



SCOPE OF WORK

Generation

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1. INTRODUCTION

Medupi Power Station Heating Ventilation and Air Conditioning (HVAC) works is not complete, some sections of the HVAC plants have been partially commissioned and tested but not complete, some areas in the plant did not incorporate HVAC in the design, some areas require HVAC redesign and retrofitting and some areas require the restoration of the HVAC system and addressing of outstanding defects or scope (including documentation) up to a stage where the affect plant can be handed over to Generation as defined in the relevant scope of work in section 3.

This document details the HVAC scope of work to address the outstanding HVAC works on Medupi Power Station where buildings or areas exists. The scope of work ranges from design, repair / plant restoration, completion of incomplete works (construction and commissioning) and completion of outstanding documentation. The respective scope of work as applicable to the buildings in this scope of work is detailed in section 3.

2. SUPPORTING CLAUSES

2.1 SCOPE

The content of this document is therefore limited to the HVAC scope of work for the following buildings or areas:

Grouping	Building or Area	Scope of work
Cable Tunnels	Cable Tunnels	Ventilation system design, construction, retrofitting and commissioning
Package 35A (P35A)	Coal Silo Substation	Design review Plant restoration and construction completion, and commissioning
	Coal Plant Substation	Design review Plant restoration and construction completion, and commissioning
	Coal Stockyard North Substation	Design review Plant restoration and construction completion, and commissioning
	Coal Stockyard Office	Design review Plant restoration and construction completion, and commissioning
	Coal Stockyard South Substation	Design review Plant restoration and construction completion, and commissioning
	Ash Conveyor Substation	Design review Plant restoration and construction completion, and commissioning
	Ash Conditioning Substation	Design review Plant restoration and construction completion, and commissioning
	Compressor House South Substation	Design review Plant restoration and construction completion, and commissioning
	Compressor House South Building	Design review Plant restoration and construction completion, and commissioning
	Substation West	Design review Plant restoration and construction completion, and commissioning
	Compressor House North Substation	Design review Plant restoration and construction completion, and commissioning

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	Substation North	Design review Plant restoration and construction completion, and commissioning
	Workshop and Stores Substation	Design review Plant restoration and construction completion, and commissioning
	IT and Comms Buildings	Design review Plant restoration and construction completion, and commissioning
	Access Control Building	Design review Plant restoration and construction completion, and commissioning
Package 35B (P35B)	Fire & Medical	Design review, Completion of data books, KKS labelling and certification, Fixing defects and completing outstanding commissioning and documentation
	Facilities Substation	Design review, Completion of data books, KKS labelling and certification, Fixing defects and completing outstanding commissioning and documentation
	Canteen	Design review, Completion of data books, KKS labelling and certification, Fixing defects and completing outstanding commissioning and documentation
	Chiller Yard	Design review, Completion of data books, KKS labelling and certification, Fixing defects and completing outstanding commissioning and documentation
	Administration Building	Design review, Completion of data books, KKS labelling and certification, Fixing defects and completing outstanding commissioning and documentation
	Compressor House North Building	Design review, Completion of data books, KKS labelling and certification, Fixing defects and completing outstanding commissioning and documentation
	Ash Dump Workshop	Design review, Completion of data books, KKS labelling and certification, Fixing defects and completing outstanding commissioning and documentation
	Office Block Building	Design review, Completion of data books, KKS labelling and certification, Fixing defects and completing outstanding commissioning and documentation
Package 35C (P35C)	Ash Dump Substation	Design review, Plant restoration / repair and service and Complete installation, minor modification and commissioning
	Workshop and Stores Building	Design review, Plant restoration / repair and service and commissioning
CEP VSD room	CEP VSD rooms (6 units)	Design review, Construction, retrofitting and commissioning

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2.1.1 Purpose

The purpose of this document is to provide Scope of work or Technical Specification to enable contractor to complete the outstanding HVAC scope.

2.1.2 Applicability

This document applies to Eskom Medupi Power Station buildings/ areas as detailed in section 2.1 and section 3.

2.2 NORMATIVE/INFORMATIVE REFERENCES

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

2.2.1 Normative

- [1] 200-71707 General Technical Specification for the Main HVAC Installation
- [2] ISO 9001 Quality Management Systems.
- [3] ISO 10007:2017 Quality management — Guidelines for configuration management
- [4] Medium Voltage AC Variable Frequency Drives Standard (240-50237146)
- [5] Design Guideline for HVAC in the Eskom Coal Fired Power Stations (240-70164623)
- [6] General Technical Specification for HVAC Systems Standard (240-102547991)
- [7] 240-7143250 Plant Labelling Standards
- [8] 389557 Medupi Contractor Quality Specification
- [9] 240-58552870 Smart Plant for Owner Operators (SPO) Documentation Metadata Standard
- [10] 240-109607736 Eskom KKS Key Part Standard
- [11] 240-100523028 Medupi Power Station Labelling and Coding User Requirements Specification
- [12] 240-109607332 Eskom Plant labelling and Abbreviation Standard
- [13] 240-93576498 KKS Coding Standard
- [14] 200-4190 The application of KKS plant coding (NMP 45-7)
- [15] 200-18202 KKS Key Part-Fossil Power Station (NPSZ 45-45)
- [16] 200-94660 Issuing of KKS certificate
- [17] VGB-B 105 E 5th edition 10/2003 – KKS Guideline
- [18] VGB-B 106 E Parts A-KKS Application Commentaries Part A General
- [19] VGB-B 106 E Part B1-KKS Application Commentaries Part B1_Mechanical Engineering
- [20] VGB-B 106 E Part B2-KKS Application Commentaries Part B2_Civil Engineering
- [21] VGB-B 106E Part B3-KKS Application Commentaries Part B3_Electrical and C&I Engineering.
- [22] VGB-B 106E Part B4-KKS Application Commentaries Part B4 Identification of C&I and Control Tasks.
- [23] 240-53114186 Project/Plant Specific Technical Document and Records Management Procedure
- [24] 200-46362 Site Inspections Procedure
- [25] 240-61227631 Piping and Instrumentation Diagram (P&ID) Standard

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- [26] 240-118378224 Drawing Quality Assurance Guideline for Gx Technology
- [27] 32-136 Contractor Health and Safety Requirements
- [28] 32-1126 Smoking Policy
- [29] 32-421 Eskom Plant Life Saving
- [30] 240-53114026 Project Engineering Change Management Procedure
- [31] 240-53114002 Engineering Change Management Procedure
- [32] 32-1033 Eskom Procurement and Supply Chain Management Policy
- [33] 240-76474270 Medupi Power Station Documents and Records Management Work Instruction
- [34] 32-173 Conflict of Interest Policy
- [35] 36-681 Eskom Plant Safety Regulation
- [36] 36-776 Rev 0 – Environmental Conditions for Process Control Electronic Equipment Used at Power Stations (GGS 1426 Rev 0)
- [37] Act No.85 of 1993 Occupational Health and Safety Act and Regulations, 1993
- [38] SANS 1091 National Colour Standards for Paints.
- [39] SANS 0108-1974 Classification of hazardous locations
- [40] SANS 10140-1 The wiring of premises part1-low voltage
- [41] SANS 60079 Part 15 Electrical apparatus for explosive gas atmosphere
- [42] 240-56355731 Environmental conditions for process control equipment used at Power Stations
- [43] SANS 60079 Part 15 Electrical apparatus for explosive gas atmosphere
- [44] SANS 2001-CG1 Construction works Part CG1: Installation of glazing in window and door frames
- [45] 200-4056 - Power Station Architectural Technical Specifications for Structures and other Buildings
- [46] 348-880042 Medupi Concrete specification for structural concrete (84CIVL053)
- [47] 240-56364545 Structural Design and Engineering Standard

2.2.2 Informative

- [48] 348-9978497 CEP VSD Control room HVAC retrofitting technical specification
- [49] SI/ESK-MET/C04237 Concept Design Report – Solution to Resolve Operational Challenges experienced in the Medupi Power Station CEP VSD Rooms (Due Diligence Report)
- [50] Occupational Health and Safety Act (Act 85 of 1993)
- [51] ISO 10007 Guidelines for Configuration Management
- [52] 240-101651897 Configuration Management Strategy

2.2.3 General

- [53] 240-49230148 Maintenance and logistics support design guideline
- [54] 240-511486 Documents and Record Management
- [55] 240-53114002 Engineering Change Management Procedure
- [56] 240-53113685 Design Review Procedure
- [57] 240-53665024 Engineering Quality Manual

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- [58] 240-56355466 Alarm Management System Guideline
- [59] 240-56355843 Pressure Measurement Systems Installation Standard
- [60] 240-56355888 Temperature Measurement Systems Installation Standard
- [61] 240-60782552 Process Flow Diagram Standard
- [62] 240-70164623 Design Guide for HVAC in Coal Fired Power Stations
- [63] 240-61227631 Piping and Instrumentation Diagram (P&ID) Standard
- [64] 240-71432150 Plant Labelling and Equipment Description Standards
- [65] 240-86973501 Engineering Drawing Standard Common Requirements
- [66] 36-1126 Eskom specification for corrosion protection
- [67] CSS 144 Eskom specification for application of painting
- [68] SANS 10111 Engineering drawings
- [69] SANS 10173 The installation, testing and balancing of air-conditioning ductwork
- [70] SANS 10400 The Application of National Building Regulations
- [71] SANS 1381- Painting
- [72] SANS 1391 Approval of welders
- [73] SANS 347 Categorization and conformity assessment criteria for all pressure equipment
- [74] SANS0140 Codes for identification

2.2.4 Forms and Templates

- [75] 240-56227927 Electrical Load List Template
- [76] 240-61379718 Control & Instrumentation Instrument Schedule Template
- [77] 240-61379755 Control & Instrumentation Drive & Actuator Schedule Template
- [78] 240-72344339 C&I Virtual Signal List Template
- [79] 240-72350241 C&I Panel Interface List Template
- [80] 240-55864360 Mechanical Equipment List Template [MELT]
- [81] 240-60782527 Control Philosophy Report Template
- [82] 552- Application for defect (concession) acceptance

2.2.5 Standards specific to HVAC industry

- [83] CIBSE Commissioning Code A: Air Distribution Systems
- [84] Commissioning Code B: Boilers
- [85] CIBSE Commissioning Code C: Automatic Controls
- [86] CIBSE Commissioning Code M: Commissioning Management
- [87] CIBSE Commissioning Code R: Refrigeration
- [88] CIBSE Commissioning Code W: Water Distribution Systems
- [89] BS 5720 British Standard Code of practice for mechanical ventilation and air conditioning
- [90] BS 8233 British Standard code of practice for sound insulation and noise reduction in buildings

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- [91] ASHRAE 15 Safety Code for mechanical refrigeration
- [92] ASHRAE62 Ventilation for acceptable indoor air quality
- [93] ASHRAE55 Thermal environmental condition for human occupancy
- [94] ASHRAE 52.1 and 52.2 standard test methods for filters
- [95] ASHRAE51/ AMCA210-Method of testing fan for certified performance rating
- [96] SANS 10400 Energy Usage in Buildings
- [97] SANS 10400 part T&W The application of the National Building Regulation in Fire Protection
- [98] SANS 10142-1 The wiring of premises
- [99] SANS1424 Filters used in air conditioning and general ventilation
- [100] SANS 1238 Air conditioning ductwork
- [101] SANS 1400 The application of the National Building Regulations
- [102] SANS193 Fire dampers
- [103] SANS 10140 Identification Colour markings
- [104] SANS10147 Refrigeration systems including plants associated with air-conditioning systems
- [105] SANS 10173 Code of practice for installation, testing and balancing of HVAC ducting-
- [106] SMACNA Duct construction standard
- [107] ASHRAE G1 Guideline for commissioning of air conditioning systems
- [108] AHRI- 550/590 Standard for Performance Rating of Water Chilling Packages
- [109] EN 779 standard test method for filters
- [110] ASME B31.5 Refrigeration piping and heat transfer components
- [111] 240-55864833 Chemistry for Auxiliary and Ancillary Cooling Water Systems Manual

2.2.6 Standards applicable to HVAC water systems

- [112] SANS 62 Steel pipes and fittings 150mmm and below
- [113] SANS 719 Steel pipes and fittings above 150mm
- [114] SANS 936 (BS5155) Float valve
- [115] SANS 1123 Flanged fittings
- [116] SANS 564 Flanged gaskets of reinforced rubber
- [117] BS EN 1171 Industrial valves – Cast iron gate valves
- [118] BS EN 12288 Industrial valves – Copper alloy gate valves
- [119] BS EN 13789 Industrial valves – Cast iron globe valves
- [120] BS EN 1983 Industrial valves – Steel ball valves
- [121] BS 5720 – British Standard: Code of practice for mechanical ventilation and air conditioning in buildings
- [122] SANS 1056-3 Ball valves Part 3: Light duty valves
- [123] SANS 1551-1 Check valves (flanged and wafer types) Part 1:

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- [124] SANS 1849 Butterfly valves for general purposes
- [125] SANS 191 Cast steel gate valves
- [126] SANS 665-1 Wedge gate and resilient seal valves for general purposes
- [127] 240-56356376 – Site commissioning for low pressure services
- [128] 200-1689 - Medupi Quality Specifications
- [129] SANS 10400 - All Parts--National Building regulations
- [130] 240-70164623 Design Guideline for HVAC in the Eskom Coal Fired Power Stations
- [131] 240-102547991 General Technical Specification for HVAC Systems Standard

2.3 DEFINITIONS

Definition	Description
BACnet	A Data Communication Protocol for Building Automation and Control Networks. A data communication protocol is a set of rules governing the exchange of data over a computer network that covers everything from what kind of cable to use to how to form a particular request or command in a standard way.
Contractor	Refers to the corporation appointed to perform the engineering, procurement, and construction Works required for the project.
Designer	A competent Person or contractor who prepares, checks and approves a design or carry out design work as part of design and build project
Design freeze	Is a binding decision that defines the whole product, its parts or parameters and allows the continuation of the design based on that decision (no further changes can be made to the design, it is cut-off for the engineers)
Employer	Refers to Eskom Holdings State Owned Company
Eskom Plant Engineering	Refers to the Eskom Engineering team who will perform the reviews and provide technical assistance for the work performed by the appointed Contractor.
Heating, Ventilating, and Air Conditioning (HVAC)	Relates to Systems that perform processes designed to regulate the air conditions within buildings for the comfort and safety of occupants. HVAC Systems condition and move air to desired areas of an indoor environment to create and maintain desirable temperature, humidity, ventilation, and air purity.
Interface	Interface in these document means either to hard wired or software interaction between the Contractors and/or other Works
Others	Others, as defined in this document includes the other discipline specific Contractors i.e. Electrical, C&I, Civil etc.
Maintenance	Maintenance can be defined as the function of keeping components or equipment in or restoring them to a serviceable condition so that they comply with design and statutory requirements and Employer standards. Maintenance includes the cleaning, removal of contaminants and waste, correct adjustment and setting, tightening, testing, fixing, refill, lubrication, rust prevention, touch up, refrigeration charge, servicing, inspection, replacement, re-installation, troubleshooting, calibration, condition determination, repair, modification, overhaul and rebuilding of equipment. Maintenance can be either preventative or corrective of nature.
Maintenance Management	Maintenance Management can be described as the management (planning, organising, leading and control) actions needed to ensure effective

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Definition	Description
	maintenance execution to provide the most efficient and optimum availability (capable of being used) and reliability (consistent quality) of the equipment installed.
Major defect	Refers to a defect that is likely to create failure of the system for its intended purpose.
Minor defect	Refers to discrepancy from the standards, but one that is not likely to affect the usability of the system.
Repairs	Repairs means the restoration of Equipment to its original function on an as-needed basis, as may be required by the Facility in response to the failure or malfunctioning of such equipment. The repair process may also include servicing, reconditioning, modification, and refurbishment.
Service	Any service requirements in accordance with the approved original equipment manufacture's maintenance documentation
Specification	The document/s forming part of the contract in which the methods of executing the various items of work to be done is described, as well as the nature and quality of the materials to be supplied and it includes technical schedules and drawings attached thereto as well as all samples and patterns
Subcontractor	Party employed by the Contractor for specialised work (i.e. electrical installation)
System	A set of things working together as parts of a mechanism or network in an organised manner or method such that the requirements of the System are achieved.
The Client	The end user will be Eskom who will be represented by Medupi Power Station throughout the duration of the Project.

2.3.1 Disclosure Classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 ABBREVIATIONS

Abbreviation	Description
ACC	Air Cooled Condenser
ACCCT	Air Cooled Condenser Condensate Tank
AFS	Air Flow Schematic
AHU	Air Handling Unit
ASHRAE	American Society for Heating Ventilation Refrigeration and Air conditioning
ASME	American Society for Mechanical Engineers
AUX	Auxiliary
BFO	Bulk Fuel Oil
CAD	Computer-Aided Drawing
CBMS	Consolidated Building Management System
CEP	Condensate Extraction Pump
CM	Corrective Maintenance
CoC	Certificate of Completion

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Abbreviation	Description
COP	Coefficient of Performance
CoE	Centre of Excellence
CPP	Condensate Polishing Plant
C&I	Control & Instrumentation
DB	Dry bulb temperature
DOL	Direct On Line
DP	Due point temperature
DX	Direct Expansion
EA	Extract Air
ECP	Engineering Change Proposal
ECSA	Engineering Council of South Africa
EDWL	Engineering Design Work Lead
ER	Engineering Response
ESP	External Static Pressure
FA	Fresh Air
h	Enthalpy (kJ/kg)
H1	Manufacturing Data Books (MCC and NCP)
H2	Construction Data Books (HVAC Mechanical, Electrical and C&I)
H3	Commissioning Data Books (Entire HVAC System in each building)
HMI	Human Machine Interface
HVAC	Heating, Ventilation, and Air Conditioning
LDE	Lead Discipline Engineer
LOSS	Limit of Supply and Services
LV	Low Voltage
KKS	Kraftwerk Keinnzeichen System (identification system)
MCB	Miniature Circuit Breaker
MCC	Motor Control Centre
MERV	Minimum efficiency Reporting Value
MPS	Medupi Power Station
MPSJV	Medupi Power Station Joint Venture
MSDS	Material Safety Data Sheet
MTTF	Mean Time to Failure
MTTR	Mean Time to Repair
MV	Medium Voltage
NCP	Network Control Panel
O&M	Operations and Maintenance
PEM	Project Engineering Manager

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Abbreviation	Description
PER	Pressure Equipment Regulations
PEC	Professional Engineering Certificate
PM	Planned Maintenance
P&ID	Piping and Instrumentation Diagram
PJFF	Pulse Jet Fabric Filter Plant
P08	Package 08
P35A	Package 35A
P35C	Package 35C
QCP	Quality Control Plan
RA	Return Air
RH	Relative Humidity
RPM	Revolutions Per Minute
SA	Supply Air
SANS	South African National Standards
SHE	Safety, Health and Environment
SLD	Single Line Diagrams
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SOW	Scope of work
TBF	Time between failures
TM	Team Medupi
VGB	Technische Vereinigung GrossKraftwerks Betreiber E.V (Major Power Plant Users Association).
VO	Variation Order
VRF	Variable Refrigerant Flow
VRV	Variable Refrigerant Volume
VSD	Variable Speed Drive
WB	Wet Bulb temperature
WTP	Water Treatment Plant

2.5 ROLES AND RESPONSIBILITIES

Role	Responsibility
Compiler	The document compiler is responsible for ensuring that this document is up-to-date and that this document is not a duplication of an existing documentation, regarding the document's objectives and content
Approver	The Functional Responsible Person shall determine if the document is fit for purpose, before the document is submitted for authorisation
Authoriser	The document authoriser is a duly delegated person with the responsibility to review the document for

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	alignment to business strategy, policy, objectives and requirements. He/she shall authorise the release and application of the document
Contractor	Execute the SOW assigned to as detailed in the report
Designer	Occupational Health and Safety Act, 1993, Construction Regulations, 2014, Section 6 Duties of the Designer applies e.g The designer inspects and declare the structure safe for use and issue a completion certificate
Employer	Provide requirements to be met by the Contractor
LPS (BoP)	It is the responsibility of the Eskom Balance of Plant (BoP) Department to ensure that the content of this scope document is executed accordingly
LDE	It is the responsibility of the multidisciplinary LDE's to ensure that their respective scopes are included and executed in accordance with this Scope of Work
Engineering Design Work Lead (EDWL)	The EDWL shall ensure that the SoW is relevant, reviewed by all affected engineering disciplines and is fit for purpose to be implemented on the relevant plant area(s).
Project Engineering Manager (PEM)	The PEM authorises the SoW based on Design review committee comments. The role change authoriser may be delegated by the project engineering manager to a professionally registered chief engineer, for example the project integration chief engineer.

2.6 PROCESS FOR MONITORING

The Contractor to submit project plan for evaluation and approval before any work commencement. Any deviation from the plan needs to be pre-approved by the Employer before any work execution. Daily/weekly progress feedback as agreed with Employer need to be provided.

Engineering work will be governed by the Design Review Procedure (240-53113685). Any changes to this document content will be performed as per the Project Engineering Change Management (240-53114026).

2.7 RELATED/SUPPORTING DOCUMENTS

In addition to Section 2.2, the contractor; provides all related and or supporting documentation (such as Plant check sheets, QCPs, Working Procedures, Certificates, Qualifications and etc.) to be used while providing services as covered in this scope of work

3. SCOPE OF WORK

3.1 CABLE TUNNEL VENTILATION SYSTEM

The contractor shall design, supply, install and commission the ventilation systems for the cable tunnels to achieve 2 air changes per hour. The construction of the Works will be undertaken while Medupi Power Station remains in operation during the complete duration of the execution of Works. Hence, the installation of new *works* is to be carried out in a systematic manner to ensure no loss of services in essential areas can be accommodated at any stage.

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3.1.1 Cable Tunnel Ventilation Scope of Works

The cable tunnel ventilation system engineering, quality assurance, quality control, inspections, plant and material selection, preparation of installation drawings, testing, balancing, commissioning, and preparation of operating and maintenance manuals, are to be managed and executed by the *Contractor* in a systematic manner as follows:

- a) Detailed Design
- b) Plant and material selection.
- c) Installation drawings.
- d) Quality assurance
- e) Plant installation.
- f) Testing, balancing, and commissioning documentation.
- g) Quality control
- h) Operating Instruction and Maintenance Manuals; and
- i) Inspection Records/Checklists and final hand-over

The Works include the following:

- a) Ducted supply and extraction system together with matching fire doors/hatches and fire dampers.
- b) Associated Electrical Works for complete tunnel ventilation system.
- c) Associated Controls and accessories for complete tunnel ventilation system.
- d) Associated building and Civil Works for complete tunnel ventilation system.
- e) Interfacing with fire detection system and CBMS
- f) Testing, balancing, and commissioning of the complete tunnel ventilation system.
- g) Provision of Painting and corrosion protection for complete tunnel ventilation system.
- h) Provision of operation & maintenance manuals.
- i) Plant Codification & Labelling and provide for complete tunnel ventilation system.
- j) The *Contractor* makes provision for spares and maintenance support as per the requirements set out in this document.

3.1.2 Fire Protection Philosophy

The tunnel ventilation system is interlocked to the fire protection system. The extraction fans will run continuously and facilitate smoke extraction in the event of a fire. The system operation and control philosophy is that when fire is detected in a zone, the relevant fire dampers on the supply side of the tunnel ventilation of that zone are closed. This is achieved through interface with the CBMS system.

3.1.3 Parts of the Cable Tunnel Ventilation Works which the Contractor is to Design

The plant and material are to be designed and selected with due regard to the installation site conditions, particularly with respect to altitude, ambient temperatures, and atmospheric conditions (refer to Appendix A25 for Medupi site design environmental data). The plant and material are to be selected to operate within the limits recommended by the manufacturers and where equipment will be required to operate at conditions deviating from the manufacturer's standard selection tables; re-rating is to be done strictly in accordance with the manufacturer's selection procedures.

The *Contractor's* design is to comprise detailed design package which will be reviewed and approved in accordance with Employer's Generation Design Review Procedure 240-53113685.

The design data specified in this specification and those dimensions shown on the tender drawings are intended for tendering purposes only. The *Contractor* is required to take the actual measurements onsite and determine their own air flow requirements to archive 2 air changes per hour before proceeding with detail design & manufacture of the complete Works as dimension accuracy remains the responsibility of the Contractor and full design accountability remains with the contractor.

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The *Contractor* shall design, produce required drawings, and select plant & material which satisfies:

- a) The overall plant performance and efficiency specification.
- b) The specified reliability; and keep maintenance costs to a minimum.
- c) Local and statutory authorities and construction requirements.
- d) Space constraints; and
- e) Local content

Contractor shall submit operating and maintenance manuals suitable for staff training. The Operating and maintenance manuals are to include the following however not limited to:

- a) Description of the complete HVAC system
- b) Operating, control and maintenance philosophies
- c) As Built drawings & Commissioning Check Sheets

The *Contractor* shall execute the following:

- a) Detailed design
- b) Plant and material acceptance testing
- c) Testing and commissioning
- d) Training of operators
- e) Training of maintenance personal
- f) Training of engineering personal
- g) Troubleshooting
- h) Implementation of an overall quality assurance plan

The *Contractor shall be* responsible for the detailed design of the *works* below and the designs are to be submitted to the Employer for approval prior to procurement and manufacture of any plant and material.

3.1.3.1 Tunnel Ventilation System Design

The envisaged process flow diagram for supply and extraction of air through the cable tunnels is as shown in the accompanying airflow schematics drawings (0.84/56249 and 0.84/36816) which forms part of this scope of works. These schematic drawings are issued for information purposes, it remains the responsibility of the contractor to design a tunnel ventilation system which is fit for purpose as per SoW, including all structural support requirements works to complete tunnel ventilation system. The airflow schematics are found in Appendix A24

The airflow schematics drawings provided show general layout of all equipment and distribution systems, complete with schematic arrangements. These, together with the specification, give sufficient information to enable the *Contractor* to estimate the cost and to determine how the system must be installed, tested, balanced, inspected, operated, serviced, and maintained. These airflow schematics drawings are not dimensioned shop drawings and cannot be used as shop drawings. Location dimensions shown are only indicative of the routes and zones in which the service must be installed.

3.1.3.1.1 Unit 1-6 Turbine and Boiler Tunnels leading to Auxiliary Bay

Each ACC basement (Turbine Plant) is equipped with 2 ducted type fresh air supply fans (each fan has an air flow capacity of 15m³/s) which are arranged on a duty & standby configuration, and supply air to the respective auxiliary bay tunnel (refer to the drawing 0.84/56249-sheet 1 to 6 for unit 1 to 6). The ACC basement supply fans are existing and have been installed as part of package 08 scope of works and do not form part of this works.

The contractor shall include in their design 2 other fresh air supply roof type fresh air fans located on the boiler side as indicated in the diagrams with each fan having a capacity of 3.5m³/s and both fans running to supply additional 7m³/s of fresh air to the auxiliary bay tunnel (refer to the airflow schematics 0.84/56249-sheet 1 to 6 for unit 1 to 6).

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The contractor shall also include in their design 2 smoke extraction fans of equal capacity at $10\text{m}^3/\text{s}$ each as shown in the accompanying air flow schematics for various auxiliary bays (refer to the drawing 0.84/56249-sheet 1 to 6 for unit 1 to 6).

3.1.3.1.2 Station Services Building Tunnel

The tunnel that links station services building and auxiliary bay 6 is supplied with fresh air by 2 -off ducted type fans and the fire wall separating the two areas is equipped with 2-off fire dampers which are normally opened during normal conditions to allow air to be extracted from auxiliary bay 6 side. The supply fans and fire dampers are existing and do not form part of this work.

3.1.3.1.3 Tunnel 23

Tunnel 23 is located between Auxiliary Bay 1 and Substation North (refer to drawings 0.84/26725 sheet 1/2/3/4/5/17). Fresh air to tunnel 23 is to be supplied through 2-off weather louvres as detailed by attached air flow schematics (0.84/56249-sheet 1) with each louver providing $0.65\text{m}^3/\text{s}$.

1-off smoke extraction fan with a capacity of $1.3\text{m}^3/\text{s}$ is to be installed between Auxiliary Bay 1 and Substation North as detailed by attached air flow schematics (0.84/56249-sheet 1).

3.1.3.1.4 Tunnel 39 and 39B

Tunnel 39 and 39B are located between Compressor House Substation North and Auxiliary Bay 2 and 3. Fresh air supply to each tunnel is to be supplied through 1-off roof type mounted fans as detailed by attached air flow schematics (0.84/56249-sheet 2 and 3 respectively) with each fan having a capacity $1.3\text{m}^3/\text{s}$.

2-off smoke extraction fans with each having a capacity of $1.3\text{m}^3/\text{s}$ are to be installed between Compressor House Substation North and Auxiliary Bay 2 and 3 as detailed by attached air flow schematics (0.84/56249-sheet 2 and 3 respectively).

3.1.3.1.5 Tunnel 44A

Tunnel 44A is located between Substation West and Diesel Generator Building. Fresh air supply to the tunnel is to be supplied through 1-off roof type mounted fans as detailed by attached air flow schematics (0.84/56249-sheet 5) with capacity $1.3\text{m}^3/\text{s}$.

1-off smoke extraction fan with a capacity of $1.3\text{m}^3/\text{s}$ is to be installed between Substation West and Diesel Generator Building as detailed by attached air flow schematics (0.84/56249-sheet 5).

3.1.3.1.6 Tunnel 44 and 46A

Tunnel 44 and 46A are located between Substation West/Diesel Generator Building and Auxiliary Bay 5. Fresh air supply to the tunnels is to be supplied through 1-off roof type mounted fans as detailed by attached air flow schematics (0.84/56249-sheet 5) with capacity $1.3\text{m}^3/\text{s}$.

1-off smoke extraction fan with a capacity of $1.3\text{m}^3/\text{s}$ is to be installed between Substation West/Diesel Generator Building and Auxiliary Bay 5 as detailed by attached air flow schematics (0.84/56249-sheet 5).

3.1.3.1.7 Tunnel 30 and 31A

Tunnel 30 and 31A are located at the Coal Stockyard Substation South. Fresh air supply to tunnel 30 and 31A is to be supplied through a weather louver at a rate of $0.3\text{m}^3/\text{s}$ and roof mounted supply air fan at a rate of $1.3\text{m}^3/\text{s}$ as detailed by attached air flow schematics (0.84/56249-sheet 7).

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1-off smoke extraction fan a capacity of 1.6m³/s is to be installed at tunnel 30 and 31A as detailed by attached air flow schematics (0.84/56249-sheet 7).

3.1.3.1.8 Tunnel 34A

Tunnel 34A is located at the Ash Conditioning Plant Substation. Fresh air supply to tunnel 34A is to be supplied from substation basement at a rate of 0.3m³/s as detailed by attached air flow schematics (0.84/56249-sheet 6).

1-off smoke extraction fan a capacity of 0.3m³/s is to be installed at Tunnel 34A as detailed by attached air flow schematics (0.84/56249-sheet 6).

3.1.3.2 Fire Dampers and Pressure Relief Dampers

The southern access opening in all ACC substation basements that leads to Auxiliary Bay tunnels is to be equipped with fire dampers in the wider section of the tunnel that will be kept open during normal operation.

The required fire damper physical sizes are estimated 800x800mm and 600mm long (for tendering purposes only). The *Contractor* shall take the actual measurements onsite before proceeding with design & manufacture of the works as accuracy remains the responsibility of the *Contractor*.

The fire dampers specified are motorized 24V AC fire dampers that are equipped with spring return actuators, combined with thermoelectric tripping device at 72°C with integral limit switches and thermal release; these will be wired by means of 2.5mm², heat resistant conductor wiring in galvanized conduit from the fire damper to the HVAC panel. The fire dampers are to be fitted with 2-off auxiliary micro switches, closed position to be monitored on the blade and open position to be monitored on the actuator. The fire dampers are powered and controlled from the HVAC panel. The fire dampers are permanently driven open in a failsafe configuration. In the event of a fire the power to all the dampers will be switched off, which will close the dampers. The fire signal will be normally closed.

The fire damper to have a 2-hour fire rating and fire sealing to be provided all around the fire damper to ensure that the 2-hour fire rating of the barrier is maintained.

An allowance is to be made for gravity type dampers that are to be installed on ACC substation which will open so that pressure can be released to the outside when all ACC substation tunnel fire dampers have been closed.

3.1.3.3 Fire Sealing

Openings and penetration through fire walls are to be fire sealed as indicated by accompanying drawings (0.84/56249-sheet 1-6 and 0.84/36816-sheet 71). Fire Seal must be 2-hour rated (have a 2-hour fire resistance) in accordance with SANS 10177-2 (stability, integrity, and insulation) or equivalent standard. Test certificate no older than 5 years to be provided for the product to be used. Product to be installed in accordance with manufacturers recommendations. Waterproofing is required for cable penetration seals.

3.1.3.4 Tunnel Ventilation Controls

The smoke ventilation fans are to be used as extraction system during normal operation/conditions and is to serve as smoke exhaust fans during fire conditions. The smoke ventilation fans are to be 2-hour fire rated and be equipped with black mild steel ducting for smoke exhaust (where required). The smoke ventilation fan starter panels, electrical and control cables are to be 2-hour fire rated as well.

The fire dampers are to be provided on the respective fire zones as detailed by the damper section above. The tunnels are divided into fire zones. The system operation is that when fire is detected in a zone, the relevant fire dampers on the supply side of the tunnel ventilation of that zone are closed.

3.1.3.5 Fire Detection Interfaces

The complete cable tunnel ventilation system is to be interfaced to the fire detection system. In the event of a fire break out, the fire detection system is to send a signal to the ventilation system starters/controllers to indicate that there is a fire in a specific zone; the ventilation system starters/controllers are to automatically stop the fresh supply air fans serving the respective areas; however, the smoke extraction fans are to continue running to exhaust the smoke out. The HVAC system is to automatically return to normal operation once the fire alarm signal to the ventilation system switchboard is cleared.

The fire detection installation is to be installed as follows:

- a) The Fire Detection System (FDS) is existing and is excluded from the works.
- b) The Fire Detection System (FDS) interfaces to the field controllers through a local hardwired failsafe interface in accordance with section 8 of 240-56737448 Fire Detection and Life Safety Design Standard.
- c) The *Contractor* shall perform a fire risk assessment which informs the tunnel ventilation response to an activation of a fire signal.
- d) The *Contractor* shall provide interface points (controller inputs) for each fire zone at the field controller to accommodate the FDS hardwired interface requirements. The smoke ventilation fan starter panels, electrical and control cables are to be 2-hour fired rated as well.
- e) The *Contractor* shall provide sufficient DIN rails to support a FDS line relay for each interface point. FDS line relays are excluded from the Works.
- f) The interfaces are localised per fire zone.
- g) In the event of a fire being detected the field controllers associated with the activated zone close all dampers and shut down supply air fans to choke the fire.
- h) The field controller's response to FDS alarms take priority over other HVAC commands.
- i) An initiated fire signal remains activate until manually reset by the fire responder.
- j) The *Contractor* shall program and configure the HVAC System and field controllers for the above requirements. The CBMS will be configured and programmed by Eskom, however the contractor should provide information for the CBMS configuration.
- k) The *Contractor* shall test and commissions the FDS interface according to SANS 10139 to confirm the above requirements.

3.1.3.6 Electrical System Design

The interfacing electrical scope of work is as follows:

- a) The *Contractor* shall provide details of the loads requiring power supply, information shall be provided on the provided load list template. 240-56227927 Electrical Load List Template.
- b) Eskom will allocate a point of connection or source supply from the current LV Switchgear.
- c) The *Contractor* shall be responsible for the supply, termination and pulling of cables from these allocated points of power supply to the load.
- a) The *Contractor* shall be responsible for sizing all cables, this includes cables from the source of supply and outgoing cables to the extraction fans. A cable schedule developed as per provided template. 240-56176097- Electrical Cable Schedule template.

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- d) All power and control Cable installations, laying, identification, type, routing, racking and termination to be done as per standard 240-56227443-Requirements for control and power cables for Power station standard.
- e) Installation of durable cable numbering for all cables connected to the equipment, the cable labelling is to be installed such that it is visible for ease of identification during maintenance and is to comply with 240-56227443 Requirements for Control and Power Cables for Power stations Standard.
- f) The MCC for the extraction fans shall be designed, manufactured, installed, and commissioned in accordance with 240-55714363-Coal Fired Power Station Lighting and Small Power Installation standards.
- g) The *Contractor* shall carry out the necessary bonding, earthing and, earth testing requirements on all new installed equipment, according to the requirements of the 240-56356396 – Earthing and Lightning Protection Standard.
- h) The *Contractor* shall be responsible for design, manufacturing, installation, and commissioning for Hazardous location areas as per SANS 10108 - The Classification of Hazardous Locations and Selection of Equipment for Use in Such Locations and 240-56536505 - Hazardous Location Standard.
- i) The *Contractor* to produce drawings, method statements/procedures and ITP's (Manufacturing and construction) for MCC boards and all the associated electrical works (i.e., cabling) prior to manufacturing and construction phase.
- j) Handover of the plant is to be done, and to include all relevant documentation including but not limited to the following:
 - Cable test certificates,
 - Cable routing and cable block diagrams,
 - 400V MCC panels should include as built single line diagrams, General Arrangements; load schedules, cable and termination schedules, A&B schedules (240-115583001), all factory test certificates, operation and maintenance manuals etc.
 - Earth continuity certificates
 - Quality verification records
- k) The *Contractor* shall provide all the Works to the Employer as per the templated listed below, for review:
 - 240-56176097: Electrical Cable Schedule Template
 - 240-56227927: Electrical Load List Template
 - 240-56356421: Electrical LV Switchgear Schedule Template
 - 240-56356465: Electrical LV List of Switchboards Template
 - 240-77302094: Electrical Termination Schedule Template
 - 240-115583001:LV switchgear Schedules A and B template
- l) Verification of the allocated circuits for serviceability and operability shall be conducted; any defects on the circuits are to be reported to the Employer before any rectification is conducted.
- m) The *Contractor* shall verify the components ratings (i.e., fuse switches, fuses, and terminals) of the allocated circuits, before completion of designs. Provision is to be made to supply the correctly rated components to achieve adequate protection grading, on acceptance of the designs and recommendations by the Employer.

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3.1.3.7 Civil, Structural and Building Works Design

The Contractor shall design, procurement, construction, and construction monitoring of all Civil and Structural Works. All designs will be submitted to the Employer for review and acceptance, as per the design review procedure (240-53113685). The Contractor's structural\civil designer shall ensure that design intent is achieved during construction. Once the construction work is completed, the *Contractor's* designer will issue the necessary certificates (inclusive of structural Professional Engineering Certificates) and as-built documentation (drawings, native files as well as structural design reports that includes all calculations).

The civil works including the following however not limited to:

- a) PJFF side tunnel escape cat ladders leading out to the top.
- b) Cat ladders for operation and maintenance access to tunnel ventilation fans
- c) Any other civil, structural, and building works required to supports the tunnel ventilation system including fire sealing of openings where required.
- d) Escape hatches and cat ladders for the ACC side cable tunnels. The positions of the escape hatches and cat ladders to be based off the fire escape route design of the tunnels.

Some tunnel link boxes, fan and louvres openings have been constructed on site, however some works are outstanding. The outstanding tunnel link boxes and fan and louvres openings are executed under a different scope. The contractor therefore required to plan the execution of the scope considering the status of the plant especially where interfacing is required. The status of link boxes, fan and louvres can be seen from Appendix A2

3.1.3.7.1 Detail of Civil Related Works

i. Inspection

It is required that the *Contractor* shall verify and inspect all existing works to confirm quality and/or any possible required modifications to the existing infrastructure. The contractor will be responsible for any required testing that the contractor's designer might require for designs.

ii. Geotechnical Design and Construction criteria

The *Contractor* shall carry out any/all geotechnical investigations for the required works (where necessary); whereafter the Contractor shall design, construct, monitor and certify all geotechnical works. The *Contractor* shall furnish all necessary equipment and resources required to execute the works. All geotechnical investigation and reporting works to be carried out in accordance with the SAICE Site Investigation Code of Practice, 2010 and Revised Guide to Soil Profiling for Civil Engineering purposes in Southern Africa" Trans. S.A.I.C.E, Vol. 15.

Medupi Specification for the preparation of engineered fills and backfill to all structures except backfill in turbine hall (200-6166) and SANS 1200 series should be adhered to in relation of earthworks, backfill and requirements for testing. All design and construction works shall be built in accordance to approved drawings and geotechnical recommendations supplied by the *Contractor*. A geotechnical PE certificate\professional declaration shall be produced by the Contractor's geotechnical specialist and shall include compilation and submission of geotechnical data books that shall be issued to the Employer for review once all works are completed.

iii. Concrete Works

The *Contractor* shall submit to the Engineer concrete mix designs, concrete-mix trial test cube results and all other required test results as indicated in the Medupi Power Station Specification for Structural Concrete (84CIVL053) prior to the placement of any concrete. Concrete mix designs with the required acceptance tests as indicated in the specification (84CIVL053) shall be submitted once reviewed and accepted by the Contractor's structural designer. Where tests results are not within specified limits the

Contractor's structural designer shall submit a report with recommendations to the Engineer for acceptance. Where the requirements of the specification (84CIVL053) appear to be unclear or ambiguous the Contractor and its designer shall discuss these with the Engineer and make the necessary recommendations in accordance with their specific project conditions.

The *Contractor* shall also submit to the Engineer for review detailed construction method statements and a quality and test plan prior to the casting of concrete. The Contractor shall submit to the Engineer its inspection and test plans (ITP's) for acceptance. The Engineer will indicate his/her hold and witness points on the ITP. All specified tests and required interventions to be itemized on the ITPs and should be easily linked/referenced to all other technical documents.

Due to the aggressive environment that the reinforced concrete works are exposed to, the exposure condition of all the reinforced concrete is classified as severe in accordance with SANS 10100-2, hence the quality of concrete works is of paramount importance. To ensure durability of the reinforced concrete works the design and construction of reinforced concrete shall be done in such a way to limit the total concrete crack widths as specified by relevant specifications.

In addition to the tests specified in the specification (84CIVL053), durability index tests shall be performed, if required by the Engineer or the Contractor, to confirm the durability of concrete placed. The durability index tests are developed to assess the transport properties of the concrete cover zone. There are three durability tests, namely Oxygen Permeability Index, Chloride Conductivity test and the Water Sorptivity test.

iv. Structural Steelwork

The *Contractor* shall ensure that all conceptual, detailed, and final construction drawings are approved as per Eskom's review processes prior to beginning construction and that compliance is maintained to all specifications for material grades that are fabricated and erected. This includes fabrication and erection tolerances, testing parameters and corrosion protection required for steel structures and their supporting elements. The Contractor is also required to submit to the Engineer, steel grade certificates, fabrication drawings, welder's certificates and quality and test plans for review prior to fabrication (refer to Section 3.5 for details).

All structural steel work must be designed, manufactured, and erected in accordance with relevant national specifications and relevant Eskom specifications.

Structural steel used shall be manufactured/fabricated to SABS 1431 or EN 10025.

v. Integration of Civil Design and Construction

The *Contractor* is responsible for the integration of the design, procurement, construction, commissioning, and certification of all systems, including any modified/altered existing infrastructure. During the concept design phase for the various disciplines and their respective designs, the Contractor shall discuss, agree, and integrate with the Employer's Engineers as per the change management processes on Medupi Site.

Design and Construction criteria:

1. The *Contractor* shall design and construct the Works in accordance with this technical specification/SOW, all final reviewed and approved construction drawings, Construction Regulations, Medupi Quality control specifications and the SANS 2001 specifications, as well as all other relevant design and construction SANS and Eskom specifications.
2. The *Contractor* shall ensure alignment with respect to degree of accuracy for every interface and where the Employer standards are limited on information shall make use of the relevant SANS and design standards.

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3. The *works* to be provided by the Contractor shall include, but is not limited to all scaffolding, site cranes, lifting equipment and construction vehicles. All excavations, earthworks and terracing as required; all signage required; any modifications required for the use of existing infrastructure (including analysis and certification); and all materials, facilities and samples required to perform inspections, tests, and commissioning as per the relevant statutory and regulatory standards and as per this Technical Specification.

vi. Construction Monitoring by Contractor's designer and Professional Engineering Certification by Contractor's designer

Construction monitoring includes but not limited to:

- a. Review a sample of each important work procedure and construction material and other technical submissions such as construction method statements, inspection and test plans and quality control and quality assurance plans.
- b. Attending site meetings and maintain adequate presence on the construction site to review samples of works and important completed work prior to enclosure or on completion as appropriate.
- c. Provide the construction team and the Engineer with technical interpretation of the plans and specification when required and checks the construction team's civil works and structures for conformity with design requirements and ensures that design intent is achieved during construction.
- d. General inspection of materials and equipment for compliance with the design documentation for adherence to National and International standards.
- e. Provides the construction team with updated design documentation (drawings and specifications) where changes are required to ensure integration with existing works and where design changes are required due to unforeseen site conditions.
- f. Prepares and, on completion of the works, provides the Employer with As-Built drawings and a final (updated) design report signed by the Contractor's ECSA registered professional person.
- g. Certifies the works as complete and that design intent is achieved during construction by issuing a completion certificate (Professional Engineering Certificate (PEC)), signed by an ECSA registered professional, in terms of the Construction Regulations, 2014, Occupational Health and Safety Act, 1993 when the works is deemed safe for commissioning.
- h. The Contractor's Designer shall provide services in accordance with ECSA's Guideline Scope of Services and Tariff of Fees for Persons Registered in terms of the Engineering Profession Act, 2000, (Act No. 46 of 2000) and the Construction Regulations, 2014, Occupational Health and Safety Act, 1993.

vii. Codes & Standards to be used in the works

The Contractor is required to adhere to the latest editions of the normative and informative references within this document, all applicable SANS standards and Eskom specifications/standards mentioned throughout this document.

CONTROLLED DISCLOSURE

3.2 PACKAGE 35A BUILDINGS SCOPE OF WORK

Package 35A scope of work includes design review, completion of construction work, repair and serving of the existing Plant where applicable and commissioning of the complete HVAC system. Buildings included under package 35A are as following:

Table 1: Medupi Package 35A (P35A) Buildings

Full Building Name	Building Description
1. Coal Silo Substation	C/Silo
2. Coal Plant Substation	C/Plant
3. Coal Stockyard North Substation	CSYN
4. Coal Stockyard Office	CSYO
5. Coal Stockyard South Substation	CSYS
6. Ash Conveyor Substation	-
7. Ash Conditioning Substation	-
8. Compressor House South Substation	CHS
9. Compressor House South Building	CHSB
10. Substation West	Sub West
11. Compressor House North Substation	CHN
12. Substation North	Sub North
13. Workshop and Stores Substation	W&S S/S
14. IT and Comms Buildings	IT
15. Access Control Building	ACB

3.2.1 Package 35A Design

3.2.1.1 Design review of package 35A scope

The Contractor shall review the design of all the HVAC systems under package 35A scope and confirm acceptance thereof through a design review report. Eskom shall issue all available design documents for review by the Contractor. Eskom shall also review the design review report to confirm acceptance of the report.

The Contractor's design review report as a minimum shall indicate the following:

- Review status of the supplied design documentation.
- Acceptance status of the overall design for construction completion and a commissioning.
- Any proposed design changes or updates where applicable.
- Any outstanding design information or documentation required or recommended by the contractor.
- Any obsolescent equipment in the design where replacement is required.

Upon acceptance of the design review report and its recommendation by Eskom, the Contractor shall implement the design review report recommendation and/or as instructed by Eskom.

All accepted design documents shall be issued to Eskom with the following information on the document.

- Contractor's Document review status
- Contractor's name

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- The name and ECSA registration number of the person who reviewed the documents.
- Review Date

As per the contract requirements the contractor shall assume full accountability for the designs they have reviewed and accepted under package 35A scope.

3.2.1.2 Ad Hoc Design Changes

Due to site integration and field conditions; design changes may be required on an ad-hoc basis. The *Contractor* shall provide design support on all changes that impact their scope. All design changes are to be accepted by TM Engineers (Mechanical, Electrical, C&I and Civil).

The *Contractor* shall ensure that HVAC systems are integrated with the existing plant. Where engineering changes are required, the Contractor is to follow the Employer's change management process (240-53114026).

3.2.1.3 Package 35A Engineering documentation

To complete the works, it is a requirement by the Quality Assurance (QA) system that all construction documents and drawings must reach a final approved status. Currently all these documents have either one of the following statuses:

- i. AWC - Authorized with Comments
- ii. A - Authorized
- iii. NA – Rejected

The contractor is to refer to Appendix A5 and A6 for detailed Equipment Submittal Schedule and Drawing Submittal Schedule

All construction documents and drawings are to be updated, revised, and submitted to the Employer for approval until it reaches Authorized/Approved status. Thereafter, the as-built drawing process can begin.

All the final documentation submittals by the contractor to be issued with As-built Status including for MCC and NCP documents. MCC documentation consists of the following documents:

- i. Material equipment submittal – MAT-document
- ii. Drawing equipment submittal – DWG format
- iii. MCC Cable Schedule
- iv. Equipment label list
- v. Load schedule

NCP documentation consists of the following documents:

- i. Material equipment submittal – MAT-document
- ii. Drawing equipment submittal – DWG format
- iii. NCP Cable Schedule
- iv. Equipment label list
- v. Points list

3.2.1.3.1 As-built Drawings

As-built drawings are to be conducted as follows:

- i. A site walk must be conducted, and the as-built drawings must be updated accordingly. The as-built stamp must be signed by the person who conducted the walk down and the person who prepared the drawing.
- ii. Drawings must be issued officially to Employer.

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- iii. The Employer team will conduct their own walk down inspection to check the drawings and provide review comments.
- iv. The Contractor is to update the drawings.

3.2.1.4 Contractor's responsibility

In terms of the contract the Contractor will take on design responsibility with the appointed Designer. The inspection of the works by the Designer must be allowed for. Any repairs/rectifications will be the responsibility of the Contractor.

3.2.2 Package 35A Site works scope

3.2.2.1 Service and Repairs of the Complete HVAC Site Works

All buildings have reached cold air (uncontrolled cold air), which means that the mechanical and electrical installations are complete and operational; however, the controls installations are incomplete and not operational. Uncontrolled air (cold air) means the supply of air by running chillers and air handling units through the Motor Control Centre (MCC) panel without the NCP.

The Employer has taken beneficial occupation and the HVAC plants are operated on manual mode 24 hours per day, 7 days a week.

Critical repairs and service are required to ensure the HVAC plant is available for commissioning & handover as detailed by Appendix A13.

Manual operation of the plant will be supported by the Client (Medupi Generation) during the completion of works, the contractor will be responsible for execution of the scope of work including training of the client employees during the execution of the works.

The execution of the Works will be undertaken while Medupi Power Station remains live during the complete duration of the execution of Works. Therefore, the contractor is required to coordinate with the client and carefully plan the execution of the works efficiently in a systematic manner to ensure no loss of services in essential areas can be accommodated at any stage.

The *Contractor* shall audit all the buildings to ensure over and above the employer's lists (Appendix A3 and A8) the repair and service required on the P35A HVAC installations is complete from replacing broken equipment to performing major service of Chillers, AHUs, Fans, MCC, NCP, Actuators and Instruments as required by OEM as well as doing water treatment of the system. All records of service and repairs done are to be kept safe and handed to the Employer at handover stage.

NB: The required Spares for repairs are included. These are to be paid on a cost-plus basis. Refer to the Rate Card in Appendix A3.2. The Contractor are to price both the Activity Schedule and the Rate Card

3.2.2.1.1 Critical Repairs

Critical repairs and service are required to ensure the plant is performing to design base and is ready for final commissioning and handover. The Contractor is to audit the plant and ensure these repairs are completed timeously so commissioning and handover is not delayed. A Provisional Sum are included in the Activity Schedule for this purpose as detailed by Appendix A1.

3.2.2.1.2 Service and repairs

Service and repairs are the responsibility of the Contractor during the execution of the works. Service and repairs are to be carried out in accordance with the approved Operational & Maintenance manuals.

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

A summary of all equipment is in Appendix A4. The service and repair schedules in Appendix A3.1. If any further technical information is required refer to the equipment submissions and drawings in Appendix A5 & A6.

The *Contractor* shall as minimum have to use the services of the original equipment suppliers for the following services, as the HVAC systems have not been handed over:

- i. Chillers
- ii. Motor Control Centres (MCC)
- iii. Network Control Panel (NCP)
- iv. Water Treatment
- v. Air filters

3.2.2.2 Completion of construction

The HVAC Works are to be completed in accordance with the approved equipment submissions and drawings as detailed by Appendix A5 & A6.

Construction in this package is mainly complete except for the items below.

- a) The *Contractor* shall install primary filters on all emergency cooling louvers. The size of the openings is indicated on the drawings.
- b) The *Contractor* shall cut and install access panels next to all motorized dampers (motorized supply air and motorized fresh air dampers).
- c) The *Contractor* shall connect all make-up water system to the chilled water system directly from the fire or potable water line instead of going via the open expansion tanks. The contractor is to tie-in into the existing water connection points which are located within the various chilled water plants. This is not applicable to Workshop and Stores Substation, Access Control Building, Compressor House South Building and Coal Stockyard Office.
- d) All HVAC equipment installed in existing barriers or walls to comply with the fire rating of the wall or barrier. All penetrations to be fire sealed. Fire Seal must be 2-hour rated (have a 2-hour fire resistance) in accordance with SANS 10177-2 (stability, integrity, and insulation) or equivalent standard. Test certificate no older than 5 years to be provided for the product to be used. Product to be installed in accordance with manufacturers recommendations.

The Contractor is to complete all outstanding defects that might exist in any building. The list of defects is included in Appendix A8.

3.2.2.2.1 Defects to be fixed

The *Contractor* shall rectify all defects and obtain sign off by Employer or their representative, thus enabling the completion of H2 Data Books. It must be noted that several Quality Verification Records (QVR) are outstanding, and these inspections will have to be completed.

3.2.2.2.2 Known Defects

The *Contractor* shall rectify all known defects and obtain sign off by Employer or their representative as follows:

- i. P35A TM defect list, Appendix A8 including contractor recommended list.

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3.2.2.2.3 Quality Verification Records

The Quality Verification Records (QVR) to be completed are to be supplied by the contractor and sample QVRs from the previous contract is detailed in Appendix A9.

3.2.2.2.4 Cladded ducting (Insulation and capping of flanged joints)

All exposed flange joints on cladded ducting and joints that could be damaged accidentally to be insulated and capped as detailed by Appendix A10.

Buildings. The Contractor will undertake full design liability for the works. The designer scope of work and division of responsibility is detailed in Appendix A7.

3.2.2.2.5 Certification

The Contractor's Designer is required to issue Professional Engineering Certificates (PEC) for the HVAC systems as well as any structures and/or modifications to structures of, for the Balance of Plant

3.2.2.3 Commissioning

The HVAC systems for all buildings has reached "Cold Air" and are operating without the control system. Each building must be fully commissioned. A commissioning procedure has been developed and approved in the previous contract.

The commissioning process is divided as follows:

- i. Water distribution system
- ii. Air distribution system
- iii. HVAC operation (functionality)

The Commissioning and hand over procedure details the approved process as per Appendix A13. This procedure details the requirements of the Employer and contains the following:

- i. Flow diagram
- ii. System description
- iii. Method statements
- iv. Cold commissioning definition and requirements
- v. Hot commissioning definition and requirements
- vi. Hand over requirements

Appendix A13 comprise of the following documents however not limited to:

- a) Eskom Commissioning (Safety Clearance) Specification
- b) ITP-HVAC-COM1-001 – water
- c) ITP-HVAC-COM2-001 – air
- d) ITP-HVAC-COM3-001 – functionality
- e) COM-HVAC-001-1 Rev H – Commissioning and Hand Over Procedure
- f) ENV-QA-COM-010 Rev 0 – Water Distribution data book index
- g) ENV-QA-COM-011 Rev 0 – Air distribution data book index
- h) ENV-QA-COM-012 Rev 0 – Operation data book index
- i) Building specific drawings:
 - i. Airflow schematics
 - ii. Piping and Instrumentation diagrams
 - iii. Chiller piping and instrumentation diagrams
 - iv. Cause & effect matrix
 - v. MCC pack
 - vi. NCP pack

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vii. Layout drawings

The *Contractor* shall commission all P35A HVAC installations after the service and repair and construction (where applicable) has been completed. Full commissioning includes but is not limited to commissioning of the water system, commissioning of the air system, commissioning of the MCC and NCP. It also includes commissioning of the monitoring interface between the HVAC system and CBMS system as well as fire detection system interface between CBMS system and HVAC system. Once commissioning has been concluded by the *Contractor*, witnessing of the commissioned systems needs to take place with Team Medupi. Upon successful witnessing of the commissioned system, the Contractor must issue Professional Engineer certificates for the HVAC works.

3.2.3 KKS Coding (Configuration Management)

The *Contractor* shall code the plant structures, systems, and components according to the KKS (Kraftwerk-Kenzeichnungs System) as developed by the VGB.

The *Contractor* shall ensure that he is fully familiar with the standard and concepts of KKS system. The *Contractor* shall supply codification of plant, equipment, and components.

The specific code for each item of the plant, equipment, measuring point, junction box, cable etc. is to appear on all documents, drawings, maintenance schedules etc.

A list of all KKS codes used by the *Contractor* shall be provided according to Employer standard documentation. The allocation of the codes is to be approved by Employer.

All designs, testing, commissioning, operating, maintenance and training documentation and databases are to be suitably and comprehensively marked, cross-referenced, and indexed with the allocated KKS codes.

3.2.3.1 Functional location of components

The list of functional locations is to be arranged in Alfa-numeric order from 1st level KKS to 3rd level KKS number to show Hardware breakdown structure in specific plant area. The list as a minimum is to include all the maintenance significant items. It is assumed that items excluded, will automatically have a run-to-failure maintenance strategy and the impact of such failure would be insignificant. Where required, breakdown can be down to 4th level of KKS.

All equipment requires 3rd level KKS coding to comply with Eskom's specifications as detailed by Appendix A4 as follows:

- i. KKS Plant Labelling & Equipment Description Standard
- ii. Medupi Power Station User Requirement Specification
- iii. The Application of KKS Plant Coding

The works shall include the following:

- i. Generating coding and obtaining Employer approval prior to installation.
- ii. Updating drawings (MCC & NCP – GA & SLD, AFS & P&ID)) to reflect approved codes and obtaining approval. (Note that QC inspections cannot proceed without these approved drawings)
- iii. Verifying current coding and applying missing labels.
- iv. Supplying and installing labels/mimic to specification (Aluminium, stainless steel, laminated PVC, or cable labels depending on application)
- v. Applying for inspection by Employer.
- vi. Rectifying any incorrect labels.
- vii. Obtaining individual KKS certificates for mechanical, electrical and C&I.

The Contractor is to employ the services of an experienced KKS engineer for this purpose.

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3.2.3.2 KKS Coding Current Status

The status of the KKS coding is as follows:

3.2.3.2.1 Mechanical Plant

For the mechanical equipment 3rd level coding has been implemented. For example, for an Air Handling Unit (AHU):

- i. Level 1 – Equipment (AHU, etc.) coded.
- ii. Level 2 – Components (Fan, etc.) coded.
- iii. Level 3 – Subcomponents (Fan belts, pulley, motor, etc.) coded.

All equipment has been labelled as per the current Equipment Label Lists (ELL) as detailed by Appendix A5 & A6. These codes are to be verified and amended as may be required.

3.2.3.2.2 Electrical Plant

The Motor Control Centres (MCC) and cabling have been coded to 2nd level as detailed by A5 & A6. The Contractor is to (MCC and cabling) bring this up to 3rd level:

- a) MCC
 - i. Level 1 – Main board – single code
 - ii. Level 2 – Tiers & individual buckets – coded on outside of panel.
 - iii. Level 3 – Components inside MCC to be coded for example, (MCB's, contactors, terminals etc.)
- b) Cables
 - i. No additional
 - ii. Cables are all coded.
 - iii. Cable cores are not coded (Cable schedules contains connection details)

3.2.3.2.3 NCP (C&I) installation

The Network Control Panels (NCP) and cabling have been coded to 2nd level as detailed by A5 & A6. The Contractor is to bring this up to 3rd level:

- c) NCP
 - i. Level 1 – Main board – single code
 - ii. Level 2 – Tiers – coded on outside of panel.
 - iii. Level 3 – Components inside NCP to be coded for example, (Controllers, relays, terminals etc.) A mimic table must be installed in panel door.
- d) Cables
 - i. Coding done – partially installed.
 - ii. Cable cores are not coded (Cable schedules contains connection details)

3.2.4 Hand over package

Upon completion of the above i.e., construction, service & repair and commissioning of the systems, the Contractor is to submit the documentation below. This documentation includes but is not limited to:

- a) HVAC O&M manual (template available in Appendix A14) and as-built drawings
- b) HVAC Spares List
- c) HVAC commissioning databooks
- d) HVAC as built documentation including drawings.
- e) Permanent KKS Certificates (HVAC Mechanical, Electrical and C&I)
- f) HVAC data books (H1, H2, and H3) for HVAC Mechanical, Electrical and C&I

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- g) HVAC CBMS schedules (Alarm List, Virtual Signal List, Cable Schedule, Instrument Schedule, Drive and Actuator list).

3.3 PACKAGE 35B BUILDINGS SCOPE OF WORK

The outstanding works for these buildings includes design review, completion of data books, KKS labelling and certification, fixing defect and servicing of the plants, commissioning completion and supplying outstanding documentation as listed in Appendix A19. The building included in this scope is as follows.

Table 2. Medupi Package 35B (P35B) Buildings

Full Building Name	Building Description
1. Fire & Medical	Fire & Medical
2. Facilities Substation	Facilities Substation
3. Canteen	Canteen
4. Chiller Yard	Chiller Yard
5. Administration Building	Administration Building
6. Compressor House North Building	Compressor House North
7. Ash Dump Workshop	Ash Dump Workshop
8. Office Block Building	Office Block Building

3.3.1 Package 35B Design

3.3.1.1 Design review of package 35B scope

The Contractor shall review the design of all the HVAC systems under package 35B scope and confirm acceptance thereof through a design review report. Eskom shall issue all available design documents for review by the Contractor. Eskom shall also review the design review report to confirm acceptance of the report.

The Contractor's design review report as a minimum shall indicate the following:

- Review status of the supplied design documentation.
- Acceptance status of the overall design for construction completion and a commissioning.
- Any proposed design changes or updates where applicable.
- Any outstanding design information or documentation required or recommended by the contractor.
- Any obsolescent equipment in the design where replacement is required.

Upon acceptance of the design review report and its recommendation by Eskom, the Contractor shall implement the design review report recommendation and/or as instructed by Eskom.

All accepted design documents shall be issued to Eskom with the following information on the document.

- Contractor's Document review status
- Contractor's name
- The name and ECSA registration number of the person who reviewed the documents.
- Review Date

As per the contract requirements the contractor shall assume full accountability for the designs they have reviewed and accepted under package 35A scope.

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3.3.1.2 Ad Hoc Design Changes

Due to site integration and field conditions; design changes may be required on an ad-hoc basis. The *Contractor* shall provide design support on all changes that impact their scope. All design changes are to be accepted by TM Engineers (Mechanical, Electrical, C&I and Civil).

The *Contractor* shall ensure that HVAC systems are integrated with the existing plant. Where engineering changes are required, the Contractor is to follow the Employer's change management process (240-53114026).

3.3.1.3 Package 35B Engineering documentation

To complete the works, it is a requirement by the Quality Assurance (QA) system that all construction documents and drawings must reach a final approved status. Currently all these documents have either one of the following statuses:

- iv. AWC - Authorized with Comments
- v. A - Authorized
- vi. NA – Rejected

The contractor is to refer to Appendix A5 and A6 for detailed Equipment Submittal Schedule and Drawing Submittal Schedule

All construction documents and drawings are to be updated, revised, and submitted to the Employer for approval until it reaches Authorized/Approved status. Thereafter, the as-built drawing process can begin.

All the final documentation submittals by the contractor to be issued with As-built Status including for MCC and NCP documents. MCC documentation consists of the following documents:

- vi. Material equipment submittal – MAT-document
- vii. Drawing equipment submittal – DWG format
- viii. MCC Cable Schedule
- ix. Equipment label list
- x. Load schedule

NCP documentation consists of the following documents:

- vi. Material equipment submittal – MAT-document
- vii. Drawing equipment submittal – DWG format
- viii. NCP Cable Schedule
- ix. Equipment label list
- x. Points list

3.3.1.3.1 As-built Drawings

As-built drawings are to be conducted as follows:

- v. A site walk must be conducted, and the as-built drawings must be updated accordingly. The as-built stamp must be signed by the person who conducted the walk down and the person who prepared the drawing.
- vi. Drawings must be issued officially to Employer.
- vii. The Employer team will conduct their own walk down inspection to check the drawings and provide review comments.
- viii. The Contractor is to update the drawings.

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

3.3.1.4 Contractor's responsibility

In terms of the contract the Contractor will take on design responsibility with the appointed Designer. The inspection of the works by the Designer must be allowed for. Any repairs/rectifications will be the responsibility of the Contractor.

3.3.2 Package 35B Site works scope

3.3.2.1 Service and Repairs of the Complete HVAC Site Works

The *Contractor* shall audit all the buildings to ensure over and above the employer's lists (Appendix A3 and A8) the repair and service required on the P35B HVAC installations is complete from replacing broken equipment to performing major service of Chillers, AHUs, Fans, MCC, NCP, Actuators and Instruments as required by OEM as well as doing water treatment of the system. All records of service and repairs done are to be kept safe and handed to the Employer at handover stage.

3.3.2.1.1 Critical Repairs

Critical repairs and service are required to ensure the plant is performing to design base and is ready for final commissioning and handover. The Contractor is to audit the plant and ensure these repairs are completed timeously so commissioning and handover is not delayed. A Provisional Sum are included in the Activity Schedule for this purpose as detailed by Appendix A1.

3.3.2.1.2 Service and repairs

Service and repairs are the responsibility of the Contractor during the execution of the works. Service and repairs are to be carried out in accordance with the approved Operational & Maintenance manuals. A summary of all equipment is in Appendix A4. The service and repair schedules in Appendix A3.1. If any further technical information is required refer to the equipment submissions and drawings in Appendix A5 & A6.

The *Contractor* shall as minimum have to use the services of the original equipment suppliers for the following services, as the HVAC systems have not been handed over:

- vi. Chillers
- vii. Motor Control Centres (MCC)
- viii. Network Control Panel (NCP)
- ix. Water Treatment
- x. Air filters

NB: Spares and equipment for repairs and breakdowns are included. These are to be paid on a cost-plus basis. Refer to the Rate Card in Appendix A3.2. The Contractor are to price both the Activity Schedule and the Rate Card

3.3.2.1.3 Defects to be fixed

The *Contractor* shall rectify all defects and obtain sign off by Employer or their representative, thus enabling the completion of H2 Data Books. It must be noted that several Quality Verification Records (QVR) are outstanding, and these inspections will have to be completed.

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3.3.2.1.4 Known Defects

The *Contractor* shall rectify all known defects and obtain sign off by Employer or their representative as follows:

- ii. P35B TM defect list, Appendix A8 including contractor recommended list

3.3.2.1.5 Quality Verification Records

The Quality Verification Records (QVR) to be completed are to be supplied by the contractor and sample QVRs from the previous contract is detailed in Appendix A9.

3.3.2.2 Commissioning

The HVAC systems for all buildings has reached “Cold Air” and are operating without the control system. Each building must be fully commissioned. A commissioning procedure has been developed and approved in the previous contract.

The commissioning process is divided as follows:

- iv. Water distribution system
- v. Air distribution system
- vi. HVAC operation (functionality)

The Commissioning and hand over procedure details the approved process as per Appendix A13. This procedure details the requirements of the Employer and contains the following:

- vii. Flow diagram
- viii. System description
- ix. Method statements
- x. Cold commissioning definition and requirements
- xi. Hot commissioning definition and requirements
- xii. Hand over requirements

Appendix A13 comprise of the following documents however not limited to:

- j) Eskom Commissioning (Safety Clearance) Specification
- k) ITP-HVAC-COM1-001 – water
- l) ITP-HVAC-COM2-001 – air
- m) ITP-HVAC-COM3-001 – functionality
- n) COM-HVAC-001-1 Rev H – Commissioning and Hand Over Procedure
- o) ENV-QA-COM-010 Rev 0 – Water Distribution data book index
- p) ENV-QA-COM-011 Rev 0 – Air distribution data book index
- q) ENV-QA-COM-012 Rev 0 – Operation data book index
- r) Building specific drawings:
 - viii. Airflow schematics
 - ix. Piping and Instrumentation diagrams
 - x. Chiller piping and instrumentation diagrams
 - xi. Cause & effect matrix
 - xii. MCC pack
 - xiii. NCP pack
 - xiv. Layout drawings

The *Contractor* shall commission all P35B HVAC installations after the service and repair has been done. Full commissioning includes but is not limited to commissioning of the water system, commissioning of the air system, commissioning of the MCC and NCP. It also includes commissioning of

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the monitoring interface between the HVAC system and CBMS system as well as fire detection system interface between CBMS system and HVAC system. Once commissioning has been concluded by the *Contractor*, witnessing of the commissioned systems needs to take place with Team Medupi. Upon successful witnessing of the commissioned system, the Contractor must issue Professional Engineer certificates for the HVAC works.

3.3.3 KKS Coding (Configuration Management)

The *Contractor* shall code the plant structures, systems, and components according to the KKS (Kraftwerk-Kenzeichnungs System) as developed by the VGB and as requirement in section 3.2.5 and 3.4.4 of this document.

The *Contractor* shall ensure that he is fully familiar with the standard and concepts of KKS system. The *Contractor* shall supply codification of plant, equipment and components.

The specific code for each item of the plant, equipment, measuring point, junction box, cable etc. is to appear on all documents, drawings, maintenance schedules etc.

A list of all KKS codes used by the *Contractor* shall be provided according to Employer standard documentation. The allocation of the codes is to be approved by Employer.

All designs, testing, commissioning, operating, maintenance and training documentation and databases are to be suitably and comprehensively marked, cross-referenced, and indexed with the allocated KKS codes.

3.3.4 Hand over package

Upon completion of the above i.e., construction, service & repair and commissioning of the systems, the Contractor is to submit the documentation below. This documentation includes but is not limited to:

- h) HVAC O&M manual (template available in Appendix A14) and as-built drawings
- i) HVAC Spares List
- j) HVAC commissioning databooks
- k) HVAC as built documentation including drawings.
- l) Permanent KKS Certificates (HVAC Mechanical, Electrical and C&I)
- m) HVAC data books (H1, H2, and H3) for HVAC Mechanical, Electrical and C&I
- n) HVAC CBMS schedules (Alarm List, Virtual Signal List, Cable Schedule, Instrument Schedule, Drive and Actuator list).

3.4 PACKAGE 35C BUILDINGS SCOPE OF WORK

Package 35C scope of work includes design review, completion of outstanding construction work, repair and serving of the exist plant and commissioning of the complete HVAC system. Building included under package 35C are as following:

Table 3: Medupi Package 35C (P35C) Buildings

Full Building Name	Building Description
1. Ash Dump Substation	-
2. Workshop and Stores Building	W&S Building

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3.4.1 Package 35C Design

3.4.1.1 Design review of package 35C scope

The Contractor shall review the design of all the HVAC systems under package 35C scope and confirm acceptance thereof through a design review report. Eskom shall issue all available design documents for review by the Contractor. Eskom shall also review the design review report to confirm acceptance of the report.

The Contractor's design review report as a minimum shall indicate the following:

- Review status of the supplied design documentation.
- Acceptance status of the overall design for construction completion and a commissioning.
- Any proposed design changes or updates where applicable.
- Any outstanding design information or documentation required or recommended by the contractor.
- Any obsolescent equipment in the design where replacement is required.

Upon acceptance of the design review report and its recommendation by Eskom, the Contractor shall implement the design review report recommendation and/or as instructed by Eskom.

All accepted design documents shall be issued to Eskom with the following information on the document.

- Contractor's Document review status
- Contractor's name
- The name and ECSA registration number of the person who reviewed the documents.
- Review Date

As per the contract requirements The contractor shall assume full accountability for the designs they have reviewed and accepted under package 35A scope.

3.4.1.2 Ad Hoc Design Changes

Due to site integration and field conditions; design changes may be required on an ad-hoc basis. The *Contractor* shall provide design support on all changes that impact their scope. All design changes are to be accepted by TM Engineers (Mechanical, Electrical, C&I and Civil).

The *Contractor* shall ensure that HVAC systems are integrated with the existing plant. Where engineering changes are required, the Contractor is to follow the Employer's change management process (240-53114026).

3.4.1.3 Package 35C Engineering documentation

To complete the works, it is a requirement by the Quality Assurance (QA) system that all construction documents and drawings must reach a final approved status. Currently all these documents have either one of the following statuses:

- vii. AWC - Authorized with Comments
- viii. A - Authorized
- ix. NA – Rejected

The contractor is to refer to Appendix A5 and A6 for detailed Equipment Submittal Schedule and Drawing Submittal Schedule

All construction documents and drawings are to be updated, revised, and submitted to the Employer for approval until it reaches Authorized/Approved status. Thereafter, the as-built drawing process can begin.

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All the final documentation submittals by the contractor to be issued with As-built Status including for MCC and NCP documents. MCC documentation consists of the following documents:

- xi. Material equipment submittal – MAT-document
- xii. Drawing equipment submittal – DWG format
- xiii. MCC Cable Schedule
- xiv. Equipment label list
- xv. Load schedule

NCP documentation consists of the following documents:

- xi. Material equipment submittal – MAT-document
- xii. Drawing equipment submittal – DWG format
- xiii. NCP Cable Schedule
- xiv. Equipment label list
- xv. Points list

3.4.1.3.1 As-built Drawings

As-built drawings are to be conducted as follows:

- ix. A site walk must be conducted, and the as-built drawings must be updated accordingly. The as-built stamp must be signed by the person who conducted the walk down and the person who prepared the drawing.
- x. Drawings must be issued officially to Employer.
- xi. The Employer team will conduct their own walk down inspection to check the drawings and provide review comments.
- xii. The Contractor is to update the drawings.

3.4.1.4 Contractor's responsibility

In terms of the contract the Contractor will take on design responsibility with the appointed Designer. The inspection of the works by the Designer must be allowed for. Any repairs/rectifications will be the responsibility of the Contractor.

3.4.2 Package 35C Site works scope

3.4.2.1 Service and Repairs of the Complete HVAC Site Works

All buildings have reached cold air (uncontrolled cold air), which means that the mechanical and electrical installations are complete and operational; however, the controls installations are incomplete and not operational. Uncontrolled air (cold air) means the supply of air by running chillers and air handling units through the Motor Control Centre (MCC) panel without the NCP.

The Employer has taken beneficial occupation and the HVAC plants are operated on manual mode 24 hours per day, 7 days a week.

Critical repairs and service are required to ensure the HVAC plant is available for commissioning & handover as detailed by Appendix A13.

Manual operation of the plant will be supported by the Client (Medupi Generation) during the completion of works, the contractor will be responsible for execution of the scope of work including training of the client employees during the execution of the works.

The execution of the Works will be undertaken while Medupi Power Station remains live during the complete duration of the execution of Works. Therefore the contractor is required to coordinate with the

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client and carefully plan the execution of the works efficiently in a systematic manner to ensure no loss of services in essential areas can be accommodated at any stage.

The *Contractor* shall audit all the buildings to ensure over and above the employer's lists (Appendix A3 and A8) the repair and service required on the P35C HVAC installations is complete from replacing broken equipment to performing major service of Chillers, AHUs, Fans, MCC, NCP, Actuators and Instruments as required by OEM as well as doing water treatment of the system. All records of service and repairs done are to be kept safe and handed to the Employer at handover stage.

NB: The required Spares for repairs are included. These are to be paid on a cost-plus basis. Refer to the Rate Card in Appendix A3.2. The Contractor is to price both the Activity Schedule and the Rate Card

3.4.2.1.1 Critical Repairs

Critical repairs and service are required to ensure the plant is performing to design base and is ready for final commissioning and handover. The Contractor is to audit the plant and ensure these repairs are completed timeously so commissioning and handover is not delayed. A Provisional Sum are included in the Activity Schedule for this purpose as detailed by Appendix A1.

3.4.2.1.2 Service and repairs

Service and repairs are the responsibility of the Contractor during the execution of the works. Service and repairs are to be carried out in accordance with the approved Operational & Maintenance manuals. A summary of all equipment is in Appendix A4. The service and repair schedules in Appendix A3.1. If any further technical information is required refer to the equipment submissions and drawings in Appendix A5 & A6.

The *Contractor* shall as minimum have to use the services of the original equipment suppliers for the following services, as the HVAC systems have not been handed over:

- xi. Chillers
- xii. Motor Control Centres (MCC)
- xiii. Network Control Panel (NCP)
- xiv. Water Treatment
- xv. Air filters

3.4.2.2 Completion of construction

The HVAC Works are to be completed in accordance with the approved equipment submissions and drawings as detailed by Appendix A5 & A6.

Construction on this package is mainly complete except for the items below.

- e) The Contractor is to install primary filters on all emergency cooling louvers. The sizes of the openings are indicated on the drawings. This is applicable to Ash Dump Substation only.
- f) The Contractor is to cut and install access panels next to all motorized dampers (motorized supply air and motorized fresh air dampers). This is applicable to Ash Dump Substation only.
- g) The Contractor is to connect all make-up water system to the chilled water system directly from the fire or potable water line instead of going via the open expansion tanks. The contractor is to tie-in into the existing water connection points which are located within the various chilled water plants. This is applicable to Ash Dump Substation only.

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3.4.2.2.1 Defects to be fixed

The *Contractor* shall rectify all defects and obtain sign off by Employer or their representative, thus enabling the completion of H2 Data Books. It must be noted that several Quality Verification Records (QVR) are outstanding, and these inspections will have to be completed.

3.4.2.2.2 Known Defects

The *Contractor* shall rectify all known defects and obtain sign off by Employer or their representative as follows:

- iii. P35C TM defect list, Appendix A8 including contractor recommended list.

3.4.2.2.3 Quality Verification Records

The Quality Verification Records (QVR) to be completed are to be supplied by the contractor and sample QVRs from the previous contract is detailed in Appendix A9.

3.4.2.2.4 Cladded ducting (Insulation and capping of flanged joints)

All exposed flange joints on cladded ducting and joints that could be damaged accidentally to be insulated and capped as detailed by Appendix A10.

Buildings. The Contractor will undertake full design liability for the works. The designer scope of work and division of responsibility is detailed in Appendix A7.

3.4.2.2.5 Certification

The Contractor's Designer is required to issue Professional Engineering Certificates (PEC) for the HVAC systems as well as any structures and/or modifications to structures of, for the Balance of Plant

3.4.2.3 Commissioning

The HVAC systems for all buildings has reached "Cold Air" and are operating without the control system. Each building must be fully commissioned. A commissioning procedure has been developed and approved in the previous contract.

The commissioning process is divided as follows:

- vii. Water distribution system
- viii. Air distribution system
- ix. HVAC operation (functionality)

The Commissioning and hand over procedure details the approved process as per Appendix A13. This procedure details the requirements of the Employer and contains the following:

- xiii. Flow diagram
- xiv. System description
- xv. Method statements
- xvi. Cold commissioning definition and requirements
- xvii. Hot commissioning definition and requirements
- xviii. Hand over requirements

Appendix A13 comprise of the following documents however not limited to:

- s) Eskom Commissioning (Safety Clearance) Specification
- t) ITP-HVAC-COM1-001 – water
- u) ITP-HVAC-COM2-001 – air

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- v) ITP-HVAC-COM3-001 – functionality
- w) COM-HVAC-001-1 Rev H – Commissioning and Hand Over Procedure
- x) ENV-QA-COM-010 Rev 0 – Water Distribution data book index
- y) ENV-QA-COM-011 Rev 0 – Air distribution data book index
- z) ENV-QA-COM-012 Rev 0 – Operation data book index
- aa) Building specific drawings:
 - xv. Airflow schematics
 - xvi. Piping and Instrumentation diagrams
 - xvii. Chiller piping and instrumentation diagrams
 - xviii. Cause & effect matrix
 - xix. MCC pack
 - xx. NCP pack
 - xxi. Layout drawings

The *Contractor* shall commission all P35C HVAC installations after the service and repair and construction (where applicable) has been completed. Full commissioning includes but is not limited to commissioning of the water system, commissioning of the air system, commissioning of the MCC and NCP. It also includes commissioning of the monitoring interface between the HVAC system and CBMS system as well as fire detection system interface between CBMS system and HVAC system. Once commissioning has been concluded by the *Contractor*, witnessing of the commissioned systems needs to take place with Team Medupi. Upon successful witnessing of the commissioned system, the Contractor must issue Professional Engineer certificates for the HVAC works.

3.4.3 KKS Coding (Configuration Management)

The *Contractor* shall code the plant structures, systems, and components according to the KKS (Kraftwerk-Kenzeichnungs System) as developed by the VGB.

The *Contractor* shall ensure that he is fully familiar with the standard and concepts of KKS system. The *Contractor* shall supply codification of plant, equipment and components.

The specific code for each item of the plant, equipment, measuring point, junction box, cable etc. is to appear on all documents, drawings, maintenance schedules etc.

A list of all KKS codes used by the *Contractor* shall be provided according to Employer standard documentation. The allocation of the codes is to be approved by Employer.

All designs, testing, commissioning, operating, maintenance and training documentation and databases are to be suitably and comprehensively marked, cross-referenced, and indexed with the allocated KKS codes.

3.4.3.1 Functional location of components

The list of functional locations is to be arranged in Alfa-numeric order from 1st level KKS to 3rd level KKS number to show Hardware breakdown structure in specific plant area. The list as a minimum is to include all the maintenance significant items. It is assumed that items excluded, will automatically have a run-to-failure maintenance strategy and the impact of such failure would be insignificant. Where required, breakdown can be down to 4th level of KKS.

All equipment requires 3rd level KKS coding to comply with Eskom's specifications as detailed by Appendix A4 as follows:

- iv. KKS Plant Labelling & Equipment Description Standard
- v. Medupi Power Station User Requirement Specification
- vi. The Application of KKS Plant Coding

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The *works* shall include the following:

- viii. Generating coding and obtaining Employer approval prior to installation.
- ix. Updating drawings (MCC & NCP – GA & SLD, AFS & P&ID)) to reflect approved codes and obtaining approval. (Note that QC inspections cannot proceed without these approved drawings)
- x. Verifying current coding and applying missing labels.
- xi. Supplying and installing labels/mimic to specification (Aluminium, stainless steel, laminated PVC, or cable labels depending on application)
- xii. Applying for inspection by Employer.
- xiii. Rectifying any incorrect labels.
- xiv. Obtaining individual KKS certificates for mechanical, electrical and C&I.

The Contractor is to employ the services of an experienced KKS engineer for this purpose.

3.4.3.2 KKS Coding Current Status

The status of the KKS coding is as follows:

3.4.3.2.1 Mechanical Plant

For the mechanical equipment 3rd level coding has been implemented. For example, for an Air Handling Unit (AHU):

- iv. Level 1 – Equipment (AHU, etc.) coded.
- v. Level 2 – Components (Fan, etc.) coded.
- vi. Level 3 – Subcomponents (Fan belts, pulley, motor, etc.) coded.

All equipment has been labelled as per the current Equipment Label Lists (ELL) as detailed by Appendix A5 & A6. These codes are to be verified and amended as may be required.

3.4.3.2.2 Electrical Plant

The Motor Control Centres (MCC) and cabling have been coded to 2nd level as detailed by A5 & A6. The Contractor is to (MCC and cabling) bring this up to 3rd level:

- e) MCC
 - iv. Level 1 – Main board – single code
 - v. Level 2 – Tiers & individual buckets – coded on outside of panel.
 - vi. Level 3 – Components inside MCC to be coded for example, (MCB's, contactors, terminals etc.)
- f) Cables
 - iv. No additional
 - v. Cables are all coded.
 - vi. Cable cores are not coded (Cable schedules contains connection details)

3.4.3.2.3 NCP (C&I) installation

The Network Control Panels (NCP) and cabling have been coded to 2nd level as detailed by A5 & A6. The Contractor is to bring this up to 3rd level:

- g) NCP
 - iv. Level 1 – Main board – single code
 - v. Level 2 – Tiers – coded on outside of panel.
 - vi. Level 3 – Components inside NCP to be coded for example, (Controllers, relays, terminals etc.) A mimic table must be installed in panel door.
- h) Cables
 - iii. Coding done – partially installed.

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- iv. Cable cores are not coded (Cable schedules contains connection details)

3.4.4 Hand over package

Upon completion of the above i.e., construction, service & repair and commissioning of the systems, the Contractor is to submit the documentation below. This documentation includes but is not limited to:

- o) HVAC O&M manual (template available in Appendix A14) and as-built drawings
- p) HVAC Spares List
- q) HVAC commissioning databooks
- r) HVAC as built documentation including drawings.
- s) Permanent KKS Certificates (HVAC Mechanical, Electrical and C&I)
- t) HVAC data books (H1, H2, and H3) for HVAC Mechanical, Electrical and C&I
- u) HVAC CBMS schedules (Alarm List, Virtual Signal List, Cable Schedule, Instrument Schedule, Drive and Actuator list).

3.5 HVAC RETROFITTING: CEP VSD ROOMS

The *Contractor* shall review the HVAC system designs, and construct, and commission the HVAC system for the CEP VSD rooms as per the approved design documentation reviewed by the contractor and also supply any outstanding documentation. The contractor will be free issued with the available HVAC equipment for this scope as per the list in appendix A31, and where the equipment is outstanding the contractor is required to supply the outstanding equipment to complete the construction and commission of the HVAC system. Upon completion the HVAC is to be evaluated against the requirements of section 3.5 and Eskom standards 240-5023714, 240-701646236, 240-102547991.

The scope also includes the removal of the existing HVAC equipment, sealing of the room and applying additional measures to maintain ambient conditions in the VSD room as required by Eskom standards 240-50237146 and 240-102547991

3.5.1 Design review

The Contractor shall review the design of the CEP VDS rooms HVAC system and confirm acceptance thereof through a design review report. Eskom shall issue all available design documents for review by the Contractor. Eskom shall also review the design review report to confirm acceptance of the report.

The Contractor's design review report as a minimum shall indicate the following:

- Review status of the supplied design documentation.
- Acceptance status of the overall design for construction completion and a commissioning.
- Any proposed design changes or updates where applicable.
- Any outstanding design information or documentation required or recommended by the contractor.
- Any obsolescent equipment in the design where replacement is required.

Upon acceptance of the design review report and its recommendation by Eskom, the Contractor shall implement the design review report recommendation and/or as instructed by Eskom.

All accepted design documents shall be issued to Eskom with the following information on the document.

- Contractor's Document review status
- Contractor's name
- The name and ECSA registration number of the person who reviewed the documents.
- Review Date

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As per the contract requirements the contractor shall assume full accountability for the designs they have reviewed and accepted under package 35A scope.

3.5.2 Design parameters

- a) The HVAC systems is to operate at 22°C ($\pm$ 2°C) such that varying ambient temperatures between day/night and summer/winter shall not adversely affect the performance of the VSD. The HVAC system shall be configured such that the room temperature during the hottest day is not exceed 30 °C,
- b) A minimum positive pressure of 5Pa with all doors closed shall be maintained inside the room in order to prevent dust ingress.
- c) The HVAC system layout has been designed to ensure that the equipment promote easy access for commissioning, maintenance, and evacuation. The contractor shall construct the HVAC system as per design and any proposed deviation from design shall be submitted through to the employer using the form 200-13769 for evaluation.

3.5.3 Mechanical requirements

- a) The HVAC system shall operate for 24 hours uninterrupted, seven days per week and to be configured to be 100% redundant both electrically and mechanically.
- b) Fresh air intake system incorporates dampers and air filtration media (ASHRAE 52.1 – 85% dust spot efficiency; ASHRAE 52.2- MERV 13; EN 779 - class F7) and to configured for two air change per hour.
- c) All dampers to be remotely controlled.
- d) Fire dampers to be installed are fire rated for two hours.
- e) Ducts within the CEP VSD rooms to be externally insulated.

3.5.4 C&I requirements

The following C&I requirements are in accordance with the Eskom standard 240-70154623, the contractor shall ensure that a fully commissioned HVAC complies with these requirements.

- a) The HVAC system shall interface with CBMS as per HVAC interface list in appendix A20 for the applicable equipment. It shall also interface with the fire detection system to shut down the HVAC system in case of fire. The fire detection signal shall be supplied by the employer.
- b) The interface with the fire system is to be via the potential free normally closed contact receiving signal from fire panels via hard wired links.
- c) For the purpose of monitoring from the control desk by the employer (Refer to appendix A20 for typical CBMS interfaces). The HVAC system shall integrate with HVAC mimics to be supplied by the employer.
- d) The control system for HVAC is a stand-alone system. The system utilises standard sensors, transducers and actuators and has the capability to communicate with the standard equipment supplied such as AHU etc in order that the performance of the components of the system can be tested, logged and commanded at the central operator's terminal.
- e) Field controllers shall operate independently of the HMI system.
- f) 100% redundancy of the equipment is required (100% standby) and therefore, installation consists of two separate control systems. Each redundant plant is to be configured with its own dedicated sensors and actuators.

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- g) The communication bus to CBMS to be BAC-net, Lon-Works or Modbus
- h) The control system includes but not be limited to the following.
 - Network equipment (hardware of the system).
 - Stand-alone control systems for each section of the plant capable of control, monitoring and alarms (NCP panel).
 - Field installed sensor, transducer and actuator controllers to operate independently of the operator workstation.
 - Interfacing with monitoring system (CBMS) supplied by others.
 - Signal point list;
 - HMI graphics;
 - The applicable software programs;
 - Cabling;
 - Power supply from termination point and cabinets;
 - Codification; and
 - Alarm prioritisation

3.5.5 Electrical requirements

- a) The *Contractor* shall supply (where required), pull, terminate and safety clear the cables as per the employer provided designs from source to destination including primary and secondary cabling (between the HVAC equipment).
- b) The Contractor shall be responsible for all the secondary racking associated with the works.
- c) The Contractor shall comply with the Eskom Cabling and Racking standard 240-56227443. for all works associated with cabling and racking.
- d) The Contractor shall be responsible for all the connections to the earth mat. The connection points to the earth mat shall be advised by the Employer.
- e) The Contractor shall comply with Eskom Earthing and Lightning Standard 240-56356396 for all works associated with earthing.
- f) The contractor shall supply all consumable materials associated with the electrical works (where there are not free issued by the employer), therefore all the cabling and earthing material.

3.5.6 Civil requirements

3.5.6.1 Civil scope and expected Contractor duties

- a) The Contractor is responsible for the construction and construction monitoring of all Civil and Structural modification scope and shall ensure that design intent is achieved during construction by adhering to all specifications outlined in Section 3.5 and design documentation in appendix A24. Once the construction work is monitored and construction completed, the Contractor will issue necessary certificates (PEC) and As built documentation. Refer to section 3.6.7.2.1 for more details regarding construction monitoring and professional certification.

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3.5.6.2 Current design details for consideration by the Contractor and Contractors Designer

- a) The figures in appendix A32 indicate civil and structural details of the VSD room that will require both the Contractor and the Contractors' Designer to consider when implementing the full scope outlined in Section 3.5. The specific civil related scope is listed below:
- g) Remove the installed fresh air grille/steel louver (refer to Appendix A23 - Figure 1).
- h) Remove all exhaust fans as per the civil design drawings (refer to Appendix A32)
- i) Brick up the wall openings resulting from the removal the fresh air grille/steel louver and two exhaust fans. The architectural details of brickwork shall match the current building aesthetics (as per drawing 0.84/1819 and 0.84/1821 indicated in Figure 1,2,3,4 in Appendix A23 and Civil design drawings in appendix A24) and in a manner that does not degrade the building.
- j) Seal the CEP VSD room to prevent dust ingress and air losses (to preserve positive pressure within the room), this includes but not limited to the concrete slab cover for the cable tunnel access and piping entry points within the VSD room and covering spaces around the doors (refer to the relevant design in appendix A24).
- k) Modify the two installed single push bar doors to auto-close, such that the positive pressure in the room is quickly recovered after personnel entry and exit.
- l) Issuing a completion certificate (Professional Engineering Certificate (PEC)) in terms of the Construction Regulations, 2014, Occupational Health and Safety Act, 1993 when the works is deemed safe for commissioning.

3.5.6.3 PEC requirements

- b) The Contractor shall make allowance to appoint the original designer, or a designer of his choice to analyse, monitor the changes and, issue a partial PEC once works (changes) are completed. As a deliverable, a copy of the professional agreement between the Contractor and the professional certifying designer shall be supplied to the Employer prior to commencement of construction work.
- c) The Contractor's ECSA registered civil designer shall ensure that any changes made to the building do not compromise the original structure. If required by the Contractor's civil designer the Contractor shall make the necessary arrangements to include the original designer in assessing the structural design changes.
- d) The Contractor shall also supply the designer's assessment design/calculation report where the impact of the modification on the existing structure has assessed in terms of new/additional loadings.

3.5.7 Configuration Management

3.5.7.1 Configuration Management Plan

The Contractor shall prepare a configuration management (CM) plan utilizing ISO 10007 as a reference guide for the scope of work. The CM plan shall include the following:

The process of managing documentation for the project works will be supported by the following"

- A complete and comprehensive description of the Contractor's document numbering conventions and revision schema;
- A description of the electronic data management system(s) that the Contractor will use for the management of documents and/or configuration items;

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- A description of the configuration management activities which will be undertaken by the Contractor as well as a rough time-scale thereof;
- A description of the baselines that will be established and the content of these baselines;
- The release procedure for product configuration information;
- The procedure for the control of changes prior to the establishment of baselines as well as after;
- The method for processing changes, emanating both internally and from sub-suppliers;
- The method for collecting, recording, processing and maintaining the data necessary for producing configuration status accounting records;
- The definition of the content and format for all configuration status accounting reports;
- A list of audits which will be conducted to ensure adherence to the CM plan.

3.5.7.2 Plant Designation

3.5.7.2.1 Plant Designation System

The Contractor shall apply the Kraftwerk-Kennzeichensystem (KKS) codification system to uniquely identify the systems, sub-systems and components constituting the Plant.

The Contractor shall apply the following guidelines and standards when codifying plant:

- The application of KKS plant coding (NMP 45-7)-200-4190
- KKS Key Part-Fossil Power Station (NPSZ 45-45)-200-18202
- Issuing of KKS certificates-200-94660
- VGB-B 106 E Parts A-KKS Application Commentaries Part A_General
- VGB-B 106 E Part B1-KKS Application Commentaries Part B1_Mechanical Engineering
- VGB-B 106 E Part B2-KKS Application Commentaries Part B2_Civil Engineering
- VGB-B 106E Part B3-KKS Application Commentaries Part B3_Electrical and C&I Engineering.
- VGB-B 106E Part B4-KKS Application Commentaries Part B4 Identification of C&I and Control Tasks.

The Contractor shall identify all plant indicated or referenced by documentation by the plant's unique KKS codes within the documentation itself.

The Contractor shall ensure that the codification assigned to plant is consistently maintained throughout the design cycle, e.g. the KKS codes indicated in the O&M manuals are consistent with the KKS codes indicated in the original process and instrumentation diagram.

The Employer shall supply the Contractor with a system-level plant breakdown structure (PBS) of the existing plant at the Site, as well as a preliminary system-level plant breakdown structure of the plant within the Contractor's scope at contract initiation. The Contractor shall review the PBS to ensure alignment with the Contractor's design philosophy, and shall expand the PBS to the complete system level (Fn level of the KKS hierarchy). The Contractor shall provide a complete system-level PBS with the submission of the process flow diagrams of the plant within the Contractor's scope.

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The Contractor shall codify all equipment, and any components which are required to be codified as per the guidelines and standards referenced in this document. The Contractor shall indicate equipment and component codification in drawings and documents indicating or referencing such plant.

The Contractor will submit all KKS codes designated by the Contractor, with the documents in which they were originally designated, to the Employer for review. The Contractor will remain responsible for ensuring that the codes designated are unique and meet the requirements established by the various standards applicable to the Project. Where any ambiguities or doubts with regards to KKS codification exist, the Contractor will engage the Employer for resolution.

3.5.7.2.2 Plant Labelling

The Contractor shall manufacture and install labels according to the Medupi Label specification, 200-3340.

Any abbreviations to plant descriptions shall be prepared in accordance to the Employer's abbreviation standard, 200-5343.

Detailed name plate or label lists with the service legends and including the KKS Code shall be prepared by the Contractor and submitted to the Employer for review and comment before commencing the manufacture of the labels. On plant areas where labels do not make ergonomically sense please consult site configuration management for guidance.

3.5.7.2.3 Plant Designation within Documentation

The Contractor shall prepare a list of KKS designations allocated to components for each scope of delivery or system (this list will be referred to as equipment list in the rest of this document for simplicity's sake, but includes documents such as cable schedules, valve schedules, etc.). The equipment list shall be submitted with the original implementation documentation describing the design of the system (e.g. process and instrumentation diagram, single line diagram, etc.). The Contractor shall ensure that the equipment list accurately represents the implementation documentation which it accompanies. The content of the lists will be agreed to per discipline with the Employer. As a minimum, the equipment list shall include:

- The KKS designation of all components within the relevant scope of work or system.
- The full verbal description of each component, compiled according to the standards referenced in this document.
- The abbreviated description of the each component, utilising abbreviations as listed in the referenced project abbreviation list, and abbreviated to a number of characters as required by the project digital control system (DCS) and as per the label requirements in, 200-3340;
- The approval status of each component, in alignment with the list of approval statuses specified for document.

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Table 4: Configuration Management Codes and Standards

Code	Description
240-58552870	Smart Plant for Owner Operators (SPO) Documentation Metadata Standard
240-71432150 240-93576498	Plant Labelling Standard KKS Coding Standard
240-53114186	Project/Plant Specific Technical Document and Records Management Procedure
240-109607332	Eskom Plant Labelling Abbreviation Standard
200-94660	Issuing of KKS Certificates Work Instruction Rev.07

3.5.8 DOCUMENTATION

All documentation and drawings shall be supplied as per the employer's standards 240-50237146 and 240-102547991 and as per requirements of this SOW.

3.5.8.1 Drawings and documents submissions

3.5.8.1.1 Employer's technical documentation

The Employer's documentation will aid the contractor when executing the works. The list of employer's documentation for CEP VSD are list in appendix A24 and A27

3.5.8.1.2 Contractor's technical documentation

In addition to the employer provided documentation the contractor shall provide any technical documentation required for the completion of the works including updated versions of employer's documentation.

3.5.8.1.1 Shop Drawings

Shop drawings are to indicate all equipment, distribution systems, testing/inspection/instrumentation positions, access requirements and builder's work requirements. Shop drawings are be based on the Employer's design shown on the drawings, approved equipment selections and samples.

The Contractor is to review, stamp all shop drawings to confirm that co-ordination with building and services drawings have taken place before submitting to the Employer for approval.

The contractor's drawings are to be prepared in accordance with SANS 10111 (Engineering drawing practice) and 240-86973501 (Engineering Drawing Standard Common Requirements). General arrangement and detailed drawings be cross referenced using KKS system.

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3.5.8.1.2 “As Built” Drawings

The Contractor is to provide “As Built” drawings based on the shop drawings embodying all modifications made during construction. The “As Built” drawings are to include floor and ceiling layout drawings indicating all terminal and/or fan coil units and/or controller positions. Safety, control and instrumentation, and drawings are also to be included “As Built” drawings indicating the intended functioning, capacity data and control functioning of all systems.

3.5.8.1.2.1 Operation and maintenance (O&M) manuals

The operating manuals are to be available for comments prior to commissioning of the equipment as described in the detailed specification.

The operation and maintenance manuals are to include but not be limited to the following:

- a) List of Contents (Index)
- b) Description of Works. General description of the functions of each of the systems including detailed description of each element of each system, how it functions, how it operates and how to maintain it and what stock or tools to carry
- c) Operation
- d) Maintenance
- e) As Built drawings. Full as-built drawings and detailed drawings, brochures and catalogues for each system and each element of each system
- f) The names, addresses and telephone/fax numbers/email addresses of all responsible persons and manufacturers/suppliers
- g) Plant and material acceptance testing certificates
- h) Testing and commissioning procedure
- i) Commissioning results
- j) Troubleshooting

3.5.8.1.2.2 Pre-commissioning documents

The following documents are supplied to the Employer by the Contractor prior to commissioning

- a) Updated Dimensioned shop drawings (where applicable) showing the general arrangement of all plant and equipment including isometrics and P&ID's or PFD's where required. Sufficient views must be given to ensure clarity and the drawing shall have at least a plan and two different elevations or sections giving overall dimensions.
- b) Update Documents (where applicable) including equipment data sheets and specification for selected equipment, electrical cabling and other associated equipment .
- c) Manufacturer's product data highlighting Minimum Efficiency Reporting Value (MERV) for filtration media.
- d) Updated Detailed electrical wiring diagrams (where applicable) including schematic and control circuits.
- e) Detailed sequencing manner for installation procedure of Works.
- f) Detailed programme for the works in sufficient detail as to represent the units of work to enable the representative to assess the progress of the works..

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- g) Corrosion protection systems, including data sheets for coating of equipment (where applicable).
- h) List of recommended spares and technical specifications for the spares, part numbers and the stock levels required.
- i) Detailed building works for complete works
- j) Detailed maintenance, reliability, control and operating philosophies
- k) Testing, balancing and commissioning procedures
- l) Plant and material acceptance testing
- m) Plant codification lists for each section of the Works
- n) Operating and maintenance manual

3.5.8.1.2.3 Document format

The Contractor shall deliver all data, drawings, and documents generated in the Contractors designed system of choice to the Engineer in the following public domain formats

- a) Data: the Contractor shall supply the following spreadsheets such as equipment list, line list, valve list, instrument list, and speciality item lists in Excel (Office 2003 compatible format). All lists will contain the following fields for each item in the lists as a minimum, functional location/tag ID (consistent with customer specifications), description, associated drawing and document names (that contain references to this item), and a minimum of 10 additional fields of data as directed by the Engineer.
- b) Drawings: drawings shall be delivered in digital format in either DGN (version eight or later) or DWG (version 2004 or later). These deliverables shall contain sufficient graphical detail, engineering intelligence, and be of proper configuration to allow the lists specified in the data deliverables to be digitally extracted. In addition drawing lists shall be delivered in Excel format that contains the following fields: drawing named, drawing type (consistent with customers checked by and up to five additional fields as per customer request.
- c) Documents: documents shall be delivered in electronic format (MSOffice 2003 compatible or Adobe Acrobat pdf files). In addition a document list shall be delivered in Excel format that contains the following fields: Document name, Document type (consistent with customer specifications), Version number, Date created, Created by.

3.5.8.1.3 Documentation update

The contractor's scope also includes documentation updates where the contractors design and implementation has impacted Employers documents, including documents supplied by the contractor. The list of documents to be updated will be finalised during project Execution.

In instances where the Employer has native files (DGN or DWG format), they will be made available to the contractor on request should they be need for documents updates. However the contractor is expected to be in a position to generate their own documents should supporting documents not be available from the Employer.

The updated documentation shall meet the requirement of section 3.5.8.1

3.5.9 SAMPLES

The Employer's representative maybe at any stage requests samples from the contractor for further evaluations and assessments.

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Samples are any samples required by the Employer which may be over and above those listed in the Samples schedule to be submitted. These are physical examples to illustrate materials, plant or workmanship, and to establish standards by which the Works may be judged.

3.5.10 PLANT TAKE OVER

The contract is deemed to be complete when the following have been completed in accordance with the relevant specifications:

- a) The Plant is erected and commissioned.
- b) Signed erection and safety clearance certificates.
- c) The final drawings have been submitted.
- d) All documentation has been submitted including testing reports and the associated certificates received. All Quality Control Plan (QCP) documentation received. Final Draft of the Technical, Operating, Maintenance manuals delivered.
- e) The Plant and all documentation/drawings are coded and labelled.
- f) All special tools have been supplied.
- g) Plant is taken over with clean set of filters

The complete system is to be subjected to performance tests under full working conditions. This is done in the last month of the defect period. The Contractor shall supply the necessary field testing instruments (thermometers and flow meters) and detailed description of field testing arrangement to prove a capacity/performance measurement accuracy of $\pm 5\%$ for performance acceptance testing.

3.6 OVERALL SCOPE REQUIREMENTS

3.6.1 Complete data books to Employer's requirements

All the existing data books are to be completed as part of quality control and assurance in accordance with Employer's Quality Management Specification as detailed by Appendix A9. The data books are divided into as follows:

- i. H1 Data Books (Factory Acceptance Test). These are complete and no further work is required.
- ii. H2 Data Books (Construction Data Book). Partially complete and the Contractor to complete to Employer's specification.
- iii. H3 Data Books (Testing and Commissioning Data Books for Entire HVAC System in each building). Contractor to complete to Employer's specification.

Document management and control of these data books is the responsibility of the Contractor and allowance is to be made for staff, processes, and site facilities.

Data books are to be submitted as follows:

- i. Three (3) Hard Copies all dividers to be cardboard with "Optitab"
- ii. Two (2) CD's or USB memory stick in PDF format, Native File, If Excel spread sheet e.g., ELL also to be included.

Drawings are to be submitted as follows:

- i. Two (2) A1 prints
- ii. Two (2) CD's or USB memory stick in PDF format, Native File, If Excel spread sheet e.g., ELL also to be included.

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Method statements, equipment submittals and other correspondences are to be submitted in hard copy and PDF format in CD's or USB memory stick.

3.6.2 NCP and CBMS Interface

The Contractor is to be responsible to interface the Network Control Panels (NCP) to the CBMS system. All NCP's have been installed and are using Distech equipment. For further details, refer to the Equipment Submissions and drawings in Appendix A5 & A6. The Sample schedules Alarm Management Systems Guideline has also been referenced in Appendix A11 and A12 respectively.

3.6.2.1 Engineering and Planning Phase of NCP and CBMS Interface

The Contractor is to use the latest approved P&ID and AFS drawings to complete C&I schedules per building as follows:

- i. Alarm list
- ii. Cable schedules
- iii. Driver and Actuator schedule
- iv. Virtual signal list
- v. Instrument schedule

IP addresses will be supplied by CBMS for the devices described on the Device Instance List.

The Virtual Signal List shall be populated on the provided template; 240-72344339 C&I Virtual Signal List for External Signal Exchange Template

ALL MCC and NCP related documents, drawings and schedules are required to be fully KKS coded to Level 3. This 3rd level coding of the MCC and NCP is required to complete the C&I schedules noted above. Engineering (Contractor) to ensure that the SLD's are updated to reflect the as-built panels in accordance with the specification before being sent to Employer's Configuration for KKS coding. Once documents are approved it is the Contractor's responsibility to physically label (KKS code) the MCC or NCP internal components.

The Contractor is to apply for Employer to inspect and sign off all labelling. The completed C&I schedules per building must be submitted to Employer's Configuration Team for KKS coding of the soft signals and alarms.

3.6.2.1.1 Alarm Schedule

Alarm rationalisation will be the combined responsibility of TM Engineering and the Contractor's designer. The Contractor's designer will review the Alarm and Virtual Signal Schedule submissions primarily for completeness of alarms, alarm priorities and rationalisation. The alarm prioritisation and rationalisation will comply to the latest revision of the Eskom Standard: 240-56355466 - Alarm Management System Guideline

3.6.2.1.2 Cable Schedule

The cable schedule already forms part of the NCP pack of documents. This format is acceptable and no further information is required.

3.6.2.1.3 Driver and Actuator schedule

Driver and actuator schedules are to include the following, however not limited to:

- i. Pump motors
- ii. Fan motors
- iii. Chiller pumps

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- iv. Chiller fans
- v. Actuated Dampers

The Drive and Actuator Schedule shall be populated on the provided template; 240-61379755 Control & Instrumentation Drive & Actuator Schedule Template.

3.6.2.1.4 Virtual Signal List

All monitoring and control signals must be listed.

3.6.2.1.5 Instrument Schedule

All instruments on AFS, P&ID's and chiller P&ID's are to be referenced as detailed in Appendix A5 & A6.

The Instrument Schedule shall be populated on the provided template; 240-61379718 Control & Instrumentation Instrument Schedule Template.

3.6.2.2 Implementation of NCP and CBMS Interface

Once the MCC and NCP 3rd level KKS codes are approved, labels or mimics will be produced and physically installed on the MCC or NCP internal components.

The Contractor is to update the MCC and NCP document pack with the approved KKS signal codes as received on the C&I schedules.

The KKS signal codes must be implemented in the NCP software and HMI graphics. HMI Graphics (NCP touch screen) is to be configured as follows:

- a) The latest AFS and P&ID drawings will be used to update the HMI homepage graphics.
- b) ALL equipment on the HMI to have KKS codes. The latest approved equipment lists must be used.
- c) The KKS codes on the HMI can be displayed either in the bottom corner of the HMI or to be displayed when hovered over with mouse. Last option is the preference of Eskom Generation.
- d) ALL equipment descriptions as per the latest approved equipment lists. Descriptions can be shortened since the faceplate of the HMI will contain building/location name and system name.
- e) A clear description is required for each alarm state especially for multi-state variables.
- f) The alarm level colours on the HMI shall be compliant to the Eskom Standard: 240-56355466 - Alarm Management System Guideline.
- g) Legend to be generated on HMI with the following:
 - i. Green: On or Running
 - ii. Red: Alarm
 - iii. Grey: Off
 - iv. Purple: Override
 - v. Orange: Offline

Interface to CBMS and the HVAC NCP panel controllers will be via BACnet/IP communication protocol. The KKS signal code must be transmitted to the CBMS.

Where necessary the contractor is to make upgrades to software on the NCPs to the latest supported version to enable interface to the CBMS. Refer to appendix A8 for the scope of the upgrade identified by the Employer.

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3.6.3 Intellectual property

The Contractor grants to the Employer an irrevocable, nonexclusive, royalty-free licence to any intellectual property to the extent necessary for the operation, maintenance, completion, repair or alteration to any works certified or that of the third party.

3.6.4 Training and Transfer of Technology

At completion of the contract, the Contractor is required to provide training and transfer system knowledge to the Employer by submitting documented Design Intent, As-built drawings, Operational and Maintenance Manual, Commissioning Records, Commissioning Report and by providing training on all the systems to the Employer's personnel to ensure that they have all the information and understanding needed to operate and maintain the features and systems in the various areas.

The training manual for the P35 scope has been approved on the previous contract as detailed by Appendix A27; and further referenced in Appendix A3, the contractor to also cover tunnel ventilation and CEP VSD HVAC scope as well. The training is to comprise of the following:

- i. General HVAC training
- ii. Building Specific Training

The following are the minimum requirements for each session:

- i. Discuss each type of equipment in detail including chilled water generators, chillers with on-board pumps, AHU's, fans, pumps, ducting, attenuators, humidifiers, duct heaters, MCC panel, NCP panel, air terminals. Show PowerPoint slides with photos.
- ii. Supplier literature.
- iii. Service and maintenance requirements.
- iv. Operating and maintenance manuals.
- v. Describe how various maintenance procedures are performed.
- vi. Identify common tools used to safely maintain the equipment.
- vii. Identify instruments used to take measurements.
- viii. OEM Supplier presentation.
- ix. Troubleshooting

The following locations must be covered under the training:

- i. P35A Buildings
- ii. P35B Buildings
- iii. P35C Buildings
- iv. Cable Tunnel Ventilation
- v. CEP VSD room
- vi. Battery rooms

The training is to be configured in six modules as follows. These are classroom-based modules however a few performance based tasks will be required. The instructor will expose the trainees to an active job site. Ensure that trainees possess and use the required PPE during any exposure to these types of settings.

Table 5: HVAC Training Modules

Module Number	Training Description
1. Module 1	Provides a broad introduction to the world of HVAC. The most basic operating principles of HVAC systems are presented. Introduction to HVAC at Medupi Power Station with the following objectives:

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Module Number	Training Description
	i. Explain the basic principles of heating, ventilation, air conditioning and refrigeration. ii. Discuss the design criteria used. iii. Discuss the sites and locations. iv. Discuss the types of HVAC systems used at Medupi Power Station
2. Module 2	Different types of equipment used at Medupi, with the objective of Introducing the types of HVAC equipment.
3. Module 3	MCC panel and electrical distribution to HVAC equipment
4. Module 4	NCP panel and interface to HVAC equipment. NCP to CBMS interface
5. Module 5	Chiller, service, and interface training (Trane, Carrier, Ciat)
6. Module 6	HVAC Equipment which includes AHU's, Fans & Attenuators, Humidifiers, duct heaters, pumps

3.6.5 Completion & Handover

The contract is deemed to be complete when the following has been completed in accordance with the scope of work:

- i. The Plant is erected and commissioned. The plant and all documentation, drawings are coded and labelled.
- ii. Signed erection and safety clearance certificates.
- iii. The final as built drawings have been submitted.
- iv. All documentation has been submitted including testing reports and the associated certificates received.
- v. All Quality Control Plan (QCP) documentation received.
- vi. Final technical, operating and maintenance manuals delivered.
- vii. Training and transfer of technology received.
- viii. All spare lists and special tools have been supplied.

3.6.6 Deliverables

The Contractor will provide sufficient documentation at Handover to the Employer for safe and sustainable maintenance and operation. This will include but not limited to:

- a) HVAC As built drawings, operating manuals, and maintenance schedules.
- b) HVAC O&M Manuals per building
- c) HVAC Spare Lists
- d) Production of CBMS Schedules for each Building
 - i. Cable Schedule
 - ii. Instrument Schedule
 - iii. Drive and Actuator Schedule
 - iv. Virtual Signal List
 - v. Alarm List
- e) Completion of CBMS Interface with CBMS Contractor.
- f) Completion of HVAC and Fire Detection Interface with CBMS Contractor.
- g) Completion of NCP Installations where applicable as per scope of work.
- h) Commissioning of all HVAC systems where applicable.
- i) Closing out of defects (manufacturing, construction, and commissioning defects).
- j) Completion and handing over of Data Books

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- i. H1 - Manufacturing Data Books (MCC and NCP)
- ii. H2 – Construction Data Books (HVAC Mechanical, Electrical and C&I)
- iii. H3 – Commissioning Data Books (Entire HVAC System in each building)
- k) Issuing of HVAC Professional Engineering Certificates for Completed works per building.
- l) Issuing out of Natives drawings (CAD, DGN, DWG format, etc.)
- m) Civil and structural drawings in As-built status
- n) Professional Engineering Certificates for all constructed and/or modified civil structures.
- o) All calculation reports for designs and/or modifications signed by the Contractor's registered professional.

3.6.7 MANAGEMENT REPORTING

3.6.7.1 General monitoring and reporting

- a) Relevant weekly and monthly reports shall be provided by the Contractor to prove the productivity, effectiveness, and efficiency of his/her services.
- b) The Contractor shall be present at the Employer's Safety meetings and planned plant walks.
- c) The Contractor maybe requested to be present at any ad hoc meetings that may arise to address any production or safety related matters.
- d) Liaison meetings shall be held with the Employer's Representative or his/ her delegate to discuss any concerns that may rise.

3.6.7.2 Special monitoring and reporting

3.6.7.2.1 Construction Monitoring and Professional Engineering Certification

The Contractor's Designer is to provide construction monitoring on the works in accordance to the provision of normal and additional services as per "Guideline Scope of Services and Tariff of Fees for Persons Registered in terms of the Engineering Profession Act 2000", for construction monitoring of the execution of the works. Construction monitoring includes but not limited to:

- a) Review a sample of each important work procedure and construction material and other technical submissions such as construction method statements, inspection and test plans and quality control and quality assurance plans.
- b) Attending site meetings and maintain adequate presence on the construction site to review samples of works and important completed work prior to enclosure or on completion as appropriate.
- c) Provide the construction team with technical interpretation of the plans and specification when required and checks the construction team's civil works and structures for conformity with design requirements and ensures that design intent is achieved during construction.
- d) General inspection of materials and equipment for compliance with the design documentation for adherence to the Eskom, National and International standards.
- e) Provides the construction team with updated design documentation (drawings and specifications) where changes are required to ensure integration with existing works and where design changes are required due to unforeseen site conditions.

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- f) Prepares and, on completion of the works, provides the Employer with As-Built drawings and a final (updated) design/calculation report signed by the Contractor's registered professional person.
- g) Certifies the works as complete and that design intent is achieved during construction by issuing a completion certificate (Professional Engineering Certificate (PEC)) in terms of the Construction Regulations, 2014, Occupational Health and Safety Act, 1993 when the works is deemed safe for commissioning.

3.6.8 QUALITY AND DOCUMENTATION MANAGEMENT CONTROL

The Supplier shall demonstrate, provide, and maintain a Quality Management System (QMS) that is ISO 9001:2015 certified or compliant thereto as well as the Supplier Quality Management Specification (240-105658000) and Medupi Contractor Quality Specification (348-389557). Compliance with the provisions of this clause in no way relieves the Supplier of the final responsibility to furnish acceptable services. Contractors QMS that includes:

- a) Ensuring that processes, plans and procedures needed for the QMS are established and maintained and the integrity of the QMS is maintained when changes are implemented.
- b) Ensuring that Quality Assurance and Quality Control Depts. are sufficiently manned with competent resources to effectively implement quality requirements.
- c) Reporting to top management on the performance of the quality management system and any need for improvement.
- d) Ensuring the awareness of customer requirements throughout Contractors organization.

Quality management shall ensure that the *Employer's* requirements as specified in the Contract are met in full and verified as such to Employer satisfaction. Quality management shall be in accordance with ISO 9001:2015 and related ISO 9000 series of Standards, and is to provide full documentary and Objective evidence that the Works have been designed, manufactured, executed, completed, and maintained in accordance with the Contract.

The quality management system shall apply to the *Contractor* and all persons real or juristic working for or on behalf of the Contractor on or in connection with the Works and regardless of the form of employment contract.

Quality management shall ensure that the Quality Control Plans, Inspection and Test Plans and procedures/instructions/method statements/ECNs/FCNs developed or adopted provide stages at which the *Employer* may witness what is being done or require what is being done to be subject to inspection before the execution continues.

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Contractor shall list all documentation needed for the effective implementation of the project quality management system (QMS) and shall, as a minimum, prepare, maintain, and implement throughout the life cycle of the project, as part of the project quality management system. The project specific documentation are as follows:

- a) Project Quality Policy
- b) Project Quality Strategy
- c) Project Quality Objectives
- d) Project Quality Management Plan
- e) Project Organisation Chart.
- f) Project RACI Matrix – may be split by Dept. /Phase/Discipline as required.
- g) Job Descriptions including performance requirements and measurements.
- h) Equipment and Process Criticality Ratings,
- i) Project Quality Assurance Plans – per project phase:
 - (i) Design
 - (ii) Manufacturing, Inspection and Testing
 - (iii) Construction, Inspection and Testing
 - (iv) Commissioning and Taking-Over
- (j) Project Quality Control Procedures - per discipline:
 - (i) Civil and Structural works.
 - (ii) Mechanical, Piping, Painting and Insulation works.
 - (iii) Electrical works.
 - (iv) Control and Instrumentation works.

Project Quality Control Procedures per individual activity identifying specific inspection and test methods and acceptance criteria.

Project Inspection and Test Plans (ITP's) per individual activity that plan, assure quality, and define inspection intervention levels.

Project Quality Verification Records per individual activity - as referenced in ITP's.

Manufacturing, Construction and Commissioning Record Books

Except where otherwise stated, all documents that constitute the Quality Management System, including proforma Quality Verification Records, shall be complete, in accordance with the Contract, and ready for use and submitted to Engineer not less than 30 days before the work governed by the documents are planned to start.

Throughout the lifecycle of the project, on a monthly basis, the contractor shall maintain and submit a

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MDL (Master Documentation List), to the *Project Manager* for review and approval. Each document on the Master Document List shall have the following marked against it:

- a) The planned and actual date of submittal to the *Project Manager*
- b) The classification of documentation (for approval, for review, or for reference) based upon the classification guidelines of Quality specification document.

(i) Class 1 - for the Engineer's approval - where the Contractor may not proceed with the Works that are the subject of the document until it has been approved by the Engineer.

(ii) Class 2 - for the *Project Manager's* Review - where the Contractor may proceed with the works that are the subject of the documentation if the *Project Manager's* has made no comment after seven (7) days from the receipt by the *Project Manager*

(iii) Class 3 - for the Engineer's Reference - where the *Project Manager* reserves the right to comment, but the *Contractor* may proceed with the works that are the subject of the documentation.

Where there is an ambiguity or where a document is produced that is not referenced therein clarification as to classification shall be sought from the *Project Manager*.

The Master Document List shall be submitted to the *Project Manager* electronically via email in native file format on a monthly basis.

The *Contractor* submits as a minimum the following documents, as required by the *Employer*, which requirement does not constitute a compensation event, during the execution of the Works: -

- a) Updated QCP register.
- b) Inspection notifications accompanied by their inspection report.
- c) Non-conformance and Defects registers and reports.
- d) Updated Site and off-site inspection schedules.
- e) Inspection and or FAT dates.
- f) Inspections completed/outstanding.
- g) Inspection and test reports
- h) Monthly contract quality progress report
- Data books for the completed Works, before commissioning can commence (refer to the Record books section 2.5.2 and data books hand over timelines)
- The Supplier agrees to control and professionally preserve and store appropriate documents, records, and recordings for a period of 5 years after termination of the agreement to guarantee the traceability of the services rendered and inspection thereof.

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- The Supplier agrees to regularly update and implement all the latest technology available as well as the necessary improvements for the installation, production and organisation deemed necessary to meet the requirements of the agreement and in order to enhance capabilities and effectiveness to deliver high quality, cost-effective security services.
- The delivered or services shall be uniform in Quality and condition, consistent with good industry practices and adhere to requested Eskom requirements, without deviation.
- The Employer shall have the right to regularly conduct inspections, assessments, audits, and surveys and perform surveillance of the Supplier's and/or Sub-Supplier facilities, sites, premises, records and documentation (including but not limited to data books) to evaluate their capability to comply with the requirements necessary to conform to contractual and QMS requirements.
- The Employer reserves the right to inspect, at reasonable times, any or all of the services performed at the Supplier's or Sub-Supplier's premises or elsewhere. Verification by Eskom shall not absolve the Supplier of the responsibility to provide acceptable product and / or services, nor shall it preclude subsequent rejection by Eskom.
- The services must comply with the agreed specifications and requirements and the applicable directives and standards set out in the Contract. Defects notified by the Employer shall be remedied by the Supplier upon demand by the Employer without undue delay and at no extra cost. The Supplier shall continuously monitor and identify non-conformances, both internal and external, as signals of opportunities for improvement making process and other relevant changes to prevent recurrence.
- The Supplier shall further identify potential problems before they occur by identifying deviations in patterns or trends in product, service, or process performance.
- Nothing contained in the Contract and/or purchase order and/or scope of work and /or works information shall relieve in any way the Supplier from the obligation of Quality control thereof.
- The Supplier guarantees that the Quality of the delivered services will comply with the requirements of the contract and/or relevant specifications.
- The Supplier shall, on request, prove its ability to relate to the proposed scope of work which establishes the manner in which the Supplier intends to perform the Contract.
- The Supplier shall, on request, prove its organisational, logistics and support resources to ensure the requirements of the contract can and will be achieved.
- The Employer reserves the right to assess and measure, during the existence of the agreement the qualifications, capability, and competence of the key staff (assigned personnel) in relation to the scope of work and to interview any / all of them to confirm the Quality evaluation.

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- The identified professional personnel who will be managing the service will be available and accessible on a continuous basis until the conclusion of the project.
- The Supplier shall demonstrate experience in comparable projects or specific aspects of the project and / or performance in similar projects, on request.
- The Quality of the services and the contents thereof will always be in accordance with professional standards.
- For the duration of the Contract, the professional staff managing the service, must be and remain a member of his/her Professional Society
- The Supplier must, at all relevant times, scrutinise and be aware of Eskom's requirements with specific focus on, inter alia, its philosophy, principles, strategies, practises, mission, vision, models, policies, and practises.
- The Supplier shall exercise reasonable professional skill, care, and diligence in the performance of his obligations in terms of this agreement.
- On awarding of the Contract to the successful Supplier, such Supplier shall present to the Employer an acceptable Quality Control Plan (QCP). The QCP shall comply with the requirements of ISO 10005

The Contractor shall employ sufficient qualified and knowledgeable quality assurance and quality control and inspection staff. These staff members shall be independent from those responsible for construction and commissioning activities and report directly to the Site Quality Department Manager and not the production team as referenced on Medupi Quality Specification (348-389557 sub-clause 3.4.1).

Quality Payment Schedule

- 1) The Contractor shall ensure that Quality Assurance is performed at all levels and phases of work carried out for the Employer.
- 2) The Contractor shall use processes to ensure that quality is built into their products/services i.e., its business processes are organized such that quality is built into the process of producing goods and rendering services. The Contractor shall work according to processes.
- 3) The Contractor shall ensure that it can be relied on to deliver quality goods and services without the need for the Employer to have to inspect all the time.

The Contractor shall keep the Quality Table of Payments (Quality Payment Schedule) updated with progressive Employer sign-off (as the work is done and payments applications are submitted). This means that as the Contractor completes an activity and has the related ITP/QCP signed by the

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Employer, the Contractor shall bring the Quality Table of Payments to the Employer's Quality representative to sign off for that activity.

The updated Quality Table of Payments shall accompany all payment applications (proforma invoices). The Contractor shall attach the signed (or partially signed if applicable) ITPs/QCPs to the payment application. Payment will only be made if the ITPs/QCPs are signed by the Employer.

3.6.9 THE CONTRACTOR SHALL UTILISE THE EMPLOYER'S QUALITY DOCUMENTATION MANAGEMENT SYSTEM AND PROCESSES (240-76474270).PROJECT IMPLEMENTATION

The Contractor shall supply the Employer, a project implementation and execution plan including but not limited to the following:

- a) Proof of previous experience of similar scope project, with respective project values in Rands (ZAR/R) and client references with their contact details.
- b) Company profile that stipulates why the Contractor is competent to execute this scope of work.
- c) Manpower Planning
- d) Organogram
- e) Curriculum Vitae, Skills and Competencies required.
- f) Quality Management Plan and/ or ISO Certification
- g) Environmental Management Plan and/or relevant ISO Certification.
- h) Safety Management Plan and/or relevant ISO Certification.
- i) Communication Plan (Weekly or monthly report).

3.6.10 PROJECT MANPOWER REQUIREMENTS

- a) The successful Contractor shall utilise/provide suitably qualified staff with experience in the following but not limited to the following knowledge areas:
 - i. Design, manufacture, construction and commissioning of the HVAC systems similar to this scope of works.
 - ii. KKS system codification.
 - iii. HVAC certifications and compliance.
 - iv. Electrical installations in the SOW
 - o The electrical plant is to be designed, supplied, installed, tested and commissioned by a qualified staff. The qualification certificates to be supplied with the tender and should form part of the works.
 - o The electrical part of HVAC works is to fully comply to Eskom standard specification 240-56227516 (LV Switchgear and Control Gear Assemblies and Associated Equipment for Voltage up to and Including 1000V AC and 1500V) and SANS 10142-1 (The wiring of premises Part 1: Low-voltage installations).
- b) The successful Contractor shall employ staffs that meet the minimum requirements related to Eskom job descriptions.

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- c) All staff brought on site in connection with the SOW should be able to fluently speak, understand and write in English as well computer literate.
- d) Proof of staff qualification is to be supplied by the Contractor on request by the Employer.
- e) The Contractor must ensure that all staff being brought in Medupi Power Station site, produce valid fitness certificate (medical test) as per specified plant man-job specification.
- f) The work force plan needs to specify ad-hoc and base crews required for the duration of the service contract.
- g) The personnel might be required to work overtime, and the Contractor should submit the proposed labour rate(s) with their tender(s).
- h) The Contractor will be required to attend Employer's meetings and adhere to statutory requirements.
- i) Before work starts on site, a kick-off meeting is held with the Contractor, and the Employer, to explain the detail requirements of the Site Regulations.
- j) Adherence and compliance to Eskom SHERQ and statutory requirements is mandatory.
- k) The Contractor is responsible for ensuring compliance to Eskom Holdings SOC Limited and Medupi Power Station specific policies, procedures and standards.
- l) The Contractor is responsible for supplying their employees with applicable PPE and Safety Harnesses when performing the task at elevated positions.

Contractor and the Employer shall carry out risk assessment to establish what hazards to the health and safety of persons are attached to any work and to the project deliverables. The Contractor shall ensure compliance to Zero Harm, Zero Injuries, Zero fatalities and Zero environmental incidents.

3.6.1 Facilities and equipment provided by the Employer and Contractor

- a) The Contractor will provide equipment and the material required for execution of the works.
- b) The Employer will provide specification documents such as drawings, data sheet etc. to assist the Contractor in the execution of the works. These documents remain the property of Medupi Power Station.
- c) The Contractor will supply all required tools, equipment to their employees to perform their tasks.

3.6.1.1 Site Facilities and Service provided by Employer

The sites are Medupi Power Station, and any further information will be made available on request.

3.6.1.2 Site Facilities and Service Provider by Contractor

3.6.1.2.1 Service Cost

- a) The Contractor's performance evaluation shall be done during monthly meetings between the Contractor and the Employer.

3.6.1.2.2 Equipment

- a) Any tools, equipment, and appliances used by the Contractor conforms to the applicable OH&S Act and Eskom safety standards and is maintained in a safe and proper working condition. The Employer has the right to stop the Contractor's use of any Equipment which, in the opinion of the Employer; does not conform to the requirements.

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3.6.1.2.3 Access to Site

- a) The Contractor makes his/her own assessment of and allows in his/her rates for those access problems that may be encountered. No extra payment or claim of any kind is allowed because of difficulties of access to the works, or for the requirement of working adjacent to or in the same area as others.
- b) Access to the site shall be in line with the Medupi Power Station's access procedure. All Contractors shall be required to make an application to enter site for the duration of the contract. An access permit shall only be issued once the Contractor has attended the safety induction and has undergone medical checks.
- c) All the assets must be declared and registered with security upon entering site. This includes portable assets such as laptop, toolbox and etc.
- d) The Contractor shall have no claim against the Employer in respect of delay at the security main gate.

3.6.1.2.4 Accommodation and Transportation

- a) The Contractor provides his/her own accommodation and transport for all his/her employees and Subcontractor engaged in the execution of the work.
- b) The cost of accommodation, as well as transportation to and from site must be included in the project price cost.

3.6.1.2.5 Communication and Correspondence

All correspondence shall be addressed to the Employer and all terms and conditions of the contract shall be adhered to with regards to communication and correspondence.

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4. AUTHORISATION

This documents has been seen and accepted by:

Name & Surname	Designation
Prenolan	Project Engineer – LPS Engineering (HVAC)
Antonie Coetzee	Manager Projects
Kudzai Pakachena	Project Engineer – LPS Engineering (HVAC)
Justin Padiachy	Project Engineer – Civil Engineering
Avesh Haricharan	Project Engineer – Civil Engineering
Refiloe Lapshe	Project Engineer – Civil Engineering
Thomas Chambale	Project Engineer – Civil Engineering
Mdu Shoji	Project Engineer - C&I Engineering
Ranwedzi Ramutsindela	Project Engineer - C&I Engineering
Mduduzi Dhlamini	Configuration Management
Hoxani Mashele	Configuration Management
Mufarisi Manyuha	Gx System Engineer
Phimani Mugwambane	Fire Engineering, Low Pressure Services
Goodman Sithole	Contracts Manager
Zak Jiyane	Project EDWL
Rofhiwa Nemutandani	Project Engineering Manager

5. REVISIONS

Date	Rev.	Compiler	Remarks
November 2020	0	P Gangan	Draft version for review by Engineering Team
November 2020	0.1	P Gangan	Document updated to incorporate various stakeholders' inputs and comments
November 2020	0.2	P Gangan	Document updated to incorporate various stakeholders' inputs and detailed appendices
January 2021	1	P Gangan	Final Document for Authorisation and Publication
July 2021	2	P Gangan	Updated revision after QS team review
August 2021	3	P Gangan	Package 08 scope removed. Tunnel Ventilation added
March 2022	4	P Gangan	P35B documentation, IT & Comms Mod added
May 2022	5	P Gangan	Maintenance scope removed- repairs and service included
October 2023	5.1	L Phogole	Incorporating additional scope and clarification meeting comments

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Date	Rev.	Compiler	Remarks
October 2023	5.2	L Phogole	Update as per the multi-disciplinary comments
November 2023	5.3	L Phogole	Final Draft for final review
November 2023	5.4	L Phogole	Final Document for DRC presentation
November 2023	5.5	L Phogole	Updated as per DRC comments
January 2024	5.6	L Phogole	Update as per Contracts management comments
January 2024	6	L Phogole	Final Document for Authorisation and Publication

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6. APPENDICES

In addition to the scope of work and other related documents applicable to the Contract, the following appendices are issued by the employer, and they show general layout of all equipment and distribution systems, complete with schematic arrangements. These, together with the scope of work give sufficient information to enable the Contractor to estimate the cost and to determine how the system installation is to be completed, tested, balanced, inspected, operated, serviced, and maintained.

The following appendices are applicable to the contract and issued with this tender documentation for tendering purposes only:

Table 6: Appendices issued by Employer

Appendix	Title
A1	Activity schedule
A2	Status of the Link boxes, Fan and Louvre openings
A3	Service & Repair Activity Schedules
A4	Major HVAC Equipment List
A5	Equipment Submittal Schedule
A6	Drawings Submittal Schedule
A7	Designer Scope of work & division of Responsibilities
A8	Defects Lists
A9	Quality Requirements
A10	Supply Air Double Skin Duct Capping Detail
A11	CBMS Schedules
A12	Alarm Management System Guideline
A13	Commissioning & Handover Procedure
A14	Operation & Maintenance Manual - Approved Format
A15	KKS Specifications
A16	General HVAC Specification
A17	Limit of Supply and Services (LOSS)
A18	Unit 1-6 Aux to ACC Substation Fire Protection Layouts
A19	P35B HVAC Works Status 25-11-2021
A20	Typical HVAC System Signals
A21	Fire proofing of duct
A22	OHSA Requirements
A23	Fresh Air Grill and Exhaust Fans Opening
A24	Employer's drawings
A25	Medupi Site Design Environmental Data
A26	Duct Riser Support Detail
A27	Training Manual
A28	Wage Bureau Report & Template
A29	Labour Site Specific Agreement (SSA)
A30	VDSS
A31	BoQ

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