (TBD)
GGSS 0667: Specification For Ceramic Lined Pulverised Fuel Pipework
GGSS 0668: Specification for Grinding Elements for Loesche, Lopulco & PHI Mills
GGSS 0669: Specification for Grinding Rings for E-Mills (TBD)
Guideline for Maintenance of Mill Reducer Gearboxes (TBD)
NWS 1454: Thermal Insulation At Power Stations

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Milling System Type Selection Report * Product Concept Design Report	* P&ID * Product Basic Design Pack * Product Basic Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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ACTIVITY: Perform / analyse existing milling system specific calculations

This activity describes the engineering specific calculations required for an existing milling system basic design. Typical engineering specific calculations that are performed / analysed are loads, flows, temperatures and pressures.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Process Output Sheet * Product Concept Design Report * Product Process Flow Report * Project Design Manual * Stakeholder Requirements Definition	* Milling System Analysis Report * Milling System Description

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Milling System Calculation Tool (Excel)	

ACTIVITY: Select upgrade/new milling system type for existing milling system

This activity uses the results from the milling system description and engineering calculations to select either the upgrade requirements or new milling system.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Milling System Description * Stakeholder Requirements Definition	* Milling System Type Selection Report * Milling System Type Specification

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Describe changes to existing milling system geometry

This activity uses the description resulting from the engineering calculations to develop a geometric model of a milling system that takes the existing plant into consideration.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Civil Calculations * Civil Drawings * Layout drawings * Milling Duct and Piping Drawings * Milling System Description	* Milling System Geometry Change Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS

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CAD	
CFD	

ACTIVITY: Model changes made to existing milling system geometry

This activity describes the total plant layout of a milling system in relation to other systems.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
36-680: Fossil Fuel Firing Regulation
NPMZ 45-392: Fire Protection Manual

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Milling System Description * Milling System Equipment Drawings * Milling System Performance Characteristics Report * Milling System Type Selection Report * Milling System Type Specification * System & Layout Drawings	* General Arrangement Drawings * Milling System Change Report * Operating Philosophy * P&ID

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Develop existing milling system basic design report

This activity will consolidate all design activities carried out during the basic design within a single design report, with a detailed delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level basic design report.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures
36-789: Specification For Tube Mill Grinding Media
36-796: Hollow Grinding Balls for B&W Mills
36-804: Specification for Tube Mill Girth & Pinion Lubrication
36-805: Specification for Tube Mill Liner Material
GGL 361095: Vibration Base Condition Monitoring of Rotating Aux Plant Machinery (TBD)
GGSS 0667: Specification For Ceramic Lined Pulverised Fuel Pipework
GGSS 0668: Specification for Grinding Elements for Loesche, Lopulco & PHI Mills
GGSS 0669: Specification for Grinding Rings for E-Mills (TBD)
Guideline for Maintenance of Mill Reducer Gearboxes (TBD)
NWS 1454: Thermal Insulation At Power Stations

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* 240-49910705: Basic Design Report Template (To be developed) * General Arrangement Drawings * Milling System Analysis Report * Milling System Description * Milling System Equipment Drawings * Milling System Type Selection Report * Product Concept Design Report * Product Process Flow Report * System & Layout Drawings	* P&ID * Product Basic Design Pack * Product Basic Design Report * System & Layout Drawings

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RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Perform milling system basic design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* P&ID * Product Basic Design Pack * Product Basic Design Report	* P&ID * Product Basic Design Pack * Product Basic Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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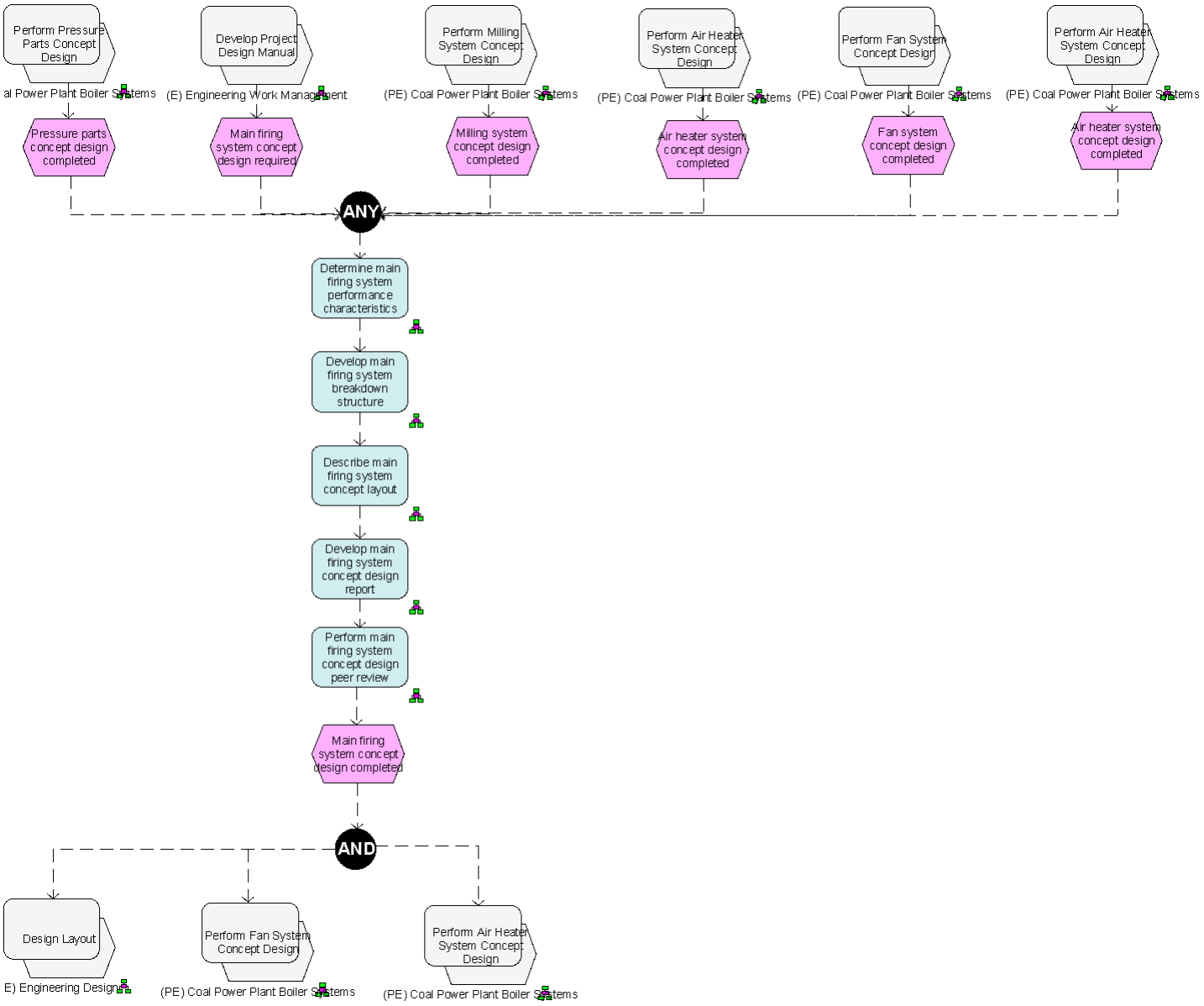
9.1.26 Perform Main Firing System Concept Design



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ACTIVITY: Determine main firing system performance characteristics

The performance characteristics (operating conditions) are determined from information contained in the relevant process sheets as well as manuals and documents containing stakeholder and system requirements. Typically, the following is required:

* Coal flows and quality
* Temperatures
* Pressures
* Air mass flows
* Boiler geometry

The output of this activity is to produce a report containing the following information for different boiler load conditions:

* Air mass flows
* Coal flows
* Temperatures and pressures

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Process Output Sheet * Product Process Flow Diagram * Product Process Flow Report * Project Design Manual * Stakeholder Requirements Definition	* Main Firing System Performance Characteristics Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop main firing system breakdown structure

Based on the performance characteristics the main components are identified and sized through simulations and calculations using the relevant design tools.

Typically the output of this activity is:

* Main firing system concept as one component;
* Sub-components and the functionality thereof.
* Process flow parameters (coal and/or air mass flows and velocities) through the different sub-components from the simulations and calculations.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Main Firing System Performance Characteristics Report	* Main Firing System Breakdown Structure

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Main Firing System Design Tool (Excel)	

ACTIVITY: Describe main firing system concept layout

This activity uses the system breakdown structure to describe the conceptual footprint of the main firing system in relation

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to other systems and equipment. The result is presented in drawings and P&IDs for the burners.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Main Firing System Breakdown Structure	* Burner Concept P&ID * System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Develop main firing system concept design report

This activity will consolidate all design activities carried out during the concept design within a single design report, with a concise delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level concept design report.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
GGR 0568: PFFR

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* System Design Report (TBD) * Burner Concept P&ID * Main Firing System Breakdown Structure * Main Firing System Performance Characteristics Report * System & Layout Drawings	* Product Concept Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Perform main firing system concept design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)

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* Product Concept Design Report	* Product Concept Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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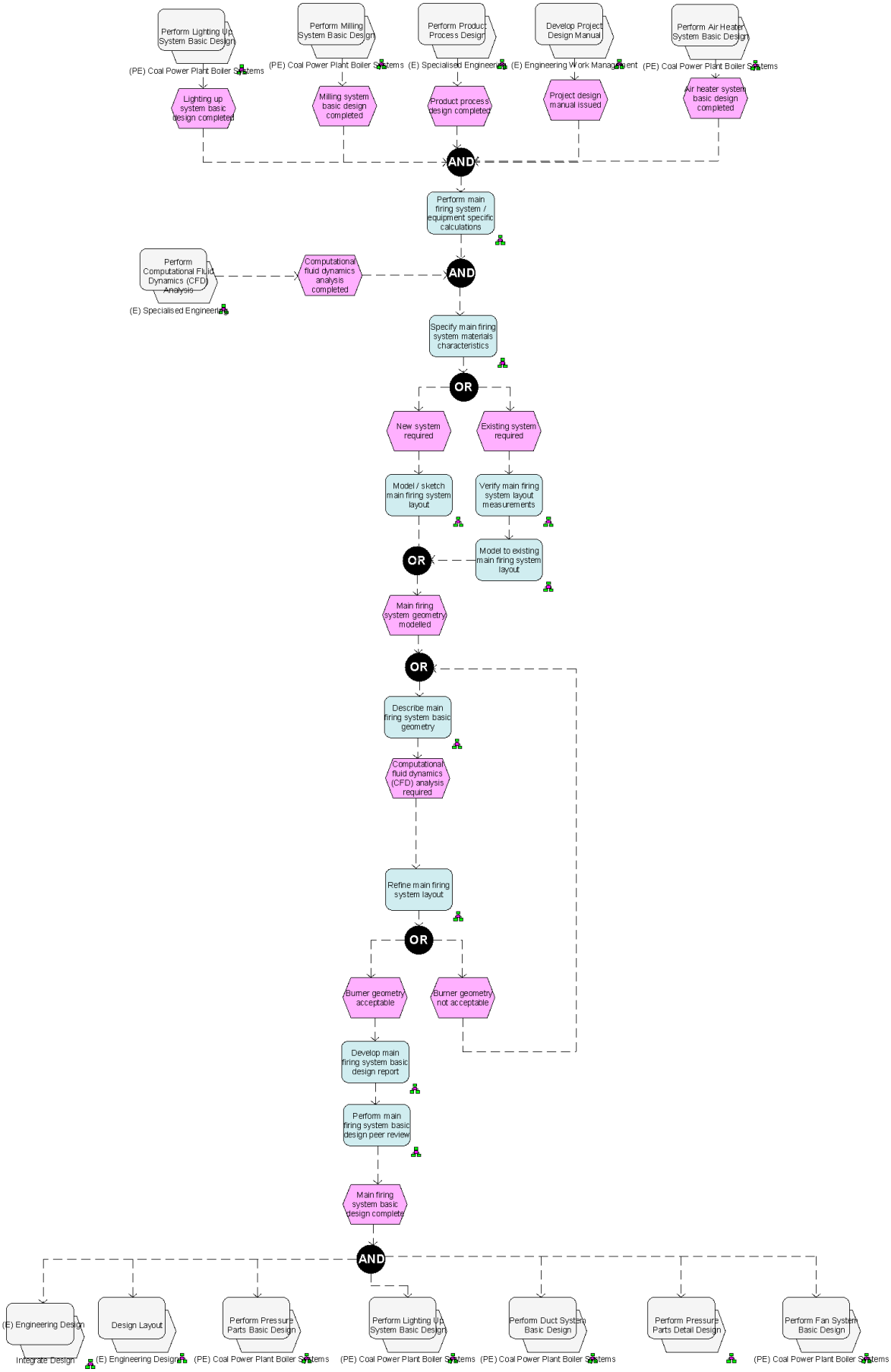
9.1.27 Perform Main Firing System Basic Design



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ACTIVITY: Perform main firing system / equipment specific calculations

This activity performs equipment specific calculations to determine burner geometry. To perform the main firing system equipment specific calculations, the following typical input information, from the concept design report and relevant documents containing stakeholder and system requirements, are required:

* General arrangement drawings;
* Process parameters (coal and air mass flows and temperatures)

The typical output produced is the burner data sheet, burner geometry and main firing system / equipment specification calculation sheet.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Main Firing System Concept Design Report * Project Design Manual	* Burner Data Sheet * Burner Geometry Report * Main Firing System / Equipment Specification Calculation Sheet

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Burner Calculation Sheet (Excel)	

ACTIVITY: Specify main firing system materials characteristics

In this activity the preliminary bill of materials is specified. To produce the typical bill of materials the following typical input are required:

* Main firing system and equipment specific calculations. These calculations outline the typical sizes of the different sections, coal and/or mass flows, air flow ratios.
* From the burner geometry, the material list is populated for each section.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Main Firing System Materials List * Burner Geometry Report * Main Firing System / Equipment Specification Calculation Sheet	* Preliminary Bill of Materials * Preliminary Bill of Quantities

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Model / sketch main firing system layout

Using the burner data, burner geometry and the information resulting from the main firing system / equipment calculations the main firing system geometry is drawn and / or described by computer aided modelling.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Burner Data Sheet * Burner Geometry Report * Main Firing System / Equipment Specification	* Burner layout and Footprint Report * Main Firing System & Layout Drawings * Main Firing System Equipment & Drawings

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Calculation Sheet	

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Burner Calculation Sheet (Excel)	
Inventor CAD	

ACTIVITY: Verify main firing system layout measurements

In this activity the system layout measurements are verified. The main firing system geometry and process parameters are verified against the calculation check sheet as well making reference to the CFD modelling and results produced.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* CFD Report * Main Firing System General Arrangement Drawing	* Main Firing System Measurement Validation Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Model to existing main firing system layout

In this activity the Main Firing System is modelled to the Existing Main Firing System Geometry. This activity is conducted if the old main firing system is to be modified with the new design. For a completely new boiler design, the main firing system design is modelled to meet the boiler out requirements.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Burner Data Sheet * Main Firing System Measurement Validation Report	* Burner layout and Footprint Report * Main Firing System Equipment & Drawings * System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Burner Calculation Sheet (Excel)	
Inventor CAD	

ACTIVITY: Describe main firing system basic geometry

The equipment and system layout drawings are used to describe the main firing system basic geometry.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Main Firing System Characteristics Report * Main Firing System Equipment & Drawings * System & Layout Drawings	* General Arrangement Drawings

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Refine main firing system layout

This activity allows the engineer to analyse and refine burner size/geometry/layout taking the results of the CFD analysis into account. The typical input used to refine the main firing system geometry/layout are:

* The initial burner geometry/footprint produced (general arrangement drawings, velocity, oxygen, temperature profiles, sizes)
* CFD simulation results which consist of the oxygen, velocity and temperature profiles, particle size concentration of the various main firing system sub-components.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Burner layout and Footprint Report * CFD Report	* Burner layout and Footprint Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Develop main firing system basic design report

This activity will consolidate all design activities carried out during the basic design within a single design report, with a detailed delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level basic design report.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Basic design report template * Burner layout and Footprint Report * Main Firing System / Equipment Specification Calculation Sheet * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report	* General Arrangement Drawings * P&ID * Product Basic Design Pack * Product Basic Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Burner Calculation Sheet (Excel)	
CAD	
Inventor CAD	

CONTROLLED DISCLOSURE
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ACTIVITY: Perform main firing system basic design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* P&ID * Product Basic Design Pack * Product Basic Design Report	* P&ID * Product Basic Design Pack * Product Basic Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

CONTROLLED DISCLOSURE
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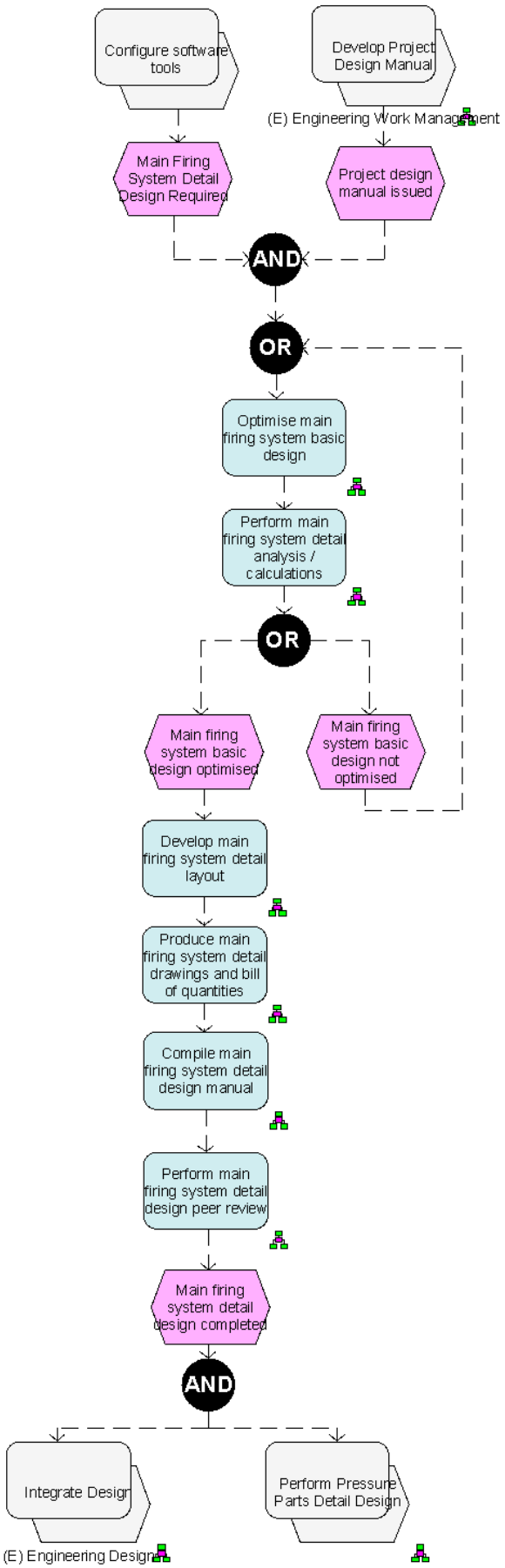
9.1.28 Perform Main Firing System Detail Design



CONTROLLED DISCLOSURE
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ACTIVITY: Optimise main firing system basic design

In this activity the main firing system basic design is optimised. For the purpose of modifying the existing main firing system with a new design, the new design is optimised taking into account the existing site layout. For the purpose of a completely new design, the main firing system basic design is optimised to meet the boiler output requirements.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Basic Design Pack * Product Basic Design Report	* Optimised Burner Basic Design Geometry * Revised Product Basic Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Burner Calculation Sheet (Excel)	

ACTIVITY: Perform main firing system detail analysis / calculations

In this activity the detail system analysis is done. The calculation is performed for different boiler load conditions (full load and part load).

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Optimised Burner Basic Design Geometry * Revised Product Basic Design Report	* Burner Data Sheet

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Burner Calculation Sheet (Excel)	
Burner Design Tool (TBA)	

ACTIVITY: Develop main firing system detail layout

In this activity the main firing system detail footprint is developed.

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Burner Data Sheet	* Burner Detail Design Geometry * System & Layout Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

ACTIVITY: Produce main firing system detail drawings and bill of quantities

The intent of this function is to produce detailed manufacturing drawings

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
Burner Basic Design Manual (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Burner Detail Design Geometry * Preliminary Bill of Quantities	* Bill of Quantities * Detailed General Arrangement Drawings * Fabrication & Manufacturing Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Inventor CAD	

ACTIVITY: Compile main firing system detail design manual

This activity will consolidate all design activities carried out during the detail design within a single design manual, with a detailed delineation of the process-, functional- and layout design as well as equipment- and three dimensional drawings. This manual is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as the manufacturing manual.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
Burner Operating & Control Philosophy (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Bill of Quantities * Detailed General Arrangement Drawings * Fabrication & Manufacturing Drawings * Product Basic Design Report	* Product Detail Design Manual

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Perform main firing system detail design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

* Detailed General Arrangement Drawings * Fabrication & Manufacturing Drawings * Product Detail Design Manual	* Detailed General Arrangement Drawings * Fabrication & Manufacturing Drawings * Product Detail Design Manual * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

CONTROLLED DISCLOSURE
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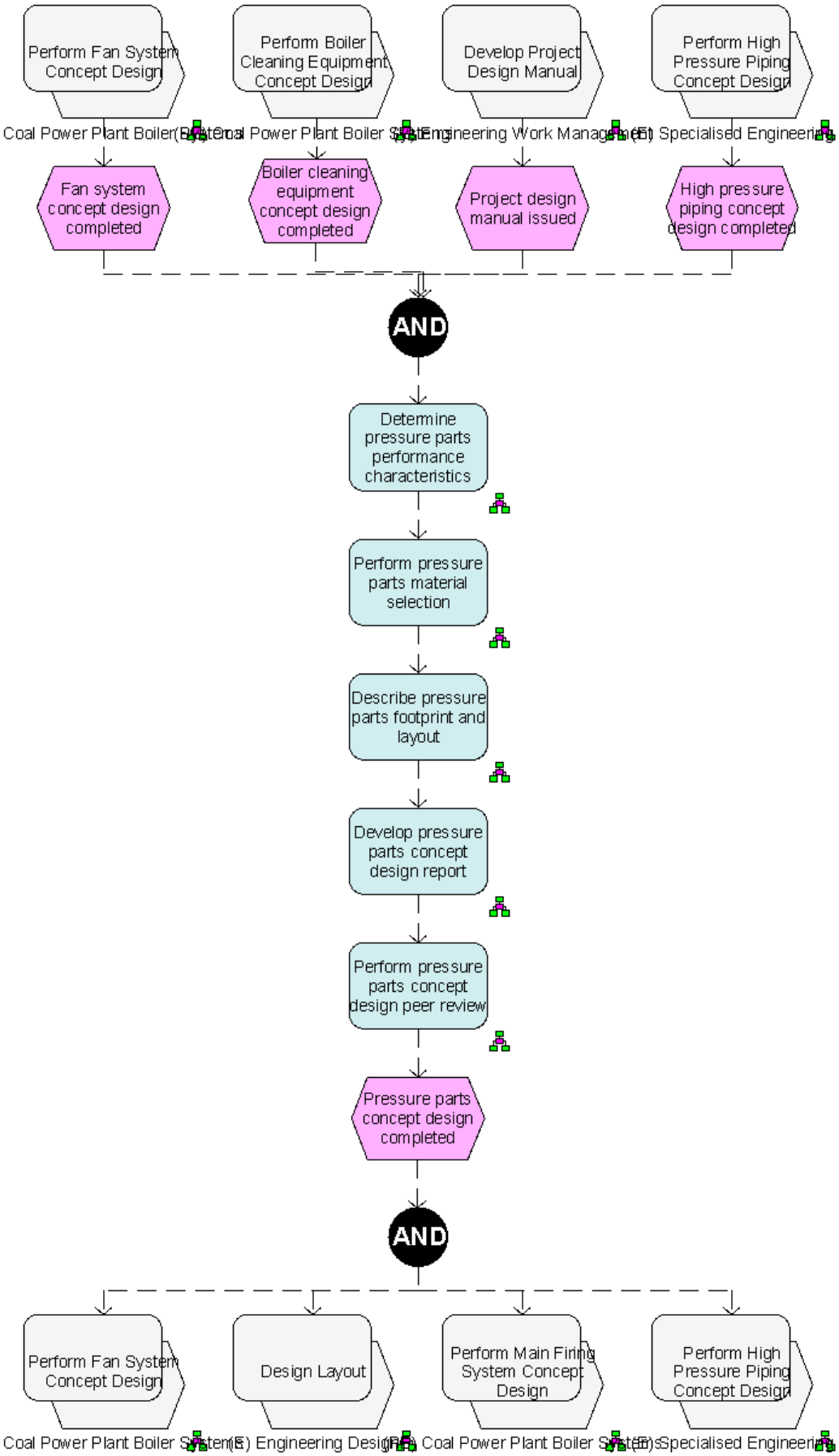
9.1.29 Perform Pressure Parts Concept Design



CONTROLLED DISCLOSURE
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ACTIVITY: Determine pressure parts performance characteristics

The performance characteristics (operating conditions) are determined from information contained in the relevant output sheets, design documents and documents containing stakeholder and system requirements. Typically, the following is required:

* Design life
* Temperatures
* Pressures
* Thermal cycles (start-up, shutdown, fatigue, excursions)

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
Pressure Parts Specification (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Boiler Process Output Sheet * Process Design Report * Project Design Manual	* Pressure Parts Performance Characteristics Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Perform pressure parts material selection

The material that is going to be used is to be selected, based on the information that is contained in the relevant report. Only the material that is to be used will be selected and not the dimensions of the material. This will be calculated at either the basic and/or detailed design stage.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
Pressure Parts Specification (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Civil Calculations * Civil Drawings * Pressure Parts Performance Characteristics Report * Vessel Design Parameter Report	* Pressure Parts Material Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

ACTIVITY: Describe pressure parts footprint and layout

In this activity the footprint and layout is described by means of a P&ID and the relevant drawings.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
Pressure Parts Specification (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Civil Calculations * Civil Drawings * Pressure Parts Performance Characteristics Report * Vessel Design Parameter Report	* General Arrangement Drawings * P&ID

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Develop pressure parts concept design report

This activity will consolidate all design activities carried out during the concept design within a single design report, with a concise delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level concept design report.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
Pressure Parts Specification (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawings * P&ID * Pressure Parts Material Report * Pressure Parts Performance Characteristics Report	* Product Concept Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	

ACTIVITY: Perform pressure parts concept design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Product Concept Design Report	* Product Concept Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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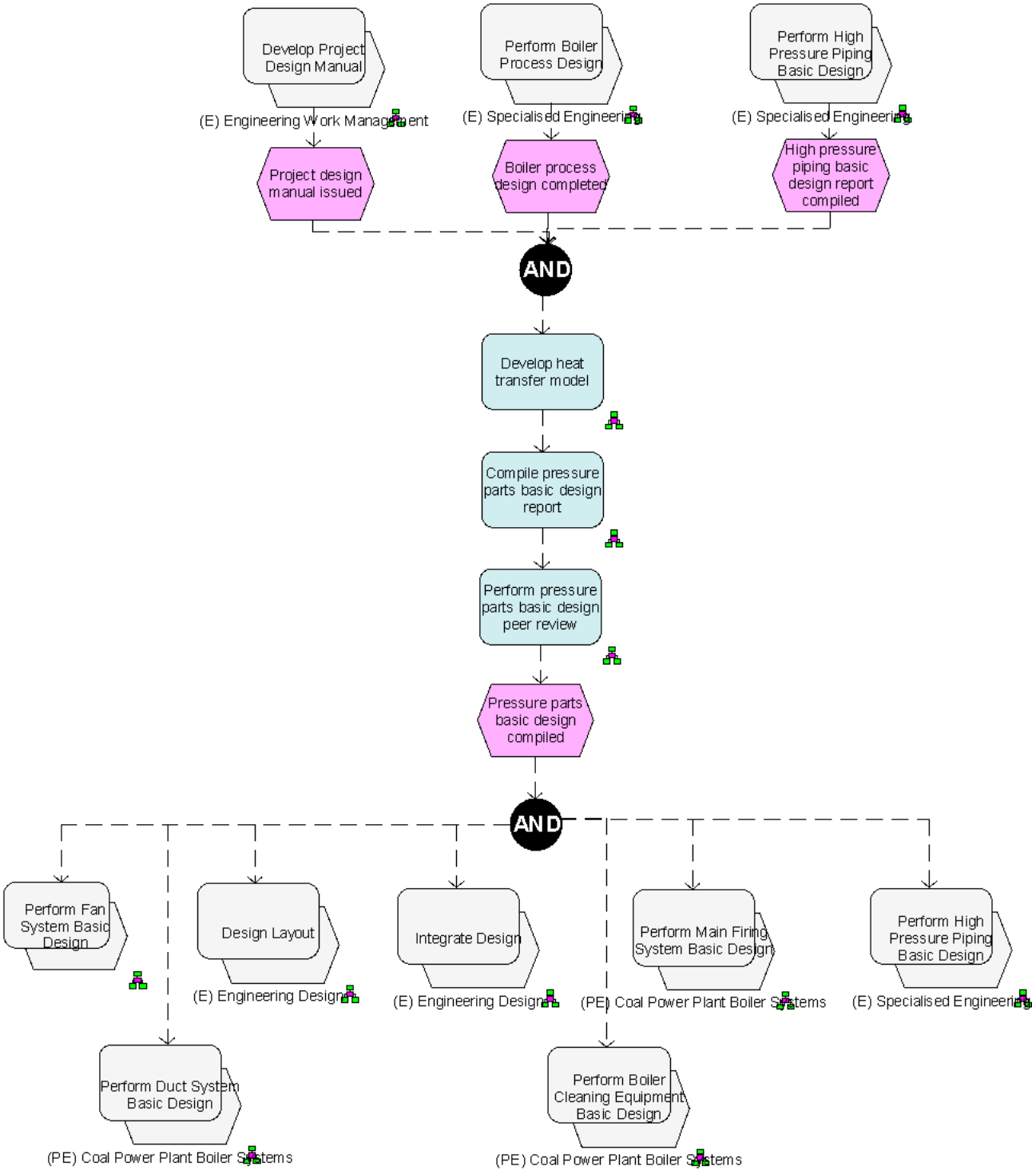
9.1.30 Perform Pressure Parts Basic Design



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ACTIVITY: Develop heat transfer model

In order to accurately design the various pressure parts equipment, an accurate heat transfer model needs to be developed. This will ensure that the different sub-sections will be sized correctly according to the chosen materials. A tool that is able to carry this out will be used. The information that is contained in the concept design product report will serve as the input to the heat transfer model.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
Pressure Parts Specification (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General arrangement drawings * P&ID * Product Concept Design Report	* General arrangement drawings * Heat Transfer Report * P&ID

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Computational Fluid Dynamics Software	
DimBo	

ACTIVITY: Compile pressure parts basic design report

This activity will consolidate all design activities carried out during the basic design within a single design report, with a detailed delineation of the process-, functional- and layout design. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as input in the integrated higher level basic design report.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures
Pressure Parts Specification (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Basic design report template * General Arrangement Drawing * Heat Transfer Report * P&ID * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report	* General Arrangement Drawing * P&ID * Product Basic Design Pack * Product Basic Design Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
Computational Fluid Dynamics Software	
DimBo	

ACTIVITY: Perform pressure parts basic design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

CONTROLLED DISCLOSURE
When downloaded from the EDS database, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the database.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* P&ID * Product Basic Design Pack * Product Basic Design Report	* P&ID * Product Basic Design Pack * Product Basic Design Report * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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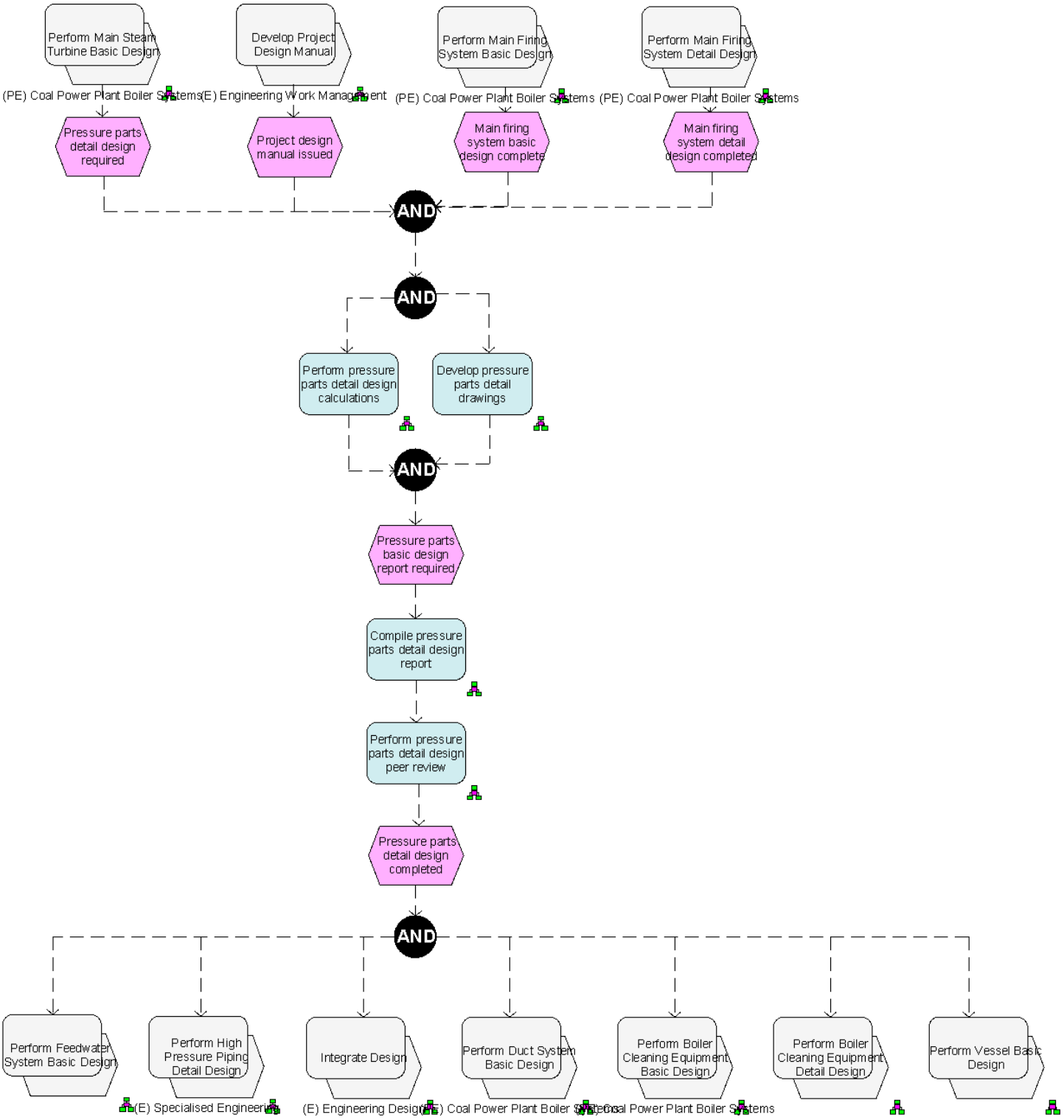
9.1.31 Perform Pressure Parts Detail Design



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ACTIVITY: Perform pressure parts detail design calculations

In this activity the pressure parts detail design calculations are performed. These include calculations for all the relevant pressure parts equipment and pressure vessels, such as the economiser, headers and blowdown vessel. Tools that are able to carry out finite element analysis, stress calculations, flow modelling, heat transfer calculations will be used in order to carry out the relevant calculations.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures
Pressure Parts Specification (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawing * P&ID * Product Basic Design Pack * Product Basic Design Report	* Pressure Parts Detail Calculation Report

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAESAR II	
Computational Fluid Dynamics Software	
DimBo	
FEA Tool	
Flownex	
Probad (T.B.C)	

ACTIVITY: Develop pressure parts detail drawings

After the detailed design calculations are completed, manufacturing drawings need to be done, and the general arrangement drawings need to be finalised based on the calculations.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures
Pressure Parts Specification (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General Arrangement Drawings * P&ID * Product Basic Design Pack * Product Basic Design Report	* General arrangement drawings * Manufacturing & Fabrication Drawings

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
CAESAR II	
Computational Fluid Dynamics Software	
DimBo	
FEA Tool	
Flownex	

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Probad (T.B.C)	

ACTIVITY: Compile pressure parts detail design report

This activity will consolidate all design activities carried out during the detail design within a single design report, with a detailed delineation of the process-, functional- and layout design as well as equipment- and three dimensional drawings. This report is used as basis for the peer review conducted within the applicable centre of excellence that, after being approved, may be used as the manufacturing manual.

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
36-486: Standard for Fossil Fuel Boiler Protection Functions: Requirements & Control Measures
Pressure Parts Specification (TBD)

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* General arrangement drawings * Manufacturing & Fabrication Drawings * Pressure Parts Detail Calculation Report	* Detail design package * Product Detail Design Manual

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

APPLICATIONS	SCREENS
CAD	
CAESAR II	
CFD Tool	
DimBo	
FEA Tool	
Flownex	
Probad (T.B.C)	

ACTIVITY: Perform pressure parts detail design peer review

This activity is concerned with the completeness and quality of the result of the design.

It involves having peers review the resulting engineering outputs.

It specifically has to:

* Ensure that the complete requirement has been addressed

* Ensure that the relevant standards and statutory requirements have been met

* Ensure that the design is valid and of quality

GOVERNED BY THESE ESKOM MANAGED DOCUMENTS:
474-1325: Design Review Procedure

INFORMATION IN (USED)	INFORMATION OUT (PRODUCED)
* Detail design package * Product Detail Design Manual	* Detail design package * Product Detail Design Manual * Record of Decision

RESPONSIBLE	ACCOUNTABLE	CONSULTED	INFORMED
* Lead Discipline Engineering Practitioner (Business Role)	* CoE Manager (Business Role)	None	None

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10 APPENDICES

A. SUBJECT MATTER EXPERTS (SME)

MODEL NAME	SME
Perform Coal Power Plant Boiler Engineering	A. Moganelwa C. van Wyk G. Motswadi H. Kleynhans L. van Wyk L. Joubert M. Laher P. Sukdeo W. Zarczinski

B. KEY PERFORMANCE INDICATORS

KPI NAME	KPI DESCRIPTION	KPI OBJECTIVE	KPI METRIC
Cost variations	Actual budget compared to the planned budget and measured in % deviation from planned budget.	To measure if work was performed within budget.	%
Design Rating	The quality of the design is rated based on the effectiveness, maturity, innovation and optimisation.	To manage the quality of the design.	%
Number of overdue actions	Overdue actions on SCOT work plan	To measure the execution efficiency of the SCOT workplan pertaining specifically to the management of standards.	#
Number of technical reworks	Design rework due to failures attributable to design.	To measure the number of times technical rework had to be performed during of a specific project.	#
Percentage compliance of technical requirements	Meeting technical requirements	To compare technical asset specifications to technical stakeholder requirements and technical execution plans (fabrication, construction, etc.) against technical stakeholder requirements and technical asset specifications.	%
Percentage design non conformance	The quality of this process output is achieved through meeting all stakeholder and system input requirements.	Stakeholder and system requirements met. Traceability from all the stakeholder and system requirements to one or all of the outputs of this process. Confirmed through the verification and validation of this process output.	Binary
Percentage design reviews failed	Percentage failed / passed Design Reviews	To measure the number of times the design review of a specific project has failed.	%

C. RISK AND CONTROL MATRIX

Refer to the attached Risk and Control Matrix

D. RACI MATRIX

Refer to the attached RACI Matrix

E. REPORT INDEX

- None

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F. STAKEHOLDERS

Name	Signature
P. Moyo General Manager: Power Delivery	
F. Sithole General Manager: Engineering Projects Management (Acting)	
C.F. Malan Manager Projects B2B Role: GCD Representative	
S. Pasquallie Middle Manager Technical B2B Role: OMO Representative	

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G. DELIVERABLE DOCUMENT APPROVAL FORM

Process Control Manual (PCM): Model Name

PCM Type: ☐ Conceptual ☑ Basic ☐ Detailed

INTRODUCTION *to be completed by process owner*

Approval Doc Name	240-53499108			
Deliverable Title	Process Control Manual (PCM) for Perform Coal Power Plant Boiler Engineering		Author	Hart, Anton
Description	This addresses activities for specifying the fuel properties to be combusted, designing the necessary interface requirements to all subsystems which include mills for pulverising the fuel and draught groups for air injection for optimum fuel combustion.. Further specifying the requirements of the flue gas systems for reducing emissions to acceptable levels and finally specifying the high pressure parts requirements related to steam generation.		Version	V1.0
Process Owner Name	Hart, Anton	Date	6 February 2013	
Telephone No	011 800 6111	Project/ Stream	Process Stream for Engineering Specialised Engineering	

RELEASE STATEMENT & APPROVAL ROUTINE SUMMARY *to be completed by Process Owner*

* By releasing the deliverable for the approval cycle by the Process Owner (PO), the undersigned confirm that the following aspects have been reviewed and conclude as follows:

Topic	*Topic fulfilled*		*Risk for Implementation**			*Reason for non Fulfillment of specific Aspect*	*Action*	*Due Date*	*Responsible Role*
	Yes	*No*	*L*	*M*	*H*				
Standardisation aspects	☒	☐	☐	☐	☐	<Add reason for non-fulfillment>	<Specify to-do>	dd mm yy	PO
Simplification aspects	☒	☐	☐	☐	☐	<Add reason for non-fulfillment>	<Specify to-do>	dd mm yy	PO
Optimisation aspects	☒	☐	☐	☐	☐	<Add reason for non-fulfillment>	<Specify to-do>	dd mm yy	PO
Eskom Compliance aspects	☒	☐	☐	☐	☐	<Add reason for non-fulfillment>	<Specify to-do>	dd mm yy	PO
Integration aspects	☒	☐	☐	☐	☐	<Add reason for non-fulfillment>	<Specify to-do>	dd mm yy	PO

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* only to be completed if aspect is not fully covered
L = no to low risk for implementation **M** = immaterial impact, medium risk for implementation **H** = Implementation cannot go ahead

C	B	D	Topic	Integrative Aspects covered		Risk for Implementation*			Gaps	Actions	Due Date	Responsible Role
				Yes	No	L	M	H				
Y	Y	Y	Alignment to HPUM (level 0-4): • Value Chain complete and appropriate • Definition of Process Objective complete and accurate • Process Activity pictorial design supporting value chain complete	☒	☐	☐	☐	☐	<Identify the gaps>	<Add the required resolution action>	dd.mm.yy	Snr Business Analyst (SBA)
Y			RACM identification of Control objectives and risks for each Sub-process, initial risk criticality evaluation	☒	☐	☐	☐	☐	<Identify the gaps>	<Add the required resolution action>	dd.mm.yy	Risk & Control QA
	Y	Y	Completeness of process design (5-6) Process Interfaces for level 5 and narratives for Level 5 & 6	☒	☐	☐	☐	☐	<Identify the gaps>	<Add the required resolution action>	dd.mm.yy 20.03.13	Process SME
	Y		RACM Complete as to Control objective, risks and manual controls, risk & control criticality	☒	☐	☐	☐	☐	<Identify the gaps>	<Add the required resolution action>	dd.mm.yy	Risk & Control QA
	Y	Y	Completeness and appropriateness of KPIs	☒	☐	☐	☐	☐	<Identify the gaps>	<Add the required resolution action>	dd.mm.yy 18.03.13	EPM SME
	Y	Y	Completeness and appropriateness of RACIs	☒	☐	☐	☐	☐	<Identify the gaps>	<Add the required resolution action>	dd.mm.yy 18.03.13	Process SME
	Y	Y	Correctness of other referenced documents (artefacts)	☒	☐	☐	☐	☐	<Identify the gaps>	<Add the required resolution action>	dd.mm.yy 20.03.13	Process SME

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C	B	D	Topic	Integrative Aspects covered		Risk for Implementation*			Gaps	Actions	Due Date	Responsible Role
				Yes	No	L	M	H				
	Y	Y	Completeness of report identification (generic–B/specific–D)	☒	☐	☐	☐	☐	<Identify the gaps> N/A	<Add the required resolution action>	dd mm yy	Technical SME
	Y	Y	Completeness of process handoffs	☒	☐	☐	☐	☐	<Identify the gaps>	<Add the required resolution action>	dd mm yy 20.03.13	Process SME
		Y	Completeness of RACMs including system & automated controls	☒	☐	☐	☐	☐	<Identify the gaps>	<Add the required resolution action>	dd mm yy	Risk & Control QA
		Y	Completeness of RICEFWs (Detailed Design only) and functional specifications	☒	☐	☐	☐	☐	<Identify the gaps> N/A	<Add the required resolution action>	dd mm yy	Technical SME
		Y	Completeness of interface/integration points	☒	☐	☐	☐	☐	<Identify the gaps> N/A	<Add the required resolution action>	dd mm yy	Technical SME
		Y	Completeness of screen / forms design	☒	☐	☐	☐	☐	<Identify the gaps> N/A	<Add the required resolution action>	dd mm yy	Technical SME
		Y	Role Names included for the applications selected	☒	☐	☐	☐	☐	<Identify the gaps> N/A	<Add the required resolution action>	dd mm yy	Technical SME
Y	Y	Y	PCM Technical QA	☒	☐	☐	☐	☐	<Identify the gaps>	<Add the required resolution action>	dd mm yy	Snr Business Analyst (SBA)

* only to be completed if aspect is not fully covered
L = no to low risk for implementation **M** = immaterial impact, medium risk for implementation **H** = Implementation cannot go ahead

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ID	Findings/ Gaps	Risk for Implementation*			Actions	Due Date	Owner
		L	M	H			
1	<Describe deficiency>	☐	☐	☐	<Describe required additions/ corrections to the document>	dd.mm.yy	Surname, First Name
2	<Describe deficiency>	☐	☐	☐	<Describe required additions/ corrections to the document>	dd.mm.yy	Surname, First Name
3	<Describe deficiency>	☐	☐	☐	<Describe required additions/ corrections to the document>	dd.mm.yy	Surname, First Name
4	<Describe deficiency>	☐	☐	☐	<Describe required additions/ corrections to the document>	dd.mm.yy	Surname, First Name
5	<Describe deficiency>	☐	☐	☐	<Describe required additions/ corrections to the document>	dd.mm.yy	Surname, First Name
6	<Describe deficiency>	☐	☐	☐	<Describe required additions/ corrections to the document>	dd.mm.yy	Surname, First Name
7	<Describe deficiency>	☐	☐	☐	<Describe required additions/ corrections to the document>	dd.mm.yy	Surname, First Name
8	<Describe deficiency>	☐	☐	☐	<Describe required additions/ corrections to the document>	dd.mm.yy	Surname, First Name
9	<Describe deficiency>	☐	☐	☐	<Describe required additions/ corrections to the document>	dd.mm.yy	Surname, First Name
10	<Describe deficiency>	☐	☐	☐	<Describe required additions/ corrections to the document>	dd.mm.yy	Surname, First Name
11	<Describe deficiency>	☐	☐	☐	<Describe required additions/ corrections to the document>	dd.mm.yy	Surname, First Name
12	<Describe deficiency>	☐	☐	☐	<Describe required additions/ corrections to the document>	dd.mm.yy	Surname, First Name

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APPROVAL AND SIGNATURE

The process sponsor is fully accountable for the approval of the deliverable, even after sign-off by programme sponsor.

- ☑ The full approval can only be provided by the process sponsor if all aspects of the approval catalogue are met.
- ☑ The conditional approval can only be provided if the outstanding gaps are rated with a "low risk" (indicating no impact on implementation). If the conditional approval is provided the process sponsor is accountable for the realisation of the identified actions at the defined due dates and within the required quality.
- ☑ If any aspect is rated "medium risk" or "high risk" the process sponsor is not supposed to provide the approval of the deliverable.

C	B	D	
			➲ By signing-off the approvers state the correct execution of the review and approval cycle as well as the correctness of the reviewed deliverable and the approver confirms the following:
Y	Y	Y	The agreed process scope is fully covered for the listed deliverable.
		Y	The PCM as designed can be realised within the Eskom environment, is efficient and practicable as well as user-friendly.
Y	Y	Y	The deliverable is correct and complete for process designs, Risk and Controls, KPIs, Reports and other applicable referenced documents as listed in the Approval sign off.
Y	Y	Y	The PCM covers the Eskom specific business requirements.
Y	Y	Y	All decisions taken are incorporated in the PCM in terms of decision, alternatives, recommendation and impact. There are no outstanding decisions to be included.
	Y	Y	All logical process chains regarding the specific deliverable including process interfaces were identified, touch points between processes were sufficiently coordinated and solutions covering process integration aspects are well reflected in the documentation.
		Y	Process interfaces aspects and their solutions have been well communicated and agreed with all required parties.
		Y	The deliverable can be handed-over to the training team can serve as the underlying basis for the development of training manuals. Therefore the deliverable fulfills its purpose.
		Y	➲ By approving the Process Control Manual (PCM), the PCM is locked and development of complete process training manuals can commence.

Party	Role	Name	Approval			Condition			Date	Signature
			Yes	No	Conditional	Action	Owner	Due Date		
Eskom	Process Owner	HART, ANTON	☒	☐	☐		Surname, First Name	dd.mm.yy	11.02.13	
Eskom	Process Sponsor	FERNANDEZ LOUIS	☒	☐	☐		Surname, First Name	dd.mm.yy	11/2/2013	
Eskom	Content QA	Surname First name	☐	☐	☐		Surname, First Name	dd.mm.yy	dd.mm.yy	

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Perform Coal Power Plant Boiler Engineering

ESKOM STRATEGIC OBJECTIVE:
Becoming a high performing organisation
Reducing our environmental footprint and pursuing low-carbon growth opportunities
Setting up for success

Process Objective:
To ensure that energy generated from coal and oil combustion is transformed to steam in the boiler to a requirement suitable for turbine generation and to treat the flue gas generated from burning the fuels to comply to environmental requirements.

Control objectives:
1 The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)

			Risk					Control																
				Ranking																				
Line#	Activity Flow	Control Objective #	Risk description	i	ii	iii		Control summary	Control name	Control nature (prevent, detect)	Control type (manual; system or IT-depend)	Frequency of control	Control Description	Control evidence	IT Application details	Exception report name	Exceptions generated by - who	Exception clearance - who	Control owner-role	Control carried out by - role	Management control monitoring	Source of Information	Control category (Standard control or Critical control)	System control type	Marked for deletion
1. 1	Perform Boiler Process Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x				All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPbE03	Prevent	Manual	Ad Hoc	Studies and analysis is performed using a software model in order to estimate, analyse or calculate thermal cycle (if required), boiler mass and energy balance and thermal expansion. The outputs of these are used to generate a boiler system process flow diagram containing consolidation of all activity outputs.	Boiler System Process Flow Diagram					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Process flow diagram template * Boiler Efficiency Report * Boiler MEB Report * Boiler thermal expansion model	Standard Control		
1. 2	Perform Boiler Process Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x				Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE04	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Record of Decision					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Boiler System Process Flow Diagram	Critical Control		
2. 1	Perform Flue Gas Desulphurisation Process Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x				All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE01	Prevent	Manual	Ad Hoc	The operating characteristics are developed based on information contained in the relevant documents and reports and contain pressures, temperatures, flows and mass and energy balance. Engineering specific calculations are used in order to design the process flow model and process design report, which contains the output of all design activities.	FGD Process Flow Report Mass and Energy Balance FGD Process Flow Diagram P&ID					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Process Flow Report Template * CFD Report * FGD Process Flow Diagram * FGD Process Flow Model * Mass and Energy Balance * P&ID * Transient Balance Report	Standard Control		

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Line#	Activity Flow	Control Objective #	Risk				Control																
			Risk description	Ranking i	Ranking ii	Ranking iii	Control summary	Control name	Control nature (prevent, detect)	Control type (manual; system or IT-depend)	Frequency of control	Control Description	Control evidence	IT Application details	Exception report name	Exceptions generated by - who	Exception clearance - who	Control owner-role	Control carried out by - role	Management control monitoring	Source of Information	Control category (Standard control or Critical control)	System control type	Marked for deletion
2. 2	Perform Flue Gas Desulphurisation Process Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE02	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Record of Decision					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* FGD Process Flow Diagram * FGD Process Flow Report * Mass and Energy Balance * P&ID	Critical Control		
3. 1	Perform Computational Fluid Dynamics (CFD) Analysis	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE05	Prevent	Manual	Ad Hoc	Customer requirements are established in order to determine if CFD is appropriate tool to be used to formulate the flow / heat transfer problem. A CAD model and mesh is developed in order to define physics, boundary conditions and solver settings and to execute the solver / simulation. The results are examined and sensitivity analysis is performed if necessary based on the outcome of the tests. A report of suitable solution outputs is generated which concludes the CFD process.	CFD Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Converged Solution	Standard Control		
3. 2	Perform Computational Fluid Dynamics (CFD) Analysis	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE06	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Record of Decision					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* CFD Report	Critical Control		

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			Risk description	Ranking i	Ranking ii	Ranking iii	Control summary	Control name	Control nature (prevent, detect)	Control type (manual; system or IT-depend)	Frequency of control	Control Description	Control evidence	IT Application details	Exception report name	Exceptions generated by - who	Exception clearance - who	Control owner-role	Control carried out by - role	Management control monitoring	Source of Information	Control category (Standard control or Critical control)	System control type	Marked for deletion
4. 1	Perform Air Heater System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE07	Prevent	Manual	Ad Hoc	The performance characteristics (operating conditions) for the air heater / steam pre-heater system are developed based on the results of the boiler process design and process flow, and contain air and gas pressures, temperatures, mass flows, and steam volume, as well as the layout drawings and geometry based on the selected air heater type. The output of all design activities carried out during the concept design are complied into an air heater / steam air pre-heater system concept design report, with a concise delineation of the process, functional and layout design.	Product Concept Design Report P&ID					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* System Design Report (TBD) * Air Heater / Steam Air Pre-Heater Selection Report * Air Heater / Steam Air Pre-Heater Specification * General Arrangement Drawings * P&ID	Standard Control		
4. 2	Perform Air Heater System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE08	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	P&ID Record of Decision Product Concept Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Concept Design Report	Critical Control		
5. 1	Perform Air Heater System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE09	Prevent	Manual	Ad Hoc	Studies and analysis are performed using a geometric model in order to estimate or calculate air heater / steam air pre-heater designs including loads, flows, temperatures and pressures for an optimised system performance. The outputs of these are used to develop a air heater / steam air pre-heater system basic design, and a report is compiled containing consolidation of all activity outputs with a detailed delineation of the process, functional and layout design.	Product Basic Design Pack Product Basic Design Report P&ID					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Basic design report template * Air Heater / Steam Air Pre-Heater Analysis Report * Air Heater / Steam Air Pre-Heater Equipment Drawings * Air Heater / Steam Air Pre-Heater System Description * General Arrangement Drawings * P&ID * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report * System & Layout Drawings	Standard Control		

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Line#	Activity Flow	Control Objective #	Risk				Control														Source of Information	Control category (Standard control or Critical control)	System control type	Marked for deletion
			Risk description	Ranking i	Ranking ii	Ranking iii	Control summary	Control name	Control nature (prevent, detect)	Control type (manual; system or IT-depend)	Frequency of control	Control Description	Control evidence	IT Application details	Exception report name	Exceptions generated by - who	Exception clearance - who	Control owner-role	Control carried out by - role	Management control monitoring				
5. 2	Perform Air Heater System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE10	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Record of Decision P&ID Product Basic Design Report Product Basic Design Pack					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Basic Design Pack * Product Basic Design Report	Critical Control		
6. 1	Perform Boiler Cleaning Equipment Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE11	Prevent	Manual	Ad Hoc	Stakeholder requirements are interpreted and applied in order to determine the boiler cleaning equipment requirements, and to define the pressure parts cleaning equipment and air heater cleaning equipment control philosophy. Pressure parts and air heater cleaning equipment is selected and the layout and geometry of the cleaning equipment is defined. The output of all design activities carried out during the concept design are complied into a boiler cleaning equipment concept design report, with a concise delineation of the process, functional and layout design.	Product Concept Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* System Design Report (TBD) * Air heater cleaning equipment control philosophy * Air heater cleaning equipment selection report * General Arrangement Drawings * Pressure parts cleaning equipment control philosophy * Pressure parts cleaning equipment selection report * System & Layout Drawings	Standard Control		
6. 2	Perform Boiler Cleaning Equipment Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE12	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Product Concept Design Report Record of Decision					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Product Concept Design Report	Critical Control		

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				i	ii	iii																	
7. 1	Perform Boiler Cleaning Equipment Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE13	Prevent	Manual	Ad Hoc	Stakeholder requirements are interpreted and applied in order to determine the boiler cleaning equipment requirements, and to define the pressure parts cleaning equipment and air heater cleaning equipment control philosophy. Pressure parts and air heater cleaning equipment layout and geometry of the cleaning equipment is defined, and a determination is made of the equipment required, and if applicable a supplier specification list is developed. The output of all design activities carried out during the basic design are complied into a boiler cleaning equipment basic design report, with a detailed delineation of the process, functional and layout design.	Product Basic Design Pack Product Basic Design Report P&ID					COE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Basic design report template Air heater cleaning equipment control philosophy * Air heater cleaning equipment selection report * Boiler cleaning equipment supplier specification list * Boiler Process Output Sheet * Boiler System Process Flow Diagram * General Arrangement Drawings * Pressure parts cleaning equipment control philosophy * Pressure parts cleaning equipment selection report * Product Concept Design Report	Standard Control		
7. 2	Perform Boiler Cleaning Equipment Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE14	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	P&ID Product Basic Design Report Record of Decision Product Basic Design Pack					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Basic Design Pack * Product Basic Design Report	Critical Control		
8. 1	Perform Boiler Cleaning Equipment Detail Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE15	Prevent	Manual	Ad Hoc	Piping supports and layout is determined in order to ensure that the route does not clash with any floors or platforms, by using relevant calculations and guidelines. Thereafter the piping size and material needs are selected based on pressure, temperature, flow rate and fatigue calculations, as well as the design of control equipment. Using the design control report, a model is generated in order to model the system and verify design accuracy and optimisation. The output of all activities is used to compile a boiler equipment detail design report with a detailed delineation of the process, functional and layout design as well as equipment and three dimensional drawings.	Detail design package Product Detail Design Manual					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	Control Equipment Design Report Detailed Pipe and Welding Drawings Equipment List General Arrangement Drawings Hanger Schedule List of Materials Piping Analysis Report Routing and Support Drawings	Standard Control		

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8. 2	Perform Boiler Cleaning Equipment Detail Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE16	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Record of Decision Product Detail Design Manual Detail design package					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Detail design package * Product Detail Design Manual	Critical Control		
9. 1	Perform Duct System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE17	Prevent	Manual	Ad Hoc	The performance characteristics (operating conditions) for the duct system are developed based on the results of the boiler process design and process flow, and contain air and gas pressures, temperatures, volume flow rates, erosion protection and thermal insulation requirements, as well as the layout drawings and geometry in relation to other systems. The output of all design activities carried out during the concept design are complied into a duct system concept design report, with a concise delineation of the process, functional and layout design.	P&ID Product Concept Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* System Design Report (TBD) * Duct System Performance Characteristics Report * General Arrangement Drawings * P&ID	Standard Control		
9. 2	Perform Duct System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE18	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Record of Decision P&ID Product Concept Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Concept Design Report	Critical Control		

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				i	ii	iii																			
10. 1	Perform Duct System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE19	Prevent	Manual	Ad Hoc	Studies and analysis are performed using a geometric model in order to estimate or calculate duct system designs and layouts including loads, flows, temperatures and pressures for an optimised system performance. The outputs of all activities are used to develop a duct system basic design with a detailed delineation of the process, functional and layout design.	P&ID Product Basic Design Report Product Basic Design Pack					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Basic design report template * Boiler Process Output Sheet * Boiler System Process Flow Diagram * Duct System Analysis Report * Duct System Description * Duct System Equipment Drawings * General Arrangement Drawings * P&ID * Product Concept Design Report * System & Layout Drawings	Standard Control		
10. 2	Perform Duct System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE20	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Record of Decision Product Basic Design Report P&ID Product Basic Design Pack					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Basic Design Pack * Product Basic Design Report	Critical Control		
11. 1	Perform Electrostatic Precipitator System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE21	Prevent	Manual	Ad Hoc	The performance characteristics (operating conditions) for the electrostatic precipitator system are developed based on the results of the boiler process design and air quality targets as set by legislation. Air flow and temperature are considered, and the layout drawings and geometry in relation to other systems are developed. The output of all design activities carried out during the concept design are complied into a electrostatic precipitator system concept design report, with a concise delineation of the process, functional and layout design.	Product Concept Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* General Arrangement Drawings * Process Flow Diagram * System & Layout Drawings	Standard Control		

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11. 2	Perform Electrostatic Precipitator System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE22	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Record of Decision Product Concept Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Product Concept Design Report * System & Layout Drawings	Critical Control		
12. 1	Perform Electrostatic Precipitator System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE23	Prevent	Manual	Ad Hoc	Studies and analysis are performed using a geometric model in order to estimate or calculate electrostatic precipitator system designs and layouts in relation to other systems, for an optimised system performance. The outputs of all activities are used to develop a electrostatic precipitator system basic design with a detailed delineation of the process, functional and layout design.	P&ID Product Basic Design Report Product Basic Design Pack					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Basic design report template * 2D System & Layout Drawings * Electrostatic Precipitator System Description * General Arrangement Drawing * Material Selection Record * P&ID * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report	Standard Control		
12. 2	Perform Electrostatic Precipitator System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE24	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Product Basic Design Report Record of Decision P&ID					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Basic Design Pack * Product Basic Design Report	Critical Control		

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				i	ii	iii																	
13. 1	Perform Fabric Filter Plant Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE25	Prevent	Manual	Ad Hoc	Studies and analysis are performed based in order to describe the fabric filter plant layout and geometry and select the dampers. The outputs of all activities are used to develop a fabric filter plant concept design with a concise delineation of the process, functional and layout design.	Product Concept Design Report P&ID					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* System Design Report (TBD) * General Arrangement Drawings * P&ID * Process flow diagram * System & Layout Drawings	Standard Control		
13. 2	Perform Fabric Filter Plant Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE26	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Product Concept Design Report Record of Decision					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Concept Design Report	Critical Control		
14. 1	Perform Fabric Filter Plant Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE27	Prevent	Manual	Ad Hoc	Studies and analysis are performed based on the boiler process model, in order to calculate the number of bags required and the maximum number of compartments. This information is used to design compartment and plant layout, pulsing system and hoppers. The outputs of all activities are used to develop a fabric filter plant basic design with a detailed delineation of the process, functional and layout design.	P&ID Design for Future Requirements Materials Alternatives Product Basic Design Report Mechanical Equipment Lists General Arrangement Drawings Product Basic Design Pack					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Basic design report template * General Arrangement Drawings * P&ID * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report	Standard Control		

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				i	ii	iii																			
14. 2	Perform Fabric Filter Plant Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE28	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	P&ID Record of Decision Product Basic Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Basic Design Pack * Product Basic Design Report	Critical Control		
15. 1	Perform Fan System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE29	Prevent	Manual	Ad Hoc	The performance characteristics (operating conditions) for the fan system are developed based on the results of the boiler process design and process flow, and contain air and gas pressures, temperatures, flow rates, coal and ash composition and erosion protection. Primary air fan type, draught fan type and induced draught fan type are selected, and the layout drawings and geometry in relation to other systems are developed. The output of all design activities carried out during the concept design are complied into a fan system concept design report, with a concise delineation of the process, functional and layout design.	P&ID Product Concept Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* System Design Report (TBD) * Forced Draught Fan Selection Report * Forced Draught Fan Specification * General Arrangement Drawings * Induced Draught Fan Selection Report * Induced Draught Fan Specification * P&ID * Primary Air Fan Selection Report * Primary Air Fan Specification * System & Layout Drawings	Standard Control		
15. 2	Perform Fan System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE30	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Record of Decision Product Concept Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Concept Design Report	Critical Control		

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				i	ii	iii																		
16. 1	Perform Fan System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE31	Prevent	Manual	Ad Hoc	Studies and analysis are performed using a geometric model in order to estimate or calculate system equipment specifications (primary air, forced draught, induced draught) . This information is used to design system layout and equipment in relation to other systems and optimise performance. The outputs of all activities are used to develop a fan system basic design with a detailed delineation of the process, functional and layout design.	Product Basic Design Report P&ID Product Basic Design Pack					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Basic design report template * Fan Equipment Drawings * Fan System Analysis Report * Fan System Layout Drawings * Forced Draught Fan System Description * General Arrangement Drawing * Induced Draught Fan System Description * P&ID * Primary Air Fan System Description * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report	Standard Control		
16. 2	Perform Fan System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE32	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Product Basic Design Pack Record of Decision P&ID Product Basic Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Basic Design Pack * Product Basic Design Report	Critical Control		
17. 1	Perform Flue Gas Desulphurisation System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE33	Prevent	Manual	Ad Hoc	Studies and analysis are performed using relevant information and a geometric model in order to estimate, size or calculate flue gas desulphurisation main equipment, chemical analysis, draught system analysis, C&I, chimney, gas LPS, auxiliary power, constructability, materials of construction and the balance of plant. This information is used to design system layout and geometry and to develop philosophies and data sheets. The outputs of all activities are used to develop a flue gas desulphurisation system concept design with a concise delineation of the process, functional and layout design.	Product Concept Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* 240-49910679: Concept Design Report Template (To be developed) * FGD Process Data Sheets	Standard Control		

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17. 2	Perform Flue Gas Desulphurisation System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE34	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Product Concept Design Report Record of Decision					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Product Concept Design Report	Critical Control		
18. 1	Perform Flue Gas Desulphurisation System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE35	Prevent	Manual	Ad Hoc	Studies and analysis are performed using relevant information and a geometric model in order to estimate, size or calculate flue gas desulphurisation main equipment, chemical analysis, draught system analysis, C&I, chimney, gas LPS, auxiliary power, constructability, materials of construction and the balance of plant. This information is used to design system layout and geometry and to develop philosophies and functional description. The outputs of all activities are used to develop a flue gas desulphurisation system basic design with a detailed delineation of the process, functional and layout design.	P&ID Product Basic Design Report Product Basic Design Pack					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Basic design report template * FGD Equipment Specifications * FGD Functional Description * FGD Operating & Control Philosophy * FGD Process Data Sheets * FGD System Description * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report	Standard Control		
18. 2	Perform Flue Gas Desulphurisation System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE36	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	P&ID Record of Decision Product Basic Design Pack Product Basic Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Basic Design Pack * Product Basic Design Report	Critical Control		

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				i	ii	iii																			
19. 1	Perform High Pressure Piping Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE37	Prevent	Manual	Ad Hoc	Piping materials and layout are determined in order to ensure that all service life and design requirements are met, as well as relevant standards that govern high pressure pipework. Piping routes are developed based on design standards, and that are efficient, economical and systematic. The output of all activities is used to compile a high pressure piping concept design report with a concise delineation of the process, functional and layout design as well as equipment and three dimensional drawings.	Product Concept Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	System Design Report (TBD) General Arrangement Drawings Piping Material Report	Standard Control		
19. 2	Perform High Pressure Piping Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE38	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Product Concept Design Report Record of Decision					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	Product Concept Design Report	Critical Control		
20. 1	Perform High Pressure Piping Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE39	Prevent	Manual	Ad Hoc	Concept design information is used to develop a pipe stress model with all conditions imposed on the piping system. From the model the support schedule and pipe stress report are created, and ISO and layout drawings are updated accordingly. The output of all activities is used to compile a high pressure piping basic design report with a detailed delineation of the process, functional and layout design.	Product Basic Design Report P&ID Product Basic Design Pack					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Basic design report template * ISO and Layout Drawings * Pipe Stress Report * Piping Stress Model * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report	Standard Control		

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				i	ii	iii																			
20. 2	Perform High Pressure Piping Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE40	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	P&ID Product Basic Design Pack Product Basic Design Report Record of Decision					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Basic Design Pack * Product Basic Design Report	Critical Control		
21. 1	Perform High Pressure Piping Detail Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice				All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE41	Prevent	Manual	Ad Hoc	High pressure piping calculations are performed in order to determine the components that are relevant to the applications. Calculations are done in accordance with relevant governance and international standards for high pressure pipework for fossil power stations. Results of the calculations are used to develop detail drawings that fully detail the geometry of all the components. The output of all activities is used to compile a high pressure piping detail design manual with a detailed delineation of the process, functional and layout design as well as equipment and three dimensional drawings.	Product Detail Design Manual Detail design package					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	Detail Design Calculations Results HP Piping Drawing Package	Standard Control		
21. 2	Perform High Pressure Piping Detail Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE42	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Detail design package Piping Method Statement Record of Decision Product Detail Design Manual					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Detail design package * Product Detail Design Manual	Critical Control		

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22. 1	Perform Lighting Up System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE43	Prevent	Manual	Ad Hoc	The performance characteristics (operating conditions) for the lighting up system are developed based on the plant configuration and type of fuel and the lighting up system footprint is developed. The output of all design activities carried out during the concept design are complied into a lighting up system concept design report, with a concise delineation of the process, functional and layout design.	Product Concept Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	System Design Report (TBD) General Arrangement Drawings Lighting Up System Performance Characteristics Report	Standard Control		
22. 2	Perform Lighting Up System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE44	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Record of Decision Product Concept Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	Product Concept Design Report	Standard Control		
23. 1	Perform Lighting Up System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Turbine Engineering that is not aligned to engineering best practice	X			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE45	Prevent	Manual	Ad Hoc	Studies and analysis are performed using a geometric model in order to estimate or calculate system / equipment specifications, layout, material characteristics and operating analysis. A full load simulation is then performed and stress and strain is measured to test equipment efficiency and stress level acceptability. This information is used to model the lighting up system layout and perform further simulation and analysis and estimate loads, flows, pressure and temperatures and define geometry. The outputs of all activities are used to develop a lighting up system basic design with a detailed delineation of the process, functional and layout design.	Product Basic Design Report P&ID Product Basic Design Pack					CoE Manager (R) Lead Discipline Engineering Practitioner (R)		CoE Manager	Basic design report template General Arrangement Drawings Product Concept Design Report Product Process Flow Diagram Product Process Flow Report System & Layout Drawings	Standard Control		

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Line#	Activity Flow	Control Objective #	Risk				Control														Source of Information	Control category (Standard control or Critical control)	System control type	Marked for deletion
			Risk description	Ranking i	Ranking ii	Ranking iii	Control summary	Control name	Control nature (prevent, detect)	Control type (manual; system or IT-depend)	Frequency of control	Control Description	Control evidence	IT Application details	Exception report name	Exceptions generated by - who	Exception clearance - who	Control owner-role	Control carried out by - role	Management control monitoring				
23. 2	Perform Lighting Up System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Turbine Engineering that is not aligned to engineering best practice	X			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPTE46	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Record of Decision P&ID Product Basic Design Report Product Basic Design Pack					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Basic Design Pack * Product Basic Design Report	Critical Control		
24. 1	Perform Milling System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE47	Prevent	Manual	Ad Hoc	The performance characteristics (operating conditions) for the milling system are developed based on the relevant boiler information and governance and include temperatures, flows, product quality, load factor and number of mills required. The output of all design activities carried out during the concept design are complied into a milling system concept design report, with a concise delineation of the process, functional and layout design.	Product Concept Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Milling System Performance Characteristics Report	Standard Control		
24. 2	Perform Milling System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE48	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Product Concept Design Report Record of Decision					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Product Concept Design Report	Critical Control		

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				i	ii	iii																		
25. 1	Perform Milling System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE49	Prevent	Manual	Ad Hoc	Stakeholder requirements are interpreted and applied in order to determine whether an existing milling system can be used or a new one must be developed. Engineering specific calculations are completed in order to determine or select types, upgrades or changes required and a model is used to model the changes to existing geometry. Using all output activities, the basic (new or existing) milling system design reports are compiled with a detailed delineation of the process, functional and layout design.	Product Basic Design Report Product Basic Design Pack System & Layout Drawings P&ID					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Milling System Type Selection Report * Product Concept Design Report * 240-49910705: Basic Design Report Template (To be developed) * General Arrangement Drawings * Milling System Analysis Report * Milling System Description * Milling System Equipment Drawings * Milling System Type Selection Report * Product Concept Design Report * Product Process Flow Report * System & Layout Drawings	Standard Control		
25. 2	Perform Milling System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE50	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Product Basic Design Report Record of Decision Product Basic Design Pack P&ID					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Basic Design Pack * Product Basic Design Report * System & Layout Drawings	Critical Control		
26. 1	Perform Main Firing System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE51	Prevent	Manual	Ad Hoc	The performance characteristics (operating conditions) for the main firing system are developed based on the relevant boiler information and governance and include temperatures, flows, pressures and geometry. The breakdown structure and layout are developed through simulations and calculations. The output of all design activities carried out during the concept design are complied into a main firing system concept design report, with a concise delineation of the process, functional and layout design.	Product Concept Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* System Design Report (TBD) * Burner Concept P&ID * Main Firing System Breakdown Structure * Main Firing System Performance Characteristics Report * System & Layout Drawings	Standard Control		

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				i	ii	iii																		
26. 2	Perform Main Firing System Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE52	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Product Concept Design Report Record of Decision					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	Product Concept Design Report	Critical Control		
27. 1	Perform Main Firing System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE53	Prevent	Manual	Ad Hoc	Studies and analysis are performed using a model in order to estimate or calculate system / equipment specifications, layout, material characteristics and operating analysis. A full load simulation is then performed and measured to test design efficiency and refine system layout. The outputs of all activities are used to develop a main fire system basic design with a detailed delineation of the process, functional and layout design.	Product Basic Design Report Product Basic Design Pack General Arrangement Drawings P&ID					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Basic design report template * Burner layout and Footprint Report * Main Firing System / Equipment Specification Calculation Sheet * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report	Standard Control		
27. 2	Perform Main Firing System Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE54	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Record of Decision Product Basic Design Report P&ID Product Basic Design Pack					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Basic Design Pack * Product Basic Design Report	Critical Control		

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				i	ii	iii																			
28. 1	Perform Main Firing System Detail Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE55	Prevent	Manual	Ad Hoc	The main firing basic design is optimised to meet boiler output requirements. Calculations are done in accordance with relevant governance and international standards for main firing system. Results of the calculations are used to develop detail layout and drawings that fully detail the geometry of all the components. The output of all activities is used to compile a main firing system detail design manual with a detailed delineation of the process, functional and layout design as well as equipment and three dimensional drawings.	Fabrication & Manufacturing Drawings Product Detail Design Manual Detailed General Arrangement Drawings					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Detailed General Arrangement Drawings * Product Basic Design Pack * Product Basic Design Report	Standard Control		
28. 2	Perform Main Firing System Detail Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE56	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Record of Decision Fabrication & Manufacturing Drawings Product Detail Design Manual General Arrangement Drawings					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Fabrication & Manufacturing Drawings * General arrangement Drawings * Product Detail Design Manual	Critical Control		
29. 1	Perform Pressure Parts Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE57	Prevent	Manual	Ad Hoc	The performance characteristics (operating conditions) for the pressure parts are developed based on the relevant boiler information and governance and include temperatures, design life, pressures and thermal cycles. The material selection and layout are developed through simulations and calculations. The output of all design activities carried out during the concept design are complied into a pressure parts concept design report, with a concise delineation of the process, functional and layout design.	Product Concept Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* General Arrangement Drawings * P&ID * Pressure Parts Material Report * Pressure Parts Performance Characteristics Report	Standard Control		

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29. 2	Perform Pressure Parts Concept Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE58	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Product Concept Design Report Record of Decision					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Product Concept Design Report	Critical Control		
30. 1	Perform Pressure Parts Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE59	Prevent	Manual	Ad Hoc	Studies and analysis are performed using a model in order to estimate or calculate pressure parts equipment, that will ensure that sub0sections will be sized correctly according to the chosen materials. The outputs of all activities are used to develop a pressure parts basic design with a detailed delineation of the process, functional and layout design.	Product Basic Design Pack General Arrangement Drawings P&ID Product Basic Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Basic design report template * General Arrangement Drawing * Heat Transfer Report * P&ID * Product Concept Design Report * Product Process Flow Diagram * Product Process Flow Report	Standard Control		
30. 2	Perform Pressure Parts Basic Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	x			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE60	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Product Basic Design Pack P&ID Record of Decision Product Basic Design Report					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* P&ID * Product Basic Design Pack * Product Basic Design Report	Critical Control		

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Line#	Activity Flow	Control Objective #	Risk					Control																		
			Risk description	Ranking				Control summary	Control name	Control nature (prevent, detect)	Control type (manual; system or IT-depend)	Frequency of control	Control Description	Control evidence	IT Application details	Exception report name	Exceptions generated by - who	Exception clearance - who	Control owner-role	Control carried out by - role	Management control monitoring	Source of Information	Control category (Standard control or Critical control)	System control type	Marked for deletion
				i	ii	iii																			
31. 1	Perform Pressure Parts Detail Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			All appropriate and relevant information, diagrams, calculations, templates and data is used to develop designs that will ensure fit for purpose and optimal Coal Power Plant Boiler Engineering designs are used that meet stakeholder and regulatory requirements.	PCPPBE61	Prevent	Manual	Ad Hoc	Calculations are done in accordance with relevant governance and international standards for pressure parts equipment and pressure vessels in order to determine economiser, blowdown vessels etc. Results of the calculations are used to develop detail layout and drawings that fully detail the geometry of all the parts. The output of all activities is used to compile a main firing system detail design manual with a detailed delineation of the process, functional and layout design as well as equipment and three dimensional drawings.	Detail design package Product Detail Design Manual					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* General arrangement drawings * Manufacturing & Fabrication Drawings * Pressure Parts Detail Calculation Report	Standard Control		
31. 2	Perform Pressure Parts Detail Design	The complete, accurate, and timely completion of any and all design specifications for Coal Power Plant Boiler Engineering, using all relevant and appropriate capabilities in order to achieve generation of power from steam that is environmentally friendly, technically fit for purpose and aligns to engineering best practice and stakeholder requirements, and that is in compliance with Eskom, legislative, regulatory and best practice standards and policies. (Complete, Accurate, Timely, Relevant, Compliant)	Incomplete, inaccurate, untimely completion of Coal Power Plant Boiler Engineering may result in: - Non-compliance with Eskom, legislative and regulatory requirements - Financial and non-financial losses - Reputational damage - Incorrect decision making - Stakeholder and customer dissatisfaction - Failure to achieve business and strategic objectives - Generation of power that is not optimal or environmentally friendly and that does not achieve stakeholder requirements - Coal Power Plant Boiler Engineering that is not aligned to engineering best practice	X			Any and all Coal Power Plant Boiler Engineering technical study and design reports are reviewed by a peer for correctness and accuracy, prior to further review and implementation.	PCPPBE62	Detect	Manual	Ad Hoc	On completion of any Power Plant Boiler Engineering process, concept and basic designs, a review is done by a peer within the department to verify the correctness and accuracy of the design against the stakeholder requirements and to ensure standards are maintained, performance is improved and to provide credibility for the suitability of the report before distribution.	Detail design package Product Detail Design Manual Record of Decision					CoE Manager (R)	Lead Discipline Engineering Practitioner (R)	CoE Manager	* Detail design package * Product Detail Design Manual	Critical Control		

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Perform Coal Power Plant Boiler Engineering Role Matrix

Process Flow (L3)	Activity Flow (L4)	Activity (L5)	Task (L6)	None	CoE Manager	Lead Discipline Engineering Practitioner	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Analyse equipment efficiency			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Analyse equipment efficiency				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Calculate / analyse stress / strain			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Calculate / analyse stress / strain				R	
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Calculate number of bags required			A		
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Calculate number of bags required				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Detail Design	Compile boiler cleaning equipment detail design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Detail Design	Compile boiler cleaning equipment detail design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Concept Design	Compile fabric filter plant concept design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Concept Design	Compile fabric filter plant concept design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Compile flue gas desulphurisation basic design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Compile flue gas desulphurisation basic design report				R	
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Basic Design	Compile high pressure piping basic design report			A		
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Basic Design	Compile high pressure piping basic design report				R	
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Concept Design	Compile high pressure piping concept design report			A		
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Concept Design	Compile high pressure piping concept design report				R	
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Detail Design	Compile high pressure piping detail design report			A		
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Detail Design	Compile high pressure piping detail design report				R	
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Detail Design	Compile HP piping detail design package			A		
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Detail Design	Compile HP piping detail design package				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Detail Design	Compile main firing system detail design manual			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Detail Design	Compile main firing system detail design manual				R	
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Basic Design	Compile pressure parts basic design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Basic Design	Compile pressure parts basic design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Detail Design	Compile pressure parts detail design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Detail Design	Compile pressure parts detail design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Conduct flue gas desulphurisation auxiliary power analysis			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Conduct flue gas desulphurisation auxiliary power analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Conduct flue gas desulphurisation auxiliary power analysis			A		

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Process Flow (L3)	Activity Flow (L4)	Activity (L5)	Task (L6)	None	CoE Manager	Lead Discipline Engineering Practitioner	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Conduct flue gas desulphurisation auxiliary power analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Conduct flue gas desulphurisation C&I analysis			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Conduct flue gas desulphurisation C&I analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Conduct flue gas desulphurisation C&I analysis			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Conduct flue gas desulphurisation C&I analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Conduct flue gas desulphurisation chemical analysis			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Conduct flue gas desulphurisation chemical analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Conduct flue gas desulphurisation chemical analysis			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Conduct flue gas desulphurisation chemical analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Conduct flue gas desulphurisation chimney analysis			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Conduct flue gas desulphurisation chimney analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Conduct flue gas desulphurisation chimney analysis			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Conduct flue gas desulphurisation chimney analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Conduct flue gas desulphurisation constructability analysis			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Conduct flue gas desulphurisation constructability analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Conduct flue gas desulphurisation constructability analysis			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Conduct flue gas desulphurisation constructability analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Conduct flue gas desulphurisation draught system analysis			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Conduct flue gas desulphurisation draught system analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Conduct flue gas desulphurisation draught system analysis			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Conduct flue gas desulphurisation draught system analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Conduct flue gas desulphurisation LPS analysis			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Conduct flue gas desulphurisation LPS analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Conduct flue gas desulphurisation LPS analysis			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Conduct flue gas desulphurisation LPS analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation Process Design	Deduce flue gas desulphurisation operational requirements			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation Process Design	Deduce flue gas desulphurisation operational requirements				R	
Perform Coal Power Plant Boiler Engineering	Perform Computational Fluid Dynamics (CFD) Analysis	Define physics, boundary conditions and solver			A		
Perform Coal Power Plant Boiler Engineering	Perform Computational Fluid Dynamics (CFD) Analysis	Define physics, boundary conditions and solver				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Define pressure parts cleaning equipment control philosophy			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Define pressure parts cleaning equipment control philosophy				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Define pressure parts cleaning equipment control philosophy			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Define pressure parts cleaning equipment control philosophy				R	

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Process Flow (L3)	Activity Flow (L4)	Activity (L5)	Task (L6)	None	CoE Manager	Lead Discipline Engineering Practitioner	
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Concept Design	Describe air heater / steam air pre-heater system geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Concept Design	Describe air heater / steam air pre-heater system geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Describe air heater / steam air pre-heater system geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Describe air heater / steam air pre-heater system geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Describe air heater cleaning equipment geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Describe air heater cleaning equipment geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Describe air heater cleaning equipment geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Describe air heater cleaning equipment geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Describe air heater cleaning equipment layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Describe air heater cleaning equipment layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Describe air heater cleaning equipment layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Describe air heater cleaning equipment layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Describe changes to existing milling system geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Describe changes to existing milling system geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Duct System Concept Design	Describe duct system geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Duct System Concept Design	Describe duct system geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Duct System Basic Design	Describe duct system geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Duct System Basic Design	Describe duct system geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Concept Design	Describe electrostatic precipitator layout and geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Concept Design	Describe electrostatic precipitator layout and geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Concept Design	Describe fabric filter plant layout and geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Concept Design	Describe fabric filter plant layout and geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Describe fan system geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Describe fan system geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Describe fan system geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Describe fan system geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Describe flue gas desulphurisation system and philosophies			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Describe flue gas desulphurisation system and philosophies				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Describe flue gas desulphurisation system and philosophies			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Describe flue gas desulphurisation system and philosophies				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Describe flue gas desulphurisation system layout & geometry			A		

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Process Flow (L3)	Activity Flow (L4)	Activity (L5)	Task (L6)	None	CoE Manager	Lead Discipline Engineering Practitioner	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Describe flue gas desulphurisation system layout & geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Describe flue gas desulphurisation system layout & geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Describe flue gas desulphurisation system layout & geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Concept Design	Describe lighting up system footprint			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Concept Design	Describe lighting up system footprint				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Describe main firing system basic geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Describe main firing system basic geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Concept Design	Describe main firing system concept layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Concept Design	Describe main firing system concept layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Describe pressure parts cleaning equipment geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Describe pressure parts cleaning equipment geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Describe pressure parts cleaning equipment geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Describe pressure parts cleaning equipment geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Describe pressure parts cleaning equipment layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Describe pressure parts cleaning equipment layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Describe pressure parts cleaning equipment layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Describe pressure parts cleaning equipment layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Concept Design	Describe pressure parts footprint and layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Concept Design	Describe pressure parts footprint and layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Design compartment and plant layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Design compartment and plant layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Detail Design	Design control equipment			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Detail Design	Design control equipment				R	
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Design hoppers			A		
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Design hoppers				R	
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Design pulsing system			A		
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Design pulsing system				R	
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Concept Design	Determine air heater / steam air pre-heater system performance characteristics			A		
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Concept Design	Determine air heater / steam air pre-heater system performance characteristics				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Determine air heater cleaning steam tapping points			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Determine air heater cleaning steam tapping points				R	

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Process Flow (L3)	Activity Flow (L4)	Activity (L5)	Task (L6)	None	CoE Manager	Lead Discipline Engineering Practitioner	
Perform Coal Power Plant Boiler Engineering	Perform Duct System Concept Design	Determine duct system performance characteristics			A		
Perform Coal Power Plant Boiler Engineering	Perform Duct System Concept Design	Determine duct system performance characteristics				R	
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Concept Design	Determine electrostatic precipitator plant performance characteristics			A		
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Concept Design	Determine electrostatic precipitator plant performance characteristics				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Determine equipment efficiency			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Determine equipment efficiency				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Determine fan system performance characteristics			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Determine fan system performance characteristics				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Process Design	Determine if thermal cycle analysis is required			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Process Design	Determine if thermal cycle analysis is required				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Concept Design	Determine lighting up system performance characteristics			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Concept Design	Determine lighting up system performance characteristics				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Concept Design	Determine main firing system performance characteristics			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Concept Design	Determine main firing system performance characteristics				R	
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Determine maximum number of compartments			A		
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Determine maximum number of compartments				R	
Perform Coal Power Plant Boiler Engineering	Perform Milling System Concept Design	Determine milling system performance characteristics			A		
Perform Coal Power Plant Boiler Engineering	Perform Milling System Concept Design	Determine milling system performance characteristics				R	
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Determine number of compartments			A		
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Determine number of compartments				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Detail Design	Determine piping size and material			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Detail Design	Determine piping size and material				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Detail Design	Determine piping supports and layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Detail Design	Determine piping supports and layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Determine pressure parts cleaning steam tapping points			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Determine pressure parts cleaning steam tapping points				R	
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Concept Design	Determine pressure parts performance characteristics			A		
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Concept Design	Determine pressure parts performance characteristics				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Determine stress level acceptability			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Determine stress level acceptability				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Determine type of boiler cleaning equipment required			A		

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Process Flow (L3)	Activity Flow (L4)	Activity (L5)	Task (L6)	None	CoE Manager	Lead Discipline Engineering Practitioner	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Determine type of boiler cleaning equipment required				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Determine type of boiler cleaning equipment required			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Determine type of boiler cleaning equipment required				R	
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Develop air heater / steam air pre-heater basic design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Develop air heater / steam air pre-heater basic design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Concept Design	Develop air heater / steam air pre-heater concept design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Concept Design	Develop air heater / steam air pre-heater concept design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Concept Design	Develop air heater / steam air pre-heater system layout drawings			A		
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Concept Design	Develop air heater / steam air pre-heater system layout drawings				R	
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Develop air heater / steam air pre-heater system layout drawings			A		
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Develop air heater / steam air pre-heater system layout drawings				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Develop air heater cleaning equipment control philosophy			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Develop air heater cleaning equipment control philosophy				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Develop air heater cleaning equipment control philosophy			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Develop air heater cleaning equipment control philosophy				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Develop boiler cleaning equipment basic design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Develop boiler cleaning equipment basic design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Develop boiler cleaning equipment concept design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Develop boiler cleaning equipment concept design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Computational Fluid Dynamics (CFD) Analysis	Develop CAD model and mesh			A		
Perform Coal Power Plant Boiler Engineering	Perform Computational Fluid Dynamics (CFD) Analysis	Develop CAD model and mesh				R	
Perform Coal Power Plant Boiler Engineering	Perform Duct System Basic Design	Develop duct system basic design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Duct System Basic Design	Develop duct system basic design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Duct System Concept Design	Develop duct system concept design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Duct System Concept Design	Develop duct system concept design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Duct System Concept Design	Develop duct system layout drawings			A		
Perform Coal Power Plant Boiler Engineering	Perform Duct System Concept Design	Develop duct system layout drawings				R	
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Basic Design	Develop electrostatic precipitator basic design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Basic Design	Develop electrostatic precipitator basic design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Concept Design	Develop electrostatic precipitator concept design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Concept Design	Develop electrostatic precipitator concept design report				R	

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Process Flow (L3)	Activity Flow (L4)	Activity (L5)	Task (L6)	None	CoE Manager	Lead Discipline Engineering Practitioner	
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Develop existing milling system basic design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Develop existing milling system basic design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Develop fan system basic design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Develop fan system basic design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Develop fan system concept design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Develop fan system concept design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Develop fan system layout drawings			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Develop fan system layout drawings				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Develop flue gas desulphurisation 3D model			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Develop flue gas desulphurisation 3D model				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Develop flue gas desulphurisation equipment specification			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Develop flue gas desulphurisation equipment specification				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Develop flue gas desulphurisation functional description			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Develop flue gas desulphurisation functional description				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Develop flue gas desulphurisation process data sheets			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Develop flue gas desulphurisation process data sheets				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Develop flue gas desulphurisation process data sheets			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Develop flue gas desulphurisation process data sheets				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation Process Design	Develop flue gas desulphurisation process design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation Process Design	Develop flue gas desulphurisation process design report				R, C	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation Process Design	Develop flue gas desulphurisation process flow model			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation Process Design	Develop flue gas desulphurisation process flow model				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Develop flue gas desulphurisation system concept design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Develop flue gas desulphurisation system concept design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Basic Design	Develop heat transfer model			A		
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Basic Design	Develop heat transfer model				R	

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Process Flow (L3)	Activity Flow (L4)	Activity (L5)	Task (L6)	None	CoE Manager	Lead Discipline Engineering Practitioner	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Develop lighting up system basic design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Develop lighting up system basic design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Concept Design	Develop lighting up system concept design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Concept Design	Develop lighting up system concept design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Develop main firing system basic design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Develop main firing system basic design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Concept Design	Develop main firing system breakdown structure			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Concept Design	Develop main firing system breakdown structure				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Concept Design	Develop main firing system concept design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Concept Design	Develop main firing system concept design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Detail Design	Develop main firing system detail layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Detail Design	Develop main firing system detail layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Milling System Concept Design	Develop milling system concept design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Milling System Concept Design	Develop milling system concept design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Develop new milling system basic design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Develop new milling system basic design report				R	
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Basic Design	Develop pipe stress model			A		
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Basic Design	Develop pipe stress model				R	
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Concept Design	Develop pressure parts concept design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Concept Design	Develop pressure parts concept design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Detail Design	Develop pressure parts detail drawings			A		
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Detail Design	Develop pressure parts detail drawings				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Develop supplier specification list			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Develop supplier specification list				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Estimate / analyse fan system related loads / flows / temperatures / pressures / etc for fan system			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Estimate / analyse fan system related loads / flows / temperatures / pressures / etc for fan system				R	
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Estimate / analyse loads / flows / temperatures / pressures / etc for air heater / steam air pre-heater system			A		
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Estimate / analyse loads / flows / temperatures / pressures / etc for air heater / steam air pre-heater system				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Estimate / analyse loads / flows / temperatures / pressures / etc for lighting up system			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Estimate / analyse loads / flows / temperatures / pressures / etc for lighting up system				R	
Perform Coal Power Plant Boiler Engineering	Perform Duct System Basic Design	Estimate / analyse loads / flows / temperatures / pressures / etc pertaining to the duct system			A		

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Process Flow (L3)	Activity Flow (L4)	Activity (L5)	Task (L6)	None	CoE Manager	Lead Discipline Engineering Practitioner	
Perform Coal Power Plant Boiler Engineering	Perform Duct System Basic Design	Estimate / analyse loads / flows / temperatures / pressures / etc pertaining to the duct system				R	
Perform Coal Power Plant Boiler Engineering	Perform Computational Fluid Dynamics (CFD) Analysis	Examine results & generate report			A		
Perform Coal Power Plant Boiler Engineering	Perform Computational Fluid Dynamics (CFD) Analysis	Examine results & generate report				R	
Perform Coal Power Plant Boiler Engineering	Perform Computational Fluid Dynamics (CFD) Analysis	Execute solver / simulation			A		
Perform Coal Power Plant Boiler Engineering	Perform Computational Fluid Dynamics (CFD) Analysis	Execute solver / simulation				R	
Perform Coal Power Plant Boiler Engineering	Perform Computational Fluid Dynamics (CFD) Analysis	Formulate flow / heat transfer problem			A		
Perform Coal Power Plant Boiler Engineering	Perform Computational Fluid Dynamics (CFD) Analysis	Formulate flow / heat transfer problem				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Process Design	Generate boiler system process flow diagram and process output sheet			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Process Design	Generate boiler system process flow diagram and process output sheet				R, I	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Detail Design	Generate caesar model			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Detail Design	Generate caesar model				R	
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Laser scan existing plant			A		
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Laser scan existing plant				R	
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Basic Design	Model / sketch electrostatic precipitator layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Basic Design	Model / sketch electrostatic precipitator layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Model / sketch main firing system layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Model / sketch main firing system layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Model changes made to existing milling system geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Model changes made to existing milling system geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Duct System Basic Design	Model duct system			A		
Perform Coal Power Plant Boiler Engineering	Perform Duct System Basic Design	Model duct system				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Model fan system layout & equipment			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Model fan system layout & equipment				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Model lighting up system layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Model lighting up system layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Model the air heater / steam air pre-heater equipment layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Model the air heater / steam air pre-heater equipment layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Duct System Basic Design	Model to existing duct system layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Duct System Basic Design	Model to existing duct system layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Basic Design	Model to existing electrostatic precipitator layout			A		

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Process Flow (L3)	Activity Flow (L4)	Activity (L5)	Task (L6)	None	CoE Manager	Lead Discipline Engineering Practitioner	
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Basic Design	Model to existing electrostatic precipitator layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Model to existing fan system layout & equipment			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Model to existing fan system layout & equipment				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Model to existing main firing system layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Model to existing main firing system layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Model to fit existing air heater / steam air pre-heater equipment layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Model to fit existing air heater / steam air pre-heater equipment layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Detail Design	Optimise main firing system basic design			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Detail Design	Optimise main firing system basic design				R	
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Perform / analyse existing milling system specific calculations			A		
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Perform / analyse existing milling system specific calculations				R	
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Perform air heater / steam air pre-heater basic design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Perform air heater / steam air pre-heater basic design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Concept Design	Perform air heater / steam air pre-heater concept design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Concept Design	Perform air heater / steam air pre-heater concept design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Perform air heater / steam air pre-heater equipment specific calculations			A		
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Basic Design	Perform air heater / steam air pre-heater equipment specific calculations				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Perform boiler cleaning equipment basic design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Perform boiler cleaning equipment basic design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Perform boiler cleaning equipment concept design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Perform boiler cleaning equipment concept design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Detail Design	Perform boiler cleaning equipment detail design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Detail Design	Perform boiler cleaning equipment detail design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Process Design	Perform boiler mass and energy balance			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Process Design	Perform boiler mass and energy balance				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Process Design	Perform boiler process design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Process Design	Perform boiler process design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Process Design	Perform boiler thermal expansion analysis			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Process Design	Perform boiler thermal expansion analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Computational Fluid Dynamics (CFD) Analysis	Perform computational flow dynamics internal review			A		
Perform Coal Power Plant Boiler Engineering	Perform Computational Fluid Dynamics (CFD) Analysis	Perform computational flow dynamics internal review				R	

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Process Flow (L3)	Activity Flow (L4)	Activity (L5)	Task (L6)	None	CoE Manager	Lead Discipline Engineering Practitioner	
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Concept Design	Perform damper selection			A		
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Concept Design	Perform damper selection				R	
Perform Coal Power Plant Boiler Engineering	Perform Duct System Basic Design	Perform duct system basic design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Duct System Basic Design	Perform duct system basic design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Duct System Concept Design	Perform duct system concept design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Duct System Concept Design	Perform duct system concept design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Duct System Basic Design	Perform duct system equipment specific calculations			A		
Perform Coal Power Plant Boiler Engineering	Perform Duct System Basic Design	Perform duct system equipment specific calculations				R	
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Basic Design	Perform electrostatic precipitator system / equipment specific calculations			A		
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Basic Design	Perform electrostatic precipitator system / equipment specific calculations				R	
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Basic Design	Perform electrostatic precipitator system basic design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Basic Design	Perform electrostatic precipitator system basic design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Concept Design	Perform electrostatic precipitator system concept design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Concept Design	Perform electrostatic precipitator system concept design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Perform equipment specific operating analysis			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Perform equipment specific operating analysis				R	
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Perform fabric filter plant basic design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Perform fabric filter plant basic design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Concept Design	Perform fabric filter plant concept design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Concept Design	Perform fabric filter plant concept design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Perform fan system basic design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Perform fan system basic design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Perform fan system concept design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Perform fan system concept design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation Process Design	Perform flue gas desulphurisation process design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation Process Design	Perform flue gas desulphurisation process design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Perform flue gas desulphurisation system basic design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Perform flue gas desulphurisation system basic design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Perform flue gas desulphurisation system concept design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Perform flue gas desulphurisation system concept design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Perform forced draught fan system equipment specific calculations			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Perform forced draught fan system equipment specific calculations				R	

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Process Flow (L3)	Activity Flow (L4)	Activity (L5)	Task (L6)	None	CoE Manager	Lead Discipline Engineering Practitioner	
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Basic Design	Perform high pressure piping basic design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Basic Design	Perform high pressure piping basic design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Concept Design	Perform high pressure piping concept design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Concept Design	Perform high pressure piping concept design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Detail Design	Perform high pressure piping detail design calculations			A		
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Detail Design	Perform high pressure piping detail design calculations				R	
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Detail Design	Perform high pressure piping detail design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Detail Design	Perform high pressure piping detail design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Perform induced draught fan system equipment specific calculations			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Perform induced draught fan system equipment specific calculations				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Perform lighting up system / equipment specific calculations			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Perform lighting up system / equipment specific calculations				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Perform lighting up system basic design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Perform lighting up system basic design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Concept Design	Perform lighting up system concept design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Concept Design	Perform lighting up system concept design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Perform lighting up system engineering analysis / simulation			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Perform lighting up system engineering analysis / simulation				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Perform load simulation			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Perform load simulation				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Perform main firing system / equipment specific calculations			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Perform main firing system / equipment specific calculations				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Perform main firing system basic design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Perform main firing system basic design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Concept Design	Perform main firing system concept design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Concept Design	Perform main firing system concept design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Detail Design	Perform main firing system detail analysis / calculations			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Detail Design	Perform main firing system detail analysis / calculations				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Detail Design	Perform main firing system detail design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Detail Design	Perform main firing system detail design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Perform milling system basic design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Perform milling system basic design peer review				R	

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Process Flow (L3)	Activity Flow (L4)	Activity (L5)	Task (L6)	None	CoE Manager	Lead Discipline Engineering Practitioner	
Perform Coal Power Plant Boiler Engineering	Perform Milling System Concept Design	Perform milling system concept design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Milling System Concept Design	Perform milling system concept design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Basic Design	Perform pressure parts basic design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Basic Design	Perform pressure parts basic design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Concept Design	Perform pressure parts concept design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Concept Design	Perform pressure parts concept design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Detail Design	Perform pressure parts detail design calculations			A		
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Detail Design	Perform pressure parts detail design calculations				R	
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Detail Design	Perform pressure parts detail design peer review			A		
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Detail Design	Perform pressure parts detail design peer review				R	
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Concept Design	Perform pressure parts material selection			A		
Perform Coal Power Plant Boiler Engineering	Perform Pressure Parts Concept Design	Perform pressure parts material selection				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Perform primary air fan system equipment specific calculations			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Basic Design	Perform primary air fan system equipment specific calculations				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Detail Design	Produce main firing system detail drawings and bill of quantities			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Detail Design	Produce main firing system detail drawings and bill of quantities				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Provide flue gas desulphurisation input to project design manual			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Provide flue gas desulphurisation input to project design manual				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Provide flue gas desulphurisation input to project design manual			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Provide flue gas desulphurisation input to project design manual				R	
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Basic Design	Refine electrostatic precipitator geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Basic Design	Refine electrostatic precipitator geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Refine fabric filter design and compile the design report			A		
Perform Coal Power Plant Boiler Engineering	Perform Fabric Filter Plant Basic Design	Refine fabric filter design and compile the design report				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Refine lighting up system geometry			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Refine lighting up system geometry				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Refine lighting up system layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Refine lighting up system layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Refine main firing system layout			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Refine main firing system layout				R	
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Concept Design	Select air heater / steam air pre-heater type			A		
Perform Coal Power Plant Boiler Engineering	Perform Air Heater System Concept Design	Select air heater / steam air pre-heater type				R	

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Process Flow (L3)	Activity Flow (L4)	Activity (L5)	Task (L6)	None	CoE Manager	Lead Discipline Engineering Practitioner	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Select air heater cleaning equipment			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Select air heater cleaning equipment				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Select air heater cleaning equipment			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Select air heater cleaning equipment				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Select flue gas desulphurisation materials of construction			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Select flue gas desulphurisation materials of construction				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Select flue gas desulphurisation materials of construction			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Select flue gas desulphurisation materials of construction				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Select forced draught fan type			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Select forced draught fan type				R	
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Concept Design	Select high pressure piping material			A		
Perform Coal Power Plant Boiler Engineering	Perform High Pressure Piping Concept Design	Select high pressure piping material				R, C	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Select induced draught fan type			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Select induced draught fan type				R	
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Select new milling system type			A		
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Select new milling system type				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Select pressure parts cleaning equipment			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Concept Design	Select pressure parts cleaning equipment				R	
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Select pressure parts cleaning equipment			A		
Perform Coal Power Plant Boiler Engineering	Perform Boiler Cleaning Equipment Basic Design	Select pressure parts cleaning equipment				R	
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Select primary air fan type			A		
Perform Coal Power Plant Boiler Engineering	Perform Fan System Concept Design	Select primary air fan type				R	
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Select system to be developed			A		
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Select system to be developed				R	
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Select upgrade/new milling system type for existing milling system			A		
Perform Coal Power Plant Boiler Engineering	Perform Milling System Basic Design	Select upgrade/new milling system type for existing milling system				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Size flue gas desulphurisation balance of plant			A		

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Process Flow (L3)	Activity Flow (L4)	Activity (L5)	Task (L6)	None	CoE Manager	Lead Discipline Engineering Practitioner	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Size flue gas desulphurisation balance of plant				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Size flue gas desulphurisation balance of plant			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Size flue gas desulphurisation balance of plant				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Size flue gas desulphurisation main equipment			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Concept Design	Size flue gas desulphurisation main equipment				R	
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Size flue gas desulphurisation main equipment			A		
Perform Coal Power Plant Boiler Engineering	Perform Flue Gas Desulphurisation System Basic Design	Size flue gas desulphurisation main equipment				R	
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Basic Design	Specify electrostatic precipitator materials characteristics			A		
Perform Coal Power Plant Boiler Engineering	Perform Electrostatic Precipitator System Basic Design	Specify electrostatic precipitator materials characteristics				R	
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Specify lighting up system material characteristics			A		
Perform Coal Power Plant Boiler Engineering	Perform Lighting Up System Basic Design	Specify lighting up system material characteristics				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Specify main firing system materials characteristics			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Specify main firing system materials characteristics				R	
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Verify main firing system layout measurements			A		
Perform Coal Power Plant Boiler Engineering	Perform Main Firing System Basic Design	Verify main firing system layout measurements				R	

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Eskom	**MEMO**	**Group IT / Strategy Execution, Architecture and Risk / EA Methodology**

Title: **PCM Non-Conformance Concession – Specialised Engineering**

Date: 5 June 2017

CR 1134

A non-conformance concession is requested by the process owner(s) for the following PCMs:

	PCM Name	Revision Date
1	240-53499108 Process Control Manual (PCM) for Perform Coal Power Plant Boiler Engineering	2014/01/31

The reason for the concession is due to the fact that the process owners are satisfied with the current PCM content and as such a review is not deemed necessary. The revision date and signatory details of the current PCMs are to be changed and the PCMs resubmitted for sign-off.

The following methodological PCM issues (which could result in audit findings) were identified and needs to be considered when approving the concession:

1. **Interfaces / Hand-offs to Other Processes**

   Interfacing / hand-offs to other PCMs are incomplete / outdated (obsolete), potentially reducing the effectiveness, usability and value of the PCMs (CARAT Business Impact: Risk to Complete, Accurate, Relevant, Accessible)

2. **Key Performance Indicators:**

   Unapproved / unregistered and potentially incorrect KPIs are listed by these PCMs, potentially impacting the quality of process monitoring and business reporting (CARAT Business Impact: Risk to Accurate, Relevant).

3. **Referenced Documents:**

   Various referenced documents are passed their revision dates, potentially making these referenced documents irrelevant (CARAT Business Impact: Risk to Accurate, Relevant).

   Links to various referenced documents are incorrect, potentially making navigation to these referenced documents problematic (CARAT Business Impact: Risk to Accessible):

4. **Applications:**

   Informal / decommissioned applications are listed in the PCMs, potentially identifying the use of a non-standard application (CARAT Business Impact: Risk to Accessible):

5. **Business Objectives**

Not all the business objectives listed in the PCMs are current Eskom strategic objectives, potentially making the PCMs inaccurate (CARAT Business Impact: Risk to Accurate, Relevant).

6. Adherence to EHPUM Technical Modeling:

Some of the models in the PCMs do not technically adhere to the EPHUM methodology, potentially reducing the effectiveness, usability and value of the PCMs (CARAT Business Impact: Risk to Complete, Accurate)

Findings Summary

The PCMs were developed prior to the formalisation of the EHPUM methodology and have numerous non-conformance issues, including interfaces to invalid / non-existent processes, the use of ungoverned KPIs, etc.

In addition, some of these PCMs were, at some stage, unlocked for updates but these updates were never completed. As a result it is not possible to follow the normal route of using the PCM content in the development database to generate new versions of the PCMs with updated date and signatory details.

The option available is thus to keep the current pdf version of the PCMs and add a new front page with new the revision date and signatures to the document in Hyperwave and update the revision and signatory details in the change control area of the ARIS database.

Process Owner Decision:

Concession Request Supported	X
Concession Request Rejected	

Leon van Wyk		07 June 2017
Process Owner Name	Signature	Date
Tshite Masike		26 June 2017
eHPUM Capability Manager	Signature	Date