Eskom	Scope of Work	Generation

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3. BACKGROUND

Arnot Power Station is a coal-fired power station in Mpumalanga Province with six turbine-generator units, each rated at approximately 375 MW. Units 1 to 3 operate with ABB Procontrol P14 systems. Units 4 to 6 operate with ABB Procontrol P14 systems.

The current Boiler Tube Leak Detection (TLD) system at Arnot Power Station lacks sufficient capability to detect leaks in the economizer tubes of all six (6) units effectively. The existing acoustic-based system cannot reliably detect economizer tube leaks, posing a risk of undetected failures, which can lead to costly unplanned outages, secondary damage, and potential safety incidents.

To address this critical gap, the project will implement a standalone system of high-temperature, in-situ flue gas humidity monitors on both the Left-Hand (LH) and Right-Hand (RH) sides after the Economizers of all six units.

The system is designed to detect water leaks with a sensitivity sufficient to identify leaks before they escalate, enhancing detection reliability, enabling proactive maintenance, and improving station safety.

The Works include the engineering design, supply, installation, integration, and commissioning of the integrated solution directly into the ABB P14 DCS. The Works include full integration of the humidity analyzers into the existing ABB P14 DCS. All DCS configuration, logic modifications, HMI mimic development, alarming, diagnostics, and historian logging are carried out by ABB or an authorised ABB sales channel partner contracted directly by the Contractor.

Integration to the ABB DCS includes signal termination, signal allocation, and provision of all technical data, loop terminations, and wiring from the analyzer converters to the ABB interface points. The Contractor provides on-site support to ABB during configuration, testing, and commissioning.

All plant, materials, and workmanship forming part of the Works comply with the latest editions of applicable Employer, national, and international standards, including the standards listed in Section 3.4 of this document.

On Completion of the Works, the Contractor provides the Employer with an operational, fully integrated Additional Boiler Tube Leak Detection System that enhances plant safety and reliability, supports proactive maintenance, and reduces the risk of unplanned outages.

3.1 HIGH LEVEL DESCRIPTION OF WORKS

The Works information includes the provision of a fully integrated Additional Boiler Tube Leak Detection System that meets the Employer's requirements:

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3.1.1 The Contractor ensures that the design, engineering, procurement, manufacturing, factory acceptance testing, offloading on site, storage, installation, commissioning, and integration are catered for.

3.1.2 The Contractor ensures that high-temperature, in-situ flue gas humidity monitors are installed on both the Left-Hand (LH) and Right-Hand (RH) sides after the Economizers of all six (6) units.

3.1.3 The Contractor ensures that the analyzer system is capable of continuous, direct measurement of water vapor (in vol% H_2O) in high-temperature flue gases.

3.1.4 The Contractor ensures that the analyzer probes can withstand a maximum flue gas temperature of 380°C and are constructed of materials resistant to flue gas composition containing H_2O, CO_2, SO_2, and fly ash.

3.1.5 The Contractor ensures that the analyzer system provides dual, isolated 4-20 mA analog outputs with HART protocol for connection to the ABB P14 DCS.

3.1.6 The Contractor ensures that the analyzer system is integrated into the ABB P14 DCS with full functionality, including display of measured values, alarms, and diagnostics on operator HMIs.

3.1.7 The Contractor ensures that the system includes automatic/semi-automatic calibration capability using instrument air as the span gas.

3.1.8 Definitions

Terminology	**Interpretation**
Converter	The unit that processes the signal from the detector probe and provides analog outputs, HMI display, and system configuration.
Detector Probe	The sensing element installed directly into the flue gas duct that measures water vapor concentration.
DCS	Distributed Control System – the ABB P14 system used for plant control and monitoring.
Economizer	A heat exchanger that preheats boiler feedwater using flue gas heat; the location where the humidity monitors are installed.
HMI	Human-Machine Interface – the graphical interface used for operation and monitoring.
In-situ	Measurement performed directly within the process stream (flue gas duct) without extractive sampling.
KKS	Identification system for power plant (Kraftwerk Kennzeichnen System) as per 240-93576498.
OEM	Original Equipment Manufacturer of the analyzer system.
Probe Protector	A mechanical shield or sleeve that protects the detector probe from fly ash erosion and mechanical damage.
SANS ISO 3834	Quality requirements for welding – applicable to the fabrication of probe adapter flanges.
TLD	Tube Leak Detection.

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3.1.9 Abbreviations

Abbreviation	Description
ABB	Asea Brown Boveri
C&I	Control and Instrumentation
DCS	Distributed Control System
ECSA	Engineering Council of South Africa
EMC	Electromagnetic Compatibility
EPRI	Electric Power Research Institute
FAT	Factory Acceptance Test
HMI	Human Machine Interface
IEC	International Electrotechnical Commission
ITP	Inspection Test Plan
KKS	Kraftwerk Kennzeichnen System (Power Plant Coding System)
LH	Left-Hand
OEM	Original Equipment Manufacturer
P&ID	Piping and Instrumentation Diagram
QCP	Quality Control Plan
RH	Right-Hand
SANS	South African National Standard
SAT	Site Acceptance Test
SHEQ	Safety Health Environmental and Quality
SIT	Site Integration Test
SOW	Scope of Work
TLD	Tube Leak Detector
UPS	Uninterruptible Power Supply
VDSS	Vendor Document Submission Schedule
WPS	Weld Procedure Specification

3.2 THE DETAILED CONTRACTOR'S DESIGN AS PER EMPLOYER'S REQUIREMENTS

3.2.1 Detailed Scope of Works as per Employer's Requirements

The Contractor is to provide all Works defined in this section, except where explicitly stated otherwise. The Contractor provides a fully integrated Additional Boiler Tube Leak Detection System as per the following:

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3.2.1.1 The Contractor ensures that the system is fully designed, engineered, procured, manufactured, factory tested, delivered to site, installed, integrated, site tested, and commissioned in accordance with the Employer's requirements and the standards listed in Section 3.4.

3.2.1.2 The Contractor designs, supplies, installs, routes, terminates, tests, and commissions all equipment, cabling, junction boxes, supports, and protective devices required for a fully functional system forming part of the Works.

3.2.1.3 The Contractor is responsible for verifying and accounting for the installation locations on the 113ft level during the detailed design phase and reconfirming during the procurement phase, before placing the order for the analyzers.

3.2.1.4 The Contractor ensures that engineered characteristics of the system are aligned with the process conditions, including flue gas temperature, composition, and dust loading.

3.2.1.5 The Contractor ensures that the analyzer system is powered by 220 V AC power supply from the existing UPS in the EDS room.

3.2.1.6 The Contractor ensures that high-temperature, in-situ flue gas humidity monitors are installed on both the Left-Hand (LH) and Right-Hand (RH) sides after the Economizers of all six (6) units.

3.2.1.7 The Contractor ensures that measurement data from the installed analyzers is displayed in the 7-in-1 Unit Control Room on the ABB P14 DCS HMI.

3.2.1.8 The Contractor ensures that the analyzer system has dual, isolated 4-20 mA analog outputs with HART protocol for connection to the ABB P14 DCS.

3.2.1.9 The Contractor is responsible for providing a field distribution board equipped with circuit breakers where required. Additionally, the Contractor supplies and terminates the necessary cables from the 220V UPS distribution board (DB) in the EDS room to the analyzers.

3.2.1.10 The Contractor is responsible for ensuring that all analyzer 4-20mA signals are properly wired to the designated C&I junction boxes. These 4-20mA signals shall be conveyed through the JBs and marshalling racks to enable the interface to the ABB DCS.

3.2.1.11 The Contractor provides all temporary Works, plant, tools, lifting equipment, scaffolding, permits, and safety measures necessary to carry out the Works.

3.2.1.12 The Works are accepted when:
a) All analyzers pass SAT with measurement accuracy within specified limits.
b) All signals are visible, correctly scaled, and logged in the ABB DCS historian.
c) All documentation in the VDSS is submitted and accepted by the Project Manager.

3.2.1.13 The Contractor shall submit, as part of the tender and prior to procurement:

a) A valid OEM Authorization Letter confirming the Contractor's authorization to supply, configure, install, and commission the proposed analyzer model for high-temperature flue gas humidity measurement at Arnot Power Station;

b) A Project-Specific OEM Partnership Letter confirming that the OEM will provide engineering validation, application support, commissioning support, and access to proprietary technical resources for this specific project; and

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c) A written commitment from the OEM confirming at least 10 years of technical support, spare parts availability, and software/firmware updates from the date of commissioning. The letters shall identify the Contractor and proposed analyzer model, be issued on the OEM's official letterhead, and be signed by an authorised OEM representative.

3.2.1.14 The Contractor shall submit a valid ABB OEM Support Letter confirming ABB's commitment to the DCS integration scope. The letter shall be one of the following:

a) If the Contractor is ABB: An OEM confirmation letter;

b) If collaborating with ABB: A signed Project-Specific Agreement or Letter of Intent (LOI) from ABB;

c) If an ABB Sales Channel Partner: A valid ABB OEM Sales Channel Partner Letter confirming ABB's full support for all configuration, software, and hardware integration works on the ABB P14 DCS. The letter shall be project-specific (referencing the Arnot Power Station Additional Boiler Tube Leak Detector Project), be verifiable directly with ABB, confirm ABB's commitment to support the integration including access to necessary software licenses, configuration tools, and specialist support during SAT and commissioning, and have more than three months remaining before expiry at the time of tender submission.

3.2.1.15 The Contractor shall submit a clause-by-clause compliance schedule as part of the tender and detailed design package, identifying the applicable OEM document and page number for each requirement specified in this Scope of Work. The compliance schedule shall demonstrate how each requirement is met and shall be submitted to the Project Manager for review and acceptance prior to procurement.

3.2.2 Operating Philosophy

3.2.2.1 The Additional Boiler Tube Leak Detection System is implemented to monitor humidity levels in the flue gas after the economizers to detect water leaks in economizer tubes, in alignment with the EPRI Boiler Tube Failure Program Best Practices – 1023087.

3.2.2.2 High-temperature, in-situ flue gas humidity monitors are installed on both the Left-Hand (LH) and Right-Hand (RH) sides after the Economizers of all six units.

3.2.2.3 Each analyzer probe measures the water vapor concentration in the flue gas and the converter unit processes the signal and converts it into a 4-20 mA analog signal (with HART protocol). This signal is routed via junction boxes and marshalling racks and interfaced into the existing ABB P14 DCS.

3.2.2.4 The DCS processes these signals to display real-time humidity readings on operator HMIs located in the Unit Control Rooms.

3.2.2.5 In addition to real-time display, the DCS implements:
a) Alarm Handling: Alarms are generated for high humidity levels, rate of change alarms, and system fault conditions based on pre-configured thresholds.
b) Data Logging: Measured values and alarm events are continuously logged to the plant historian to support performance analysis and reporting.
c) Self-Diagnostics: The system includes comprehensive self-diagnostics for cell failure, temperature abnormalities, and system errors, with status available via contact outputs and the local display.

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3.2.2.6 The system operates as a monitoring system with alarm functionality and does not form part of any automatic control loop. Its primary function is to enhance detection reliability and enable proactive maintenance.

3.2.3 General Requirements for the Contractor's Works

3.2.3.1 The Contractor's design and engineering is carried out in accordance with the Eskom Engineering Policy (240-4332798) and the Design Review Procedure (240-53113685).

3.2.3.2 The Contractor provides all equipment and services to fulfil all requirements specified in this Works Information.

3.2.3.3 The Contractor ensures that all Works comply with professional engineering practice and standards and are designed for the environmental conditions prevailing at Arnot Power Station, in accordance with Eskom Standard 240-56355731 (Environmental Conditions for Process Control Equipment).

3.2.3.4 The Contractor completes and submits a detailed design package for review by the Employer.

3.2.3.5 The Contractor, as far as reasonably practicable, supplies equipment and components that are standardized and compatible with the existing installed equipment and systems at Arnot Power Station.

3.2.3.6 The Contractor provides all temporary equipment, including power and signal cables, necessary to deliver a fully functional system forming part of the Works.

3.2.4 Functional Requirements

3.2.4.1 The Contractor verifies that each signal indication on the ABB DCS display has the same accuracy as the field measurement with no more than 1% deviation.

3.2.4.2 The Contractor verifies that the analyzer system provides continuous, direct measurement of water vapor with the following performance specifications:
a) Measurement Range: 0 to 100 vol% H_2O.
b) Measurement Accuracy: ±1% vol H_2O or better at the expected process conditions.
c) Response Time: 90% response within 5 seconds of a gas change.
d) Self-Diagnostics: Comprehensive self-diagnostics for cell failure, temperature abnormalities, and system errors, with status available via contact outputs and the local display.

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3.2.4.3 The Contractor performs, as a minimum, the following engineering, design, configuration, and installation services in accordance with IEC 61511 (Functional safety), IEC 61207 (Performance evaluation of gas analyzers), and IEC 61010 (Safety requirements):
a) Detail design, including probe selection, sizing, and verification of installation locations.
b) Procurement of all system components, including probes, converters, cabling, junction boxes, power supplies, and all auxiliary equipment.
c) Factory Acceptance Testing (FAT) of the system, including simulation of 4-20 mA outputs, verification of measurement range and accuracy, and calibration certificates traceable to national standards in accordance with IEC 61207-1, IEC 61207-2, and IEC 61207-3.
d) Delivery to and offloading at site with appropriate handling procedures and tagging of all equipment in accordance with ISO 2859 (Sampling procedures for inspection by attributes).
e) Installation of the analyzers and associated equipment, including mechanical mounting, electrical termination, signal cabling, environmental sealing, and earthing in accordance with SANS 10142-1 and Eskom Standard 240-56356396 (Earthing and Lightning Protection).
f) KKS labelling of all instruments, cables, junction boxes, and DCS I/O points in accordance with Eskom Standard 240-93576498.
g) Interfacing with existing plant infrastructure, including signal routing through junction boxes and marshalling racks to the ABB DCS input modules.
h) Configuration of signals into the ABB DCS, including signal scaling, alarm threshold configuration, HMI mimic development, and historian logging.
i) Simulation and loop-checking of all signals, including verification of accuracy, alarm conditions, and DCS display prior to commissioning.
j) Commissioning, functional testing, and optimisation of the system under actual plant operating conditions.
k) Training of the Employer's personnel in the operation, maintenance, and troubleshooting of the system and its DCS interface.
l) Provision of all documentation, including as-built drawings, P&IDs, instrument data sheets, calibration certificates, signal lists, and configuration backups in accordance with ISO/IEC 82045 (Document management).
m) Quality management for all activities, including inspections, testing reports, and conformity assessments as per ISO 9001.
n) Provision of Certificates of Compliance (CoCs) for all new electrical installations in accordance with SANS 10142-1.
o) Compliance with site safety rules and Eskom's SHEQ requirements.

3.2.4.4 The Contractor is responsible for the provision of a detailed operating philosophy as per the Contractor's detailed design of the Works and shall submit this to the Employer for acceptance prior to commencing with the installation activities.

3.2.4.5 The Contractor provides a detailed maintenance philosophy for the system, including a preventive maintenance plan that covers all components, inspection intervals, calibration requirements, and fault diagnostics.

3.2.4.6 The Contractor provides critical spares list for the Works.

3.2.4.7 The Contractor provides all required software, licences, and user agreements associated with the operation, configuration, diagnostics, and maintenance of the system.

3.2.4.8 The Contractor does not commence any installation activities until the detailed design has been completed, submitted, and formally accepted by the Employer.

3.2.4.9 The field work does not commence without official access from the Employer.

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3.2.5 Field Instrumentation Technical Requirements

3.2.5.1 The Contractor supplies high-temperature, in-situ flue gas humidity analyzers as part of the Works. These analyzers shall be selected and configured to suit the site-specific process conditions at the economizer outlet, in accordance with IEC 61207-1, IEC 61207-2, and IEC 61207-3 (Performance evaluation of gas analyzers).

3.2.5.2 The Contractor ensures that each analyzer system consists of a separate converter unit and a detector probe.

3.2.5.3 The Contractor ensures that the detector probe meets the following specifications:
a) Must withstand a maximum flue gas temperature of 380°C (320°C design + 60°C overfire margin). Higher temperature capability is acceptable and viewed favourably.
b) Must be constructed of materials (e.g., SUS 316 or better) resistant to flue gas composition containing H_2O, CO_2, SO_2, and fly ash.
c) Must include protection against fly ash erosion (e.g., a dedicated probe protector or built-in design robustness) as specified by the OEM for high-dust environments.
d) Probe length and insertion assembly shall be designed for the specific mounting geometry on the 113ft level.
e) The depth of the analyzer from the inside of the ducting shall not exceed 3 m.

3.2.5.4 The Contractor ensures that the converter unit meets the following specifications:
a) Shall feature an LCD touchscreen for local operation, display of measured values, and system configuration.
b) Shall provide dual, isolated 4-20 mA analog outputs with HART protocol for connection to the ABB P14 DCS.
c) Shall have a minimum of four (4) programmable contact outputs for alarms and system status.
d) Must have an IP65 rating for the converter enclosure in accordance with SANS 60529 (Degrees of protection provided by enclosures).
e) The system design must include the capability for automatic/semi-automatic calibration using instrument air as the span gas.

3.2.5.5 The Contractor verifies correct installation and signal quality during commissioning.

3.2.5.6 The Contractor ensures that all analyzers supplied under this contract are fully compatible with the existing ABB P14 DCS installed at Arnot Power Station.

3.2.5.7 The Contractor provides analyzers that output 4-20 mA analog signals with HART protocol.

3.2.5.8 The Contractor ensures that the analyzer system is suitable for the following conditions:
a) Sample gas temperature: 0 to 380°C (minimum requirement).
b) Sample gas pressure: -5 to +20 kPa typical.
c) Flue gas composition: H_2O, CO_2, SO_2, and fly ash.
d) Ambient temperature at installation location: 50-60°C.
e) Installation height: approximately 113ft.
f) Access conditions: Moderate to Difficult.

3.2.5.9 The Contractor verifies the accuracy and suitability of the above parameters for the purpose of detailed design, equipment selection, and installation.

3.2.5.10 The Contractor shall submit evidence demonstrating the suitability of the proposed probe/sensor design for the harsh flue gas environment, including:

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a) Material specifications confirming resistance to flue gas composition containing H_2O, CO_2, SO_2, and fly ash (e.g., SUS316 or better);

b) Mechanical design details for wear/dust protection (e.g., probe protector, dust filter, or built-in design robustness);

c) Thermal design verification confirming capability to measure at a maximum sample gas temperature of at least 380°C (higher temperature capability is acceptable and viewed favourably);

d) Evidence of OEM-verified design for high-temperature, high-dust applications. The evidence may include OEM datasheets, application notes, material specifications, operating references, or an application-specific OEM declaration.

3.2.6 Field-to-DCS Signal Connections

a) The Contractor connects, terminates, tests and commissions the additional Tube Leak Detector (TLD) signals for each of Units 1 to 6 at the following existing field junction boxes and ABB DCS Universal Input Modules. In the equipment identifiers below, “X” represents the applicable Unit number.

LH-side TLD

- Field junction box: X0HHL01GB005
- Field junction box process pins: 7 and 8
- Equipment-room cubicle: X0CBA01
- Cubicle process pins: b30 and b32
- Universal Input Module: 81EU50R1210
- Module position/reference: FE016

RH-side TLD

- Field junction box: X0HHL01GB006
- Field junction box process pins: 5 and 6
- Equipment-room cubicle: X0CBA01
- Cubicle process pins: b26 and b28
- Universal Input Module: 81EU50R1210
- Module position/reference: FE015

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b) Before commencing installation, the Contractor verifies the specified junction boxes, cubicles, process pins, module positions, signal types, polarity and availability of the allocated DCS input channels. Any discrepancy is reported to the Project Manager for resolution before termination or configuration work proceeds.

c) The Contractor supplies, installs, routes, labels and terminates all required signal cables between the additional TLD equipment, the field junction boxes and the equipment-room cubicles. All terminations and cable cores are identified using the applicable Employer KKS coding and labelling requirements.

d) The Contractor updates the relevant cable schedules, termination schedules, loop diagrams, instrument hook-up diagrams, junction-box drawings, cubicle drawings, I/O allocation schedules and DCS configuration records to reflect the final connections.

e) All field-to-DCS connections are subjected to continuity testing, insulation testing where applicable, point-to-point checks, loop checks, signal simulation and functional testing. Test results are included in the final handover data book.

3.2.7 Field Instrumentation, Cabling and Infrastructure Requirements

3.2.7.1 The Contractor provides for power cabling required as part of the Works in compliance with SANS 10142-1 and Eskom Standard 240-56227443 (Requirements for Control and Power Cables for Power Stations).

3.2.7.2 The Contractor provides all cable racking, conduits, and trenching required to complete the Works in accordance with SANS 60529 and Eskom Standard 240-56227443.

3.2.7.3 The Contractor makes use of existing cable racking where reasonably practical.

3.2.7.4 The Contractor designs and implements the wiring routes from the analyzers to the designated C&I junction boxes.

3.2.7.5 The Contractor terminates the 4-20mA signal cables at both the analyzer converter end and the junction box end, ensuring proper connections.

3.2.7.6 The Contractor integrates the 4-20mA signals from the junction boxes into the marshalling rack system.

3.2.7.7 The Contractor also terminates these 4-20mA signals at the marshalling cabinet end. The Contractor provides detailed documentation, including wiring diagrams and configuration details, for future maintenance and troubleshooting purposes.

3.2.7.8 The Contractor is responsible for the design, supply, installation, termination, labelling, testing, and commissioning of all system signal and communication cabling.

3.2.7.9 The Contractor ensures that all cables are concealed and routed through suitable conduit, trunking, or cable trays.

3.2.7.10 The Contractor designs cable routing to separate control and instrumentation cables from power cables, considering electromagnetic interference and common mode failure risks in accordance with IEC 61000-5-2 (Electromagnetic compatibility – Earthing and cabling) and IEC 61326 (EMC requirements).

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3.2.7.11 The Contractor ensures that the colour coding of all new cabling and wiring is consistent with the existing installed instrumentation colour coding.

3.2.7.12 The Contractor ensures that all cabling, cable racking, and conduits comply with Eskom Standard 240-56227443 and all relevant SANS standards.

3.2.7.13 The Contractor provides all instrumentation hook-up diagrams in accordance with Eskom Standard 240-105730768 (Instrumentation Hook-up Diagrams Standard).

3.2.7.14 The Contractor provides Cable Schedules in accordance with Eskom Template 240-56176097.

3.2.7.15 The Contractor shall submit detailed Calibration System Design documentation as part of the detailed design package, including:

a) Calibration Methodology – describing the proposed (semi-)automatic calibration procedure, including calibration gas selection, calibration intervals, and acceptance criteria;

b) Filter/Regulator Sizing – demonstrating that the instrument air supply is adequately filtered and regulated for the analyzer's requirements;

c) Purge Flow Assurance – confirming that the purge air system maintains adequate flow to protect the probe optics or sensor;

d) Calibration Unit Specification – detailing the proposed calibration unit (e.g., solenoid valves, flow controller) and its integration into the system. The calibration system design shall be subject to design freeze prior to procurement.

3.2.8 Instrument Hook Up Requirements

3.2.8.1 The Contractor shall design, manufacture, and install a protective sleeve adapter flange (probe pocket) to connect the probe assembly to the existing economizer test port. The adapter flange shall:

a) Ensure a secure, leak-tight installation;

b) Be manufactured from suitable high-temperature material (e.g., SUS316 or better);

c) Comply with welding standard SANS ISO 3834.

3.2.8.2 The Contractor shall submit for approval as part of the detailed design package:

a) Probe Pocket Adapter Design Drawings – detailed design drawings showing dimensions, materials, tolerances, and installation method;

b) Material Specifications – confirming suitability for the high-temperature, corrosive flue gas environment;

c) Weld Procedure Specification (WPS) – demonstrating compliance with SANS ISO 3834;

d) Instrument Hook-up Diagrams – defining the interface between the mechanical installation (process connection) and the C&I installation (probe assembly), including all fittings, tubing, and mounting requirements in accordance with the Instrumentation Hook-up Diagrams standard (240-105730768). These design deliverables shall be subject to design freeze prior to fabrication and installation.

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3.2.9 Interface with the ABB DCS

3.2.9.1 The Contractor, through the DCS OEM contracted directly by the Contractor, is responsible for the full integration of the system into the existing ABB P14 DCS. This includes all configuration, functional testing, commissioning, documentation, and handover activities related to ABB DCS integration.

3.2.9.2 The Contractor shall submit a DCS Integration Detailed Design Package for review and acceptance by the Employer prior to any configuration work on the ABB P14 DCS. The package shall include:

a) Interface Drawings – detailed drawings showing all connections between the analyzer system and the ABB P14 DCS;

b) Point List – complete list of all signals (tag names, signal types, scaling, engineering units) to be integrated;

c) HMI Faceplate Designs – detailed designs showing how the humidity measurements, alarms, and system status will be displayed to operators;

d) Configuration Methodology – describing how the DCS will be configured, tested, and commissioned, including backup and restoration procedures;

e) Alarm Philosophy– defining alarm thresholds, priorities, and responses. The DCS integration design shall be subject to design freeze prior to any configuration work on the live DCS.

3.2.9.3 The Contractor shall submit documentation describing the ABB DCS execution and support arrangement, including:

a) Confirmation of whether ABB will participate as the main contractor, consortium member, subcontractor or technical-support provider;

b) A signed project-specific agreement, Letter of Intent, valid ABB channel-partner letter or other verifiable evidence of ABB support;

c) Description of ABB's proposed scope and responsibilities;

d) Proposed ABB resources, competencies and relevant experience;

e) Responsibility matrix between the Contractor, ABB and Eskom;

f) DCS engineering and configuration arrangements;

g) Software, licensing and engineering-tool arrangements;

h) Testing and commissioning responsibilities;

i) Technical escalation and defect-resolution arrangements;

j) Post-commissioning support arrangements.

3.2.10 OEM Restriction and Engagement

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3.2.10.1 The Contractor ensures not to perform any DCS configuration or logic modifications on the ABB P14 DCS unless they are the Original Equipment Manufacturer (ABB) or a formally recognised ABB-authorised sales channel partner.

3.2.10.2 If the Contractor is not the DCS OEM or a formally authorised OEM channel partner, it remains the Contractor's sole responsibility to initiate, manage, and maintain a formal engagement with the OEM to carry out all ABB DCS-related configuration and integration activities required under this contract.

3.2.10.3 The Contractor is responsible for the full management, coordination, and funding of this engagement as part of the Works.

3.2.11 Responsibility and Accountability

3.2.11.1 The Contractor remains fully accountable for the successful completion and performance of all Works defined in this section, regardless of whether ABB performs the DCS tasks.

3.2.11.2 The Contractor ensures that all DCS configuration work is carried out in accordance with the DCS OEM's engineering and configuration standards, as well as Employer's plant-specific DCS integration and security requirements.

3.2.12 Configuration of Signals in the ABB DCS

3.2.12.1 The DCS OEM or channel partner carries out the configuration of analyzer signals in the ABB P14 DCS, including:
a) Configuration of 4-20 mA and HART signals.
b) Development and implementation of alarm logic and thresholds.
c) Development of ABB HMI graphics, including mimic diagrams and faceplates.
d) Update of the DCS signal database and application of KKS tag structure.
e) Integration of data into the ABB historian.
f) Backup and restoration of modified ABB DCS configurations.

3.2.13 Simulation and Loop Checking

3.2.13.1 The DCS OEM performs simulation and loop checking of all analyzer signals, including:
a) Verification of correct signal scaling and accurate display on the ABB HMI.
b) Testing of alarm conditions and diagnostic outputs.
c) Confirmation that all signal data is correctly recorded in the ABB historian.

3.2.14 Electrical Power Supply Requirements

3.2.14.1 The Contractor provides and ensures that all permanent and temporary electrical installations forming part of the Works comply with the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) and with SANS 10142-1.

3.2.14.2 The Contractor obtains and submits a valid Certificate of Compliance (CoC) for each applicable installation forming part of the Works before commissioning or acceptance by the Project Manager.

3.2.14.3 The Contractor ensures the analyzers forming part of the Works are powered from a reliable power supply backed by a UPS in the event of AC power loss, in accordance with Eskom Standard 240-56176852 (Essential Power Supplies for Power Stations).

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3.2.14.4 The Contractor designs, supplies, installs, and commissions the 220V AC power supply from the existing UPS to the equipment provided as part of the Works.

3.2.14.5 The Contractor is fully responsible for the supply, installation, routing, and termination of all power cables forming part of the Works.

3.2.14.6 The Contractor tests the complete power distribution system to verify proper functionality and compliance with relevant electrical standards and regulations.

3.2.14.7 All power cables shall comply with Eskom Standard 240-56227443 and relevant SANS standards.

3.2.14.8 The Contractor shall provide Power Supply Distribution Design, Single Line Diagrams, Cable Sizing Calculations, and Protection Coordination Study for review and acceptance by the Project Manager.

3.2.15 Earthing Design Function Requirements

3.2.15.1 The Contractor provides a complete and coordinated earthing design for all electrical and instrumentation equipment forming part of the Works in accordance with Eskom Standard 240-56356396 (Earthing and Lightning Protection).

3.2.15.2 The Contractor ensures that all necessary functional earthing is provided to eliminate electromagnetic interference (EMI), reduce signal noise, and protect analog signals from transient voltages and ground loops, in accordance with IEC 61000-5-2.

3.2.15.3 The Contractor ensures that all earthing and surge protection measures are provided in accordance with:
a) Eskom Standard 240-56356396 (Earthing and Lightning Protection).
b) SANS/IEC 62305 (Protection against lightning).
c) SANS/IEC 61000-5-2 (Electromagnetic compatibility - Earthing and cabling).
d) SANS 10142-1.

3.2.15.4 The Contractor tests and documents the earth impedance/resistance at all relevant connection points.

3.2.16 Environmental Requirements

3.2.16.1 The Contractor is responsible for selecting and supplying all equipment and materials necessary for the execution of the Works. All such items shall be suitable for the environmental conditions specific to their installed location.

3.2.16.2 The Contractor ensures that all equipment is rated to operate reliably within the expected environmental conditions at the point of installation, including but not limited to temperature, humidity, vibration, and airborne contaminants.

3.2.16.3 The Contractor carries out all installation, commissioning, and related Works activities in accordance with Employer's SHEQ requirements. All Works comply with the Occupational Health and Safety Act (Act No. 85 of 1993) and the Construction Regulations.

3.2.16.4 The Contractor ensures that all field-mounted equipment meets a minimum ingress protection rating of IP65 or higher for the converter enclosure, as specified in SANS 60529.

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3.2.17 Maintenance Philosophy

3.2.17.1 The Contractor is responsible for developing and submitting a comprehensive Maintenance Philosophy and Preventative Maintenance Plan for the Additional Boiler Tube Leak Detection System and all associated instrumentation, power, and communication components forming part of the Works.

3.2.17.2 The Preventative Maintenance Plan aligns with manufacturer recommendations and site-specific operating conditions and must be submitted to the Project Manager for review and acceptance before handover.

3.2.17.3 The Contractor compiles and submits a detailed Critical Spares List for all components provided under the Works.

3.2.17.4 The Contractor provides relevant training to the maintenance and engineering team to ensure that all periodic maintenance inspections are carried out effectively.

3.2.18 Acceptance Testing

3.2.18.1 The Contractor is responsible for developing test procedures to demonstrate the integrity of the system in accordance with IEC 62381 (Automation Systems in the Process Industry - FAT, SAT, and SIT).

3.2.18.2 These procedures are submitted to the Employer for written approval.

3.2.18.3 The test procedures shall include simulation tests and shall be witnessed by the Employer.

3.2.18.4 The Contractor ensures that technical personnel from the Employer are available during installation tests to correct any discrepancies immediately.

3.2.19 Spare Parts

3.2.19.1 The Contractor provides spare parts in accordance with the recommended spares list.

3.2.19.2 The Contractor provides a listing of recommended spare parts.

3.2.19.3 The Contractor ensures that attention is given to equipment with a high rate of failure as well as equipment with long delivery times.

3.2.20 Training

3.2.20.1 The Contractor provides training on the equipment and systems included as part of the Works to the various categories of the Employer's technical staff for the duration of the Works.

3.2.20.2 Training provided by the Contractor is directly applicable to the actual equipment supplied for the Works. All training will consist of both theoretical and practical training.

3.2.20.3 The Contractor ensures that two levels of training are completed. The basic course shall be orientated towards maintenance personnel and shall give a full understanding of the system operation, fault-finding, and basic system changes.

3.2.20.4 The Contractor ensures that the advanced level course is orientated toward engineering personnel for all system changes.

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3.2.21 Limits of Supply and Services

3.2.21.1 The Contractor provides System Engineering Works on the ABB P14 DCS control system. The Contractor liaises with ABB for the Works or shall be an ABB sales channel partner. No one else, other than the above stated, will be authorised to work on the ABB DCS system.

3.2.21.2 The supply and installation of the Additional Boiler Tube Leak Detection System is fully covered by the Contractor's scope of work.

3.2.21.3 The commissioning of the project shall be fully covered by the Contractor's scope of work.

3.2.22 Performance Requirements

3.2.22.1 The Contractor's design for the Works complies with the Employer's performance specifications and standards.

3.2.22.2 The system must detect water leaks with a sensitivity sufficient to identify leaks before they escalate, with a leak rate of less than 60 kg/s.

3.2.22.3 The system design shall comply with the EPRI Boiler Tube Failure Program Best Practices – 1023087, as compiled by the Electric Power Research Institute (EPRI).

3.2.23 Procedure for Submission and Acceptance of Contractor's Design

3.2.23.1 The Contractor establishes a document tracking system to record the dates for the supply and receipt of all design drawings, calculations, and design documentation.

3.2.23.2 The Contractor supplies the documentation listed below as the minimum requirements of this specification in the design package before any manufacturing, construction or commissioning commences.

3.2.23.3 The Contractor ensures the Vendor Document Submittal Schedule (VDSS) indicating when all documents are submitted, containing the following:
a) Drawing Register.
b) Complete detailed design file.
c) Functional Specifications.
d) Component material datasheets.
e) Quality Control Procedures.
f) Quality Control Plan and Inspection and Test Plan.
g) Method Statements.
h) Commissioning procedures.
i) Technical, Operation and Maintenance Manuals of all plant equipment.
j) Operating Philosophies as per the Contractor's detailed design.
k) Maintenance Philosophy.
l) Instrument/Signal schedule.
m) Instrument Hook-up Diagrams in accordance with Eskom Standard 240-105730768.
n) Power Supply Distribution Design, Single Line Diagrams, Cable Sizing Calculations, and Protection Coordination Study.
o) Electrical termination schedules.
p) Critical Spares List.
q) Operating, Maintenance and Engineering Training Manuals.
r) Compliance Matrix – demonstrating alignment with all sections of this Works Information.

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3.2.23.4 The Contractor seeks acceptance of the detailed designs from the Project Manager. Only drawings and designs accepted by the Employer shall be used for construction.

3.2.24 Testing and Commissioning

3.2.24.1 The Contractor ensures the following:

a) Testing and commissioning shall be in accordance with IEC 62381.
b) The services of skilled personnel to supervise the testing and commissioning.
c) All management, supervision, labour, tools, instruments, test apparatus, calibration equipment and any other equipment and facilities as may be necessary.
d) The Contractor's preliminary trials and commissioning of the Works shall be carried out by the Contractor's representatives.
e) The Contractor supplies all data books with signed ITPs and as-built drawings of the Works.
f) Commissioning of the system shall be done by the Contractor's staff with the Employer's dedicated operations/commissioning staff.
g) The Contractor submits a commissioning schedule and programme for acceptance to the Employer.
h) Before the system is placed in service, the Contractor certifies that it is in a suitable and safe condition.
i) The Contractor provides a detailed Commissioning Test Procedure (CTP) for review and acceptance by the Project Manager prior to commissioning.
j) The Contractor ensures that commissioning of the ABB DCS is carried out fully by an ABB sales channel partner or ABB.

3.2.24.2 The Contractor shall submit detailed Testing and Commissioning Procedures as part of the detailed design package, including:

a) SIT/SAT philosophy and methodology;

b) Detailed test stages and sequences;

c) Indicative test sheets with pass/fail criteria;

d) Acceptance criteria for all tests;

e) DCS point-to-point and functional verification approach;

f) Defect-management and retesting process. The testing and commissioning procedures shall be subject to design freeze prior to commencement of testing activities.

3.2.24.3 The Contractor shall submit a detailed Calibration and Documentation Traceability Plan as part of the detailed design package, including:

a) Calibration methodology with traceability to national/international standards;

b) Certification and compliance approach;

c) Data book structure and handover process. The plan shall be subject to design freeze prior to procurement and installation.

3.2.25 Plant and Material Requirements

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3.2.25.1 The Contractor prepares and submits a project Inspection and Test Plan (ITP) for all plant and materials included in the scope.

3.2.25.2 The Contractor shall use only ISO 9001 accredited suppliers for products, as required by ISO 9001.

3.2.25.3 The Contractor shall submit a project-specific Quality Control Plan (QCP) and Inspection Test Plan (ITP) framework as part of the detailed design package, including:

a) Defined hold (H), witness (W), and review (R) points for fabrication, installation, and testing activities;

b) Document-review and non-conformance processes;

c) List of quality documentation to be included in the final data book. The QCP and ITP shall be subject to design freeze and acceptance by the Project Manager prior to commencement of any fabrication or installation activities.

3.2.26 As-built Drawings, Operating Manuals and Maintenance Schedules

3.2.26.1 All as-built drawings shall be available to the Employer as soon as the plant is ready for commissioning. All drawings and reports compiled for the Works are to become the property of the Employer on completion of the Works.

3.2.26.2 The Contractor ensures the following:
a) Makes use of a system compatible with the Employer's Microstation (Version 8i) CAD for all drawings supplied to the Employer, in accordance with Eskom Standard 240-86973501 (Engineering Drawing Standard - Common Requirements).
b) Implements and maintains an updated drawing register.
c) Submits four prints of all "as built" drawings with approval signatures at completion by the ECSA registered professional engineer accountable for the design, backed up on the electronic medium.

3.2.27 Technical, Operating and Maintenance Manuals

3.2.27.1 The Contractor provides good quality operating and maintenance manuals prepared by suitably experienced personnel.

3.2.27.2 The maintenance manuals state explicitly the maintenance requirements for each piece of equipment.

3.2.27.3 Manuals are in English and each manual is complete with the Power Station's name, contract number and index.

3.2.27.4 The technical manuals include fully detailed descriptions, as-built drawings, diagrams, illustrations, schedules, and data for use by Employer's technical staff.

3.2.28 Plant and Materials

3.2.28.1 Quality:
a) The Employer places emphasis on the provision of a comprehensive Quality Management System (QMS) for all phases of the project in accordance with ISO 9001.
b) The Contractor and all of the Contractor's suppliers holds a valid certificate of compliance for their QMS to the requirements of ISO 9001.

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3.2.29 Construction requirements

3.2.29.1 The Contractor carries out the works in accordance with the Occupational Health and Safety Act (85/1993): Construction Regulations, the South African Environment Protection Act, the waste management code of practice and the regulations promulgated thereunder and Eskom Safety, Health, Environment and Quality (SHEQ) Policy 32-727 for all works.

3.2.29.2 The Contractor provides all labour, installation tackle, gear and tools, vehicles, rigging tackle, temporary works including any earthworks required, craneage and foundations for such, consumables, site workshops, site offices, stores, facilities, equipment and cleaning materials required to Provide the Works.

3.2.29.3 The Contractor is responsible for the supply/procurement of Plant and Material, fabrication/manufacturing, shop detailing, painting/galvanising, handling, shipping, storage, testing, delivery, off-loading, erection/construction, disposal of debris, final painting and finishing complete in every detail of this project.

3.2.29.4 The Contractor is responsible to construct any works that can reasonably be inferred from this Technical Specification and the Employer's drawings.

3.2.29.5 The Contractor provides all the test equipment for testing, the sub-assemblies and the functional groups for site testing, commissioning, and performance testing.3.3.3.6 The Contractor provides all necessary temporary works required to complete the works. This includes scaffolding, suspended platforms, rope access work, material hoists, cranes, services etc.

3.2.29.6 During the erection period, the Contractor, before taking occupation on a site, obtains a permit to work from the Project Manager. Before a part of the site is released for access to others, the said part conforms to the safety requirements of OHS Act. The party taking access then becomes the 'User' in terms of the OHS Act. The releasing of a part of the Site in the above-described manner does not relieve the 'Contractor Giving Access' of any of his obligations in terms of his contract with the Employer. No unauthorised person(s) enters any prohibited/restricted area.

3.2.29.7 Daily diaries/logs/data books are kept and signed by the Contractor and are also signed off daily by the Supervisor. The following is to be recorded (as a minimum) in the daily diaries:
a) Manpower and Equipment used;
b) Description of any unique occurrences, incidents or accidents;
c) Delays and reasons for the delays;
d) Industrial relations abnormalities;
e) Interface and access problems;
f) Description of activities to be performed.

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3.2.29.8 In addition, the Contractor adheres to the following:
a) The Contractor is restricted to the Site;
b) The Contractor is not to enter any other areas and ensures that his employees abide by the regulations;
c) The Contractor performs all hoisting and lifting by qualified riggers;
d) The Contractor's Equipment does not impair the operation or access to the plant;
e) The Contractor provides any temporary or expendable materials required for the storage of material;
f) The Contractor safeguards and secures all items whilst in the Contractor's custody and control, until completion of the works;
g) The adjacent plant and equipment are not modified without written permission from the Project Manager. Modification in this sense includes, but is not limited to: welding onto existing plant, drilling into structural steel, cutting or removing, and loading adjacent structures.

3.2.29.9 All items that are assembled and constructed off site are listed and provided to the Project Manager. From this an ITP is developed between the Project Manager and the Contractor to determine the intervention points.

3.2.29.10 The Contractor has previous relevant experience with regards to the construction of the works. The Contractor submits the previous work experience of his Construction Manager. The Contractor submits a company profile which includes:
a) A list of traceable references that adequately proves that the Contractor (or their Sub-Contractor) has the relevant experience with regard to the mechanical aspects of the Works;
b) Organogram.

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3.2.30 Work method statement

3.2.30.1 The Contractor provides a detailed work Method Statement for each activity of his work, together with activity durations. In addition to a description of the method of constructing the works, the Contractor, in his work Method Statement, includes the following as a minimum:
a) The scope of the Method Statement;
b) A comprehensive description of the activity;
c) Construction methodology and sequence of construction taking into consideration access restrictions and safety requirements;
d) How the Contractor has taken into account the constraints for constructing the works;
e) A clear description of the responsibilities of the Contractor's personnel involved in the activity, including (where applicable) his Project Manager, Site Quality Manager, Site Engineer, Health and Safety Manager, Technical Office Manager, Production Manager, Supervisor, Environmental Officer and other personnel required for the activity work;
f) Reference to applicable statutory requirements and how the requirements have been taken into account;
g) Health, safety, and quality control for the activity;
h) All plant, equipment and machinery required to complete activity;
i) Quality control points as accepted by the Project Manager;
j) Laydown areas requirements;
k) Temporary works to be used including Project Manager's acceptance where such is supported off existing structures;
l) Rigging studies and design calculations where applicable;
m) Manufacturer's literature/Technical Data Sheets for all materials used including product description, composition, material and performance properties, installation, and application procedures, use limitations and recommendations;
n) Plan for confining, collecting, and disposing of waste materials as a result of removal operations, where applicable;
o) Works required to safeguard existing infrastructure and services;
p) Risk assessments associated with shutdown of plant/equipment were deemed necessary, in order to execute the works.

3.2.30.2 All work Method Statements include the name and qualification of the personnel working in the specified activity in conjunction with the requirements as set out in Supplier Quality Management Specification (240-105658000). All Method Statements are reviewed and accepted by Project Manager prior to starting any work.

3.2.30.3 The Contractor shall submit a Detailed Project Schedule as a tender returnable and maintain it throughout the project. The schedule shall be in Gantt chart format and include:

a) Key Milestones – design approval, design freeze, procurement, FAT, delivery, installation, commissioning, handover;

b) Critical Path – clearly identified;

c) Outage Windows – alignment with opportunistic boiler outages (~1 week) and/or cold reserve opportunities;

d) Long-Lead Item Procurement Timelines – procurement, manufacturing, and delivery dates for critical components (e.g., analyzer probes, custom adapter flanges, calibration units);

e) Resource Loading and Levelling – showing the number of personnel required for each phase;

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f) Dependencies – between activities, clearly identified.

3.2.31 Installation timeline

3.2.31.1 The Contractor's methodology and program must accommodate a phased installation approach. Cable pulling and installation of converter units can proceed during normal operation. However, the final installation of detector probes and their adapters into the flue gas duct may be scheduled and executed during opportunistic boiler outages, which typically have a minimum duration of one (1) week. The Contractor must demonstrate how they will plan and mobilize to efficiently complete the critical path duct-penetration work within this outage window.

3.2.32 General Construction Work Method Statement / Construction Execution Plan

3.2.32.1 As a tender returnable, the Contractor submits a Concept Construction Work Method Statement taking into consideration the various phases of the project. This high-level Method Statement clearly illustrates how the Contractor accounts for the risks of this project, demonstrates an understanding of the project constraints, and outlines the proposed construction methodology. This Method Statement is tailored to address the specified project objectives and requirements and adequately deals with the critical characteristics of the project.

3.2.32.2 The Concept Construction Work Method Statement (tender returnable) includes, at minimum, the following:
a) Constraints identified and considered by the Contractor;
b) Interfacing with Others – the Contractor illustrates an understanding of the work that is to be completed by Others and accommodates for the completion of such work in his methodology;
c) Description and illustrations of a construction traffic plan, use of laydown areas and plot plan;
d) Shifts and hand overs for the various sections of the works – this information is to enable the Employer to integrate the programmes of the various contractors;
e) Design tools and systems that the Contractor plans to use;
f) High-level risk assessment which lists risks specific to the works and is accompanied with associated proposed mitigations;
g) High-level inspection and quality control plan;
h) A clear description of the responsibilities of the Contractor's personnel involved with the works, including (where applicable) his Project Manager, Site Quality Manager, Site Engineer, Health and Safety Manager, Technical Office Manager, Production Manager, Supervisor, Environmental Officer, Fabricator, Transporter and other personnel required for the works;
i) Construction sequencing considerations which take into account the constraints as indicated in this Works Information;
j) An investigation into the possibility of carrying out work prior to the outage or post outage, if applicable. This investigation clearly defines all activities which can be carried out prior to outage (if any) and is reflected accordingly in the Construction Programme.

3.2.32.3 Following Contract Award, the Contractor shall develop and submit a Detailed Design Document and a Detailed Construction Work Method Statement / Construction Execution Plan to the Project Manager for review and acceptance. These documents shall be submitted at least one (1) month prior to commencing with any construction activities and shall be developed in accordance with the accepted Concept Construction Work Method Statement submitted at tender stage, incorporating any clarifications, negotiations, or changes agreed during contract award.

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3.2.33 Detailed Design Document

3.2.33.1 The Contractor shall submit a Detailed Design Document as a post-contract award deliverable for review and acceptance by the Project Manager. The Detailed Design Document shall be subject to a design freeze as per the Eskom Project Life-Cycle Model (PLCM) process and Design Review Procedure (240-53113685), and shall not proceed to procurement or construction until formal design freeze approval is obtained from the Project Manager.

3.2.33.2 The Detailed Design Document shall include, as a minimum, the following:

a) System Architecture & Detailed Design Report

- Complete system design philosophy and operational concept;
- Detailed block diagrams and schematics showing all major components (probes, converters, junction boxes, cabling, power supplies, DCS interface) and their interconnections;
- Signal flow diagrams and communication protocol details;
- Detailed descriptions of control strategy, alarm handling, HMI display philosophy, and integration with the existing ABB P14 DCS.

b) Detailed Mechanical Design

- Probe/Sensor design for harsh environment, including detailed material specifications (e.g., SUS316 or better), wear/dust protection design, and thermal design verification for 380°C flue gas and high-dust conditions;
- Probe pocket adapter flange design, including detailed design drawings, material specifications, weld procedure specification (WPS) aligned with SANS ISO 3834, and leak-proof sealing method;
- Instrument Hook-up Diagrams defining the interface between the mechanical installation (process connection) and the C&I installation (probe assembly), including all fittings, tubing, and mounting requirements in accordance with Instrumentation Hook-up Diagrams standard (240-105730768).

c) Detailed C&I Design

- Calibration system design, including filter/regulator sizing, purge flow assurance, and (semi-)automatic calibration methodology;
- Instrumentation list, instrument loop diagrams, cable block diagrams, and termination schedules;
- Field engineering drawings including instrument location drawings, junction box location drawings, panel location drawings and cable routing;
- Layout/general assembly drawings.

d) Detailed Electrical Design

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- Power supply distribution design from the UPS in the equipment room to the probe/converter, including cable sizing, protection, and distribution;
- Single line diagrams;
- Cable sizing calculations and protection coordination study;
- UPS capacity verification;
- Earthing design in accordance with Eskom Standard 240-56356396 (Earthing and Lightning Protection).

e) DCS Integration Design Package

- Interface drawings showing all connections between the analyzer system and the ABB P14 DCS;
- Comprehensive point list with all signals (tag names, signal types, scaling, engineering units);
- HMI faceplate designs showing humidity measurements, alarms, and system status displays;
- DCS configuration methodology, including backup and restoration procedures;
- Alarm philosophy defining alarm thresholds, priorities, and responses.

f) Compliance Matrix

- Detailed matrix demonstrating alignment with all sections of this Scope of Work, including Eskom standards and specifications referenced throughout.

3.2.33.3 The Detailed Design Document shall be prepared in accordance with the following Eskom standards and procedures:
a) Engineering Drawing Standard - Common Requirements (240-86973501);
b) KKS Coding Standard (240-93576498);
c) Design Review Procedure (240-53113685);
d) Engineering Change Management Procedure (240-53114002);
e) Project Engineering Change Management Procedure (240-53114026).

3.2.33.4 The Detailed Design Document shall be submitted to the Project Manager for review and acceptance. The design shall undergo formal Design Freeze Review in accordance with the Eskom Design Review Procedure (240-53113685). No procurement, fabrication, or construction activities shall commence until formal design freeze approval is obtained from the Project Manager.

3.2.33.5 The Detailed Design Document shall be signed off by an ECSA Professionally registered Technologist and/or Engineer who takes full professional accountability for the designs, in accordance with the Engineering Profession Act, 2000 (Act 46 of 2000).

3.2.33.6 The Detailed Design Document shall be submitted in electronic format, i.e., drawings in CAD format (Microstation *.dgn or AutoCAD *.dwg) and calculations, specifications, etc. in Microsoft Office, Microsoft Excel or .pdf format. Drawings are to be done on Eskom drawing sheets, which will be provided.

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3.2.34 Detailed Construction Work Method Statement / Construction Execution Plan

3.2.34.1 Following Contract Award, the Contractor shall develop and submit a Detailed Construction Work Method Statement / Construction Execution Plan to the Project Manager for review and acceptance. This detailed plan shall be submitted at least one (1) month prior to commencing with any construction activities and shall be developed in accordance with the accepted Concept Construction Work Method Statement submitted at tender stage, incorporating any clarifications, negotiations, or changes agreed during contract award.

3.2.34.2 The Detailed Construction Work Method Statement / Construction Execution Plan shall include, as a minimum:
a) All elements listed in the tender returnable (3.3.6.2) but developed to a detailed level with specific site information verified through site walkdowns and surveys;
b) Detailed sequential erection procedure which clearly shows detailed consideration for stability requirements of the structure (if applicable) at all stages during erection;
c) Detailed constructability analysis which includes:

- An analysis of the access to Site;
- An analysis of the crane usage requirements, crane locations and possible congestion to traffic;
- An analysis of the excavations and construction activities required by Others and associated possible impacts on the delivery of the works;

d) Detailed installation methodology for each critical activity, including probe installation, duct penetration, and adapter flange fabrication and installation;
e) Detailed resource plan – comprehensive resource allocation including labour, equipment, materials, and subcontractors for each phase of the Works;
f) Detailed risk assessment – a comprehensive risk register addressing project-specific technical and execution risks with actionable, assigned mitigations and contingency plans;
g) Detailed quality control plan – project-specific QCP and Inspection Test Plan (ITP) with defined Hold, Witness, and Review points;
h) Detailed temporary works plan – identification and specification of all scaffolding, temporary power, access platforms, and other temporary works required for the 113ft elevation installation;
i) Detailed safety plan – comprehensive safety file and task-specific risk assessments for all high-risk activities (hot work, working at heights, confined spaces);
j) Interface management plan – detailed coordination procedures for all interfacing systems and contractors.

3.2.34.3 The Detailed Construction Work Method Statement / Construction Execution Plan shall be subject to design freeze and formal acceptance by the Project Manager prior to the commencement of any construction, fabrication, or installation activities on Site.

3.2.34.4 The Contractor shall demonstrate proven experience in the design, construction, commissioning, and maintenance of humidity analyzer systems and/or Tube Leak Detection (TLD) systems in coal-fired power plants or similar industrial environments. The Contractor shall submit, as part of the tender:

a) Completion Certificates or Signed Contracts or Task Orders for at least one (1) relevant project completed within the last 10 years;

b) Client Contact Details (name, designation, organization, phone/email) for verification;

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c) Project References – summarizing the scope, including analyzer technology type, maximum flue gas temperature, installation location, and successful integration with a plant DCS/SCADA.

3.2.34.5 The Contractor shall submit an OEM-endorsed Supply-Chain and Continuity Plan confirming:

a) The approved route through which Eskom will obtain spare parts and technical support;

b) Whether Eskom can procure directly from the OEM or through alternative authorised channels;

c) Alternative support arrangements if the appointed Contractor or local distributor becomes unavailable;

d) OEM technical escalation and step-in arrangements;

e) Locations of repair facilities and spare parts stock;

f) Typical lead times for critical spare parts;

g) Arrangements for identifying and approving alternative authorised suppliers;

h) Measures preventing Eskom from becoming permanently dependent on one local distributor;

i) Access to configuration files, passwords, licences, software and diagnostic tools if the appointed Contractor is no longer available.

3.2.34.6 The Contractor shall submit a Project Risk Register as a tender returnable and maintain it throughout the project. The risk register shall include:

a) Identified Risks – specific to the project (e.g., outage delays, integration issues, calibration failures, probe durability, access constraints);

b) Risk Ratings – likelihood, impact, and priority for each risk;

c) Mitigation Strategies – clear actions to reduce or eliminate each risk;

d) Responsible Person/Role – for each mitigation action;

e) Contingency Plans – for high-priority risks.

3.2.34.7 The following technical risks are considered acceptable:

a) Use of an ECSA-registered Professional Technologist instead of a Professional Engineer for the lead engineering role;

b) Proposal includes a technically sound, OEM-supported probe protector solution that differs slightly from the example given in the SOW but is certified for the application;

c) Proposal offers a probe with a maximum temperature capability exceeding 380°C but with slightly different material specifications, provided OEM certification is maintained.

3.2.34.8 The following technical risks are considered unacceptable:

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a) Proposal relies on unverified, non-OEM certified analyzer hardware/software without traceable OEM support;

b) Incomplete interface design that fails to address integration with the ABB P14 DCS;

c) Installation methodology that requires extended, unplanned unit outages beyond short opportunistic windows;

d) Failure to demonstrate that the proposed probe/sensor design is suitable for the harsh flue gas environment, including inadequate material selection, lack of wear/dust protection, or inability to withstand 380°C;

e) Lack of evidence for at least 10 years of OEM support for the proposed analyzer system.

3.2.35 Electrical Specifications

3.2.35.1 The Contractor shall provide a complete and coordinated electrical design for all equipment and systems forming part of the Works, including but not limited to power supply distribution, cabling, protection, earthing, and lightning protection.

3.2.35.2 Power Supply Requirements

3.2.35.2.1 The Contractor shall ensure that the analyzers forming part of the Works are powered from a reliable power supply backed by a UPS in the event of AC power loss, in accordance with Eskom Standard 240-56176852 (Essential Power Supplies for Power Stations).

3.2.35.2.2 The Contractor shall verify the operating parameters of the existing UPS for design purposes and design, supply, install, and commission the 220V AC power supply from the existing UPS to all equipment provided as part of the Works.

3.2.35.2.3 The Contractor shall provide and install all power supply cables, circuit breakers, distribution boards, and protective devices required to safely and reliably power all equipment forming part of the Works.

3.2.35.2.4 The Contractor shall provide a field distribution board equipped with circuit breakers, including:
a) Selecting and procuring a suitable field distribution board with an adequate number of circuit breakers;
b) Designing the cable routing and sizing the cables to efficiently transfer power from the 220V UPS DB to the field DB;
c) Terminating the cables at both ends;
d) Ensuring proper labelling and identification of the circuits to facilitate maintenance and troubleshooting;
e) Testing the complete power distribution system to verify proper functionality and compliance with relevant electrical standards and regulations.

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3.2.35.2.5 The Contractor shall submit the following power supply design deliverables for review and acceptance by the Project Manager:
a) Power Supply Distribution Design – describing the power connection from the UPS distribution board in the equipment room to the probes and converters, including cable sizing, protection, and distribution;
b) Single Line Diagrams – showing all power distribution circuits, protection devices, and interfaces with existing UPS and distribution boards;
c) Cable Sizing Calculations – demonstrating that all power cables are adequately sized for the load and distance;
d) Protection Coordination Study – demonstrating that all circuit breakers and protection devices are correctly sized and coordinated;
e) UPS Capacity Verification – confirming that the available UPS capacity is sufficient for the new load.

3.2.35.2.6 All power cables shall comply with Eskom Standard 240-56227443 (Requirements for Control and Power Cables for Power Stations) and relevant SANS standards.

3.2.35.3 Cabling, Termination, Routing and Racking

3.2.35.3.1 The Contractor shall provide all cabling, termination, routing, and racking for power and signal cables in compliance with SANS 10142-1 and Eskom Standard 240-56227443.

3.2.35.3.2 The Contractor shall provide durable cable numbering/labelling for all cables connected to the equipment, using labelling that facilitates easy maintenance.

3.2.35.3.3 The Contractor shall secure all cables installed with suitable cable glands, straps, or clamps on racks and control cubicles.

3.2.35.4 The Contractor shall submit cable schedules for all cables, inclusive of origin, target, type, size, and termination details, using Eskom Template 240-56176097.

3.2.35.5 The Contractor shall ensure that all cables are concealed and routed through suitable conduit, trunking, or cable trays.

3.2.35.6 The Contractor shall design cable routing to separate control and instrumentation cables from power cables, considering electromagnetic interference and common mode failure risks in accordance with IEC 61000-5-2 and IEC 61326.

3.2.35.7 The Contractor shall make use of existing cable routes and cable racks where reasonably practical. If not feasible, the Contractor shall provide and install new racks.

3.2.35.8 The Contractor shall ensure that all disturbed fire seals are repaired or replaced in accordance with Site fire protection standards.

3.2.35.9 Earthing, Lightning and Electrical Protection

3.2.35.9.1 The Contractor shall provide a complete and coordinated earthing design for all electrical and instrumentation equipment forming part of the Works in accordance with Eskom Standard 240-56356396 (Earthing and Lightning Protection).

3.2.35.9.2 The Contractor shall ensure that all necessary functional earthing is provided to eliminate electromagnetic interference (EMI), reduce signal noise, and protect analog signals from transient voltages and ground loops, in accordance with IEC 61000-5-2.

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3.2.35.9.3 The Contractor shall ensure that all earthing and surge protection measures are provided in accordance with:
a) Eskom Standard 240-56356396 (Earthing and Lightning Protection);
b) SANS/IEC 62305 (Protection against lightning);
c) SANS/IEC 61000-5-2 (Electromagnetic compatibility - Earthing and cabling);
d) SANS 10142-1.

3.2.35.9.4 The Contractor shall submit the proposed earthing concept, including drawings, calculations, and connection details, to the Project Manager for review and acceptance prior to installation.

3.2.35.9.5 The Contractor shall test and document the earth impedance/resistance at all relevant connection points and submit results to the Project Manager for acceptance.

3.2.35.10 Testing and Certification

3.2.35.10.1 The Contractor shall provide and ensure that all permanent and temporary electrical installations forming part of the Works comply with the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) and with SANS 10142-1.

3.2.35.10.2 The Contractor shall obtain and submit a valid Certificate of Compliance (CoC) for each applicable installation forming part of the Works before commissioning or acceptance by the Project Manager.

3.2.35.10.3 The Contractor shall test the complete power distribution system to verify proper functionality and compliance with relevant electrical standards and regulations.

3.2.36 Control And Instrumentation (C&I) Specifications

3.2.36.1 The Contractor shall design, supply, install, terminate, test, and commission the humidity analyzer system, which shall consist of a separate converter unit and a detector probe. The system must be capable of continuous, direct measurement of water vapor (in vol% H_2O) in high-temperature flue gases.

3.2.36.2 Analyzer System Performance Specifications

3.2.36.2.1 The Contractor shall verify that the analyzer system provides continuous, direct measurement of water vapor with the following performance specifications:
a) Measurement Range: 0 to 100 vol% H_2O;
b) Measurement Accuracy: ±1% vol H_2O or better at the expected process conditions;
c) Response Time: 90% response within 5 seconds of a gas change;
d) Self-Diagnostics: Comprehensive self-diagnostics for cell failure, temperature abnormalities, and system errors, with status available via contact outputs and the local display.

3.2.36.3 Detector Probe Specifications

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3.2.36.3.1 The Contractor shall ensure that the detector probe meets the following specifications:
a) Must withstand a maximum flue gas temperature of 380°C (320°C design + 60°C overfire margin). Higher temperature capability is acceptable and viewed favourably;
b) Must be constructed of materials (e.g., SUS 316 or better) resistant to flue gas composition containing H_2O, CO_2, SO_2, and fly ash;
c) Must include protection against fly ash erosion (e.g., a dedicated probe protector or built-in design robustness) as specified by the OEM for high-dust environments;
d) Probe length and insertion assembly shall be designed for the specific mounting geometry on the 113ft level;
e) The depth of the analyzer from the inside of the ducting shall not exceed 3 m.

3.2.36.4 Converter Unit Specifications

3.2.36.4.1 The Contractor shall ensure that the converter unit meets the following specifications:
a) Shall feature an LCD touchscreen for local operation, display of measured values, and system configuration;
b) Shall provide dual, isolated 4-20 mA analog outputs with HART protocol for connection to the ABB P14 DCS;
c) Shall have a minimum of four (4) programmable contact outputs for alarms and system status;
d) Must have an IP65 rating for the converter enclosure in accordance with SANS 60529 (Degrees of protection provided by enclosures);
e) The system design must include the capability for automatic/semi-automatic calibration using instrument air as the span gas.

3.2.36.5 Calibration System Design

3.2.36.5.1 The Contractor shall submit detailed Calibration System Design documentation as part of the detailed design package, including:
a) Calibration Methodology – describing the proposed (semi-)automatic calibration procedure, including calibration gas selection, calibration intervals, and acceptance criteria;
b) Filter/Regulator Sizing – demonstrating that the instrument air supply is adequately filtered and regulated for the analyzer's requirements;
c) Purge Flow Assurance – confirming that the purge air system maintains adequate flow to protect the probe optics or sensor;
d) Calibration Unit Specification – detailing the proposed calibration unit (e.g., solenoid valves, flow controller) and its integration into the system.

3.2.36.5.2 The calibration system design shall be subject to design freeze prior to procurement.

3.2.36.6 Reference Air System

3.2.36.6.1 The humidity analyzer system requires a supply of clean, dry instrument air for its reference gas and for calibration (span gas). Instrument air piping is already available on all units.

3.2.36.6.2 The Contractor shall tap off as required for the Works and shall comply with the Specification for Low Pressure Pipeline standard 240-123801640.

3.2.36.6.3 The purge air must be tapped off from the instrument air supply and must be installed with a filter/regulator and water trap including by-pass with isolation valves.

3.2.36.6.4 The system design must ensure a constant supply of instrument air at the required pressure and flow rate as per the analyzer's specifications.

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3.2.36.7 Field Engineering and Instrumentation

3.2.36.7.1 The Contractor shall ensure all location of equipment allow for safe and easy access for maintenance and calibration.

3.2.36.7.2 The Contractor shall provide and ensure all converters are calibrated and comply with the process data sheet.

3.2.36.7.3 The Contractor shall include all instrument calibration sheets in the quality documentation package for the Works.

3.2.36.7.4 The Contractor shall utilise and comply with instrument hook-up diagrams for all field installations, including:
a) Instrument stands/supports;
b) Instrument Process Hook-up;
c) Analyzer Sample Loop Tubing;
d) Instrument Air Supply Tubing.

3.2.36.7.5 The Contractor shall provide Instrument Loop Diagrams.

3.2.36.7.6 The Contractor shall provide termination schedules.

3.2.36.7.7 The Contractor shall provide Location Drawings including Instrument Location Drawings, Junction Box Location Drawings, Panel Location Drawings, and Cable Routing.

3.2.36.7.8 The Contractor shall provide Layout / General Assembly Drawings including Converter/Panel Layouts, Marshalling/Termination Layouts, Junction Box Layouts, and I/O Card Allocation.

3.2.36.7.9 The Contractor shall provide all plant/equipment identification labels.

3.2.36.7.10 The Contractor shall provide a QCP for the Project with Hold and Witness points.

3.2.36.8 Instrument Hook-up Requirements

3.2.36.8.1 The Contractor shall provide all instrumentation hook-up diagrams in accordance with Eskom Standard 240-105730768 (Instrumentation Hook-up Diagrams Standard).

3.2.36.8.2 The Contractor shall supply, install, and terminate the interface cable from the detector probes to the analyzer converters (System cable +/- 15m).

3.2.36.8.3 The Contractor shall supply, install, and terminate the signal cables from the analyzer converters to the newly installed local junction boxes (UVG 8 +/-5m per Analyzer).

3.2.36.8.4 The Contractor shall supply and install enclosures where signal cables from the humidity analyzers are to be terminated. These junction boxes must have a canopy installed over them and an IP65 rating with double locks.

3.2.36.8.5 The Contractor shall design, test, and commission the functional logic and ensure the plant system functions as per the control and operating philosophy.

3.2.36.9 DCS Integration Requirements

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3.2.36.9.1 The Contractor, through the DCS OEM contracted directly by the Contractor, is responsible for the full integration of the system into the existing ABB P14 DCS.

3.2.36.9.2 The Contractor shall submit a DCS Integration Detailed Design Package for review and acceptance by the Employer prior to any configuration work on the ABB P14 DCS. The package shall include:
a) Interface Drawings – detailed drawings showing all connections between the analyzer system and the ABB P14 DCS;
b) Point List – complete list of all signals (tag names, signal types, scaling, engineering units) to be integrated;
c) HMI Faceplate Designs – detailed designs showing how the humidity measurements, alarms, and system status will be displayed to operators;
d) Configuration Methodology – describing how the DCS will be configured, tested, and commissioned, including backup and restoration procedures;
e) Alarm Philosophy – defining alarm thresholds, priorities, and responses.

3.2.36.9.3 The DCS integration design shall be subject to design freeze prior to any configuration work on the live DCS.

3.2.36.9.4 The Contractor shall ensure that all DCS configuration work is carried out in accordance with the DCS OEM's engineering and configuration standards, as well as Employer's plant-specific DCS integration and security requirements.

3.2.37 Mechanical Specifications

3.2.37.1 The Contractor develops the Employer's design into detailed design for all mechanical related works and creates drawings where necessary.

3.2.38 Probe and Sensor Mounting Requirements

3.2.38.1 The Contractor shall install humidity analyzers at locations on each economizer gas exit path as indicated on the installation drawings per unit.

3.2.38.2 The Contractor shall ensure that the detector probe is installed with appropriate wear protection (e.g., a probe protector) if the sample gas flow velocity is approximately 10 m/sec or more, or if a high concentration of dust is present. The material shall last for at least three years, which is Arnot's outage philosophy.

3.2.38.3 The installation shall ensure that the sensor at the tip of the detector is not subjected to mechanical shock, pressure stress, or direct water droplets.

3.2.38.4 The depth of the humidity analyzers from the inside of the ducting shall not exceed 3 m.

3.2.38.5 The Contractor shall ensure that the analyzer system is suitable for the following conditions:
a) Sample gas temperature: 0 to 380°C (minimum requirement);
b) Sample gas pressure: -5 to +20 kPa typical;
c) Flue gas composition: H_2O, CO_2, SO_2, and fly ash;
d) Ambient temperature at installation location: 50-60°C;
e) Installation height: approximately 113ft;
f) Access conditions: Moderate to Difficult.

3.2.39 Probe Pocket Adapter Flange Design

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3.2.39.1 The Contractor shall design, manufacture, and install a protective sleeve adapter flange (probe pocket) to connect the probe assembly to the existing economizer test port.

3.2.39.2 The adapter flange shall:
a) Ensure a secure, leak-tight installation;
b) Be manufactured from suitable high-temperature material (e.g., SUS316 or better);
c) Comply with welding standard SANS ISO 3834.

3.2.39.3 The Contractor shall submit for approval as part of the detailed design package:
a) Probe Pocket Adapter Design Drawings – detailed design drawings showing dimensions, materials, tolerances, and installation method;
b) Material Specifications – confirming suitability for the high-temperature, corrosive flue gas environment;
c) Weld Procedure Specification (WPS) – demonstrating compliance with SANS ISO 3834;
d) Instrument Hook-up Diagrams – defining the interface between the mechanical installation (process connection) and the C&I installation (probe assembly), including all fittings, tubing, and mounting requirements in accordance with the Instrumentation Hook-up Diagrams standard (240-105730768).

3.2.39.4 These design deliverables shall be subject to design freeze prior to fabrication and installation.

3.2.40 Welding Requirements

3.2.40.1 All welding installation shall comply with Eskom Standard 240-56241933 (Control of Welding during Construction, Repair and Maintenance Activities Standard).

3.2.40.2 The Contractor shall comply with SANS ISO 3834 (Quality requirements for welding) for all welding activities associated with the fabrication and installation of the probe pocket adapter flange and associated mechanical works.

3.2.40.3 The Contractor shall submit welding procedure specifications (WPS) and material certificates for approval.

3.2.41 Structural and Mounting Requirements

3.2.41.1 The installation must be designed for Moderate to Difficult access conditions. The construction methodology must account for the installation height (~113 ft) and ambient temperatures of 50-60°C.

3.2.41.2 If the new humidity analyzers require support of the weight, the Contractor shall supply drawings showing how this will be achieved. It is desirable to install a self-supporting probe.

3.2.41.3 The Contractor shall verify the precise locations, economizer sampling port levels, and quantities of all works areas and verify these with the Employer before execution of the works.

3.2.41.4 Mounting holes shall be supplied by the Employer as per the installation drawings. Drawing 0.41/2694 (Arrangement of economizer outlet casing) shall be consulted.

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3.3 CONFIGURATION AND DOCUMENTATION MANAGEMENT

3.3.1 Documentation Management

3.3.1.1 General Requirements:
a) The Contractor includes the Employer's document number in the title block.
b) The language of all documentation is in the English language.
c) The Contractor retains project design calculations and information for the entire life cycle of the plant.

3.3.1.2 Document Identification:
a) The Contractor is required to submit the Vendor Document Submission Schedule (VDSS) as per agreed dates with the Project Manager.
b) The VDSS is revisable, and changes shall be discussed and agreed upon by all parties.

3.3.1.3 Document Submission:
a) All project documents must be submitted to the delegated Project Manager with transmittal note according to Eskom Standard 240-76992014 (Technical Document and Record Management Work Instruction).
b) The Contractor is provided with the following standards which must be adhered to:

3.3.1.4 Project Handover Documentation Management Procedure (240-66920003).

3.3.1.5 Project Documentation Deliverable Requirement Specification (240-65459834).

3.3.1.6 Technical Documentation Classification and Designation Standard (240-54179170).

3.3.1.7 Drawings:
a) The creation, issuing and control of all Engineering Drawings will be in accordance with Eskom Standard 240-86973501 (Engineering Drawing Standards - Common Requirements).
b) An electronic copy of all drawings shall be issued to the Project Manager.

3.3.2 Configuration Management

3.3.2.1 Plant Coding Allocation:
a) Coding of the design shall be based on the KKS coding system in accordance with Eskom Standard 240-93576498.
b) The KKS coding system is to be applied during the design review stage(s) and cross referenced to all arrangement drawings, schematics, wiring diagrams, instructions and manuals.

3.3.2.2 Engineering Change Management:
a) All Design change management shall be performed in accordance with Eskom Standard 240-53114002 (Engineering Change Management Procedure).
b) Project Engineering Change Management shall be in accordance with Eskom Standard 240-53114026 (Project Engineering Change Management Procedure).

3.3.2.3 Design Review Documentation:
a) The Contractor conducts design reviews as per Eskom Standard 240-53113685 (Design Review Procedure).

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3.4 BILL OF QUANTITIES

3.4.1 The Contractor shall compile a comprehensive Bill of Quantities (BOQ) based on the approved Detailed Design Document.

3.4.2 The BOQ shall account for each aspect/component of the Works, including but not limited to:
a) All equipment, materials, and components;
b) Labour and installation services;
c) Temporary works;
d) Testing and commissioning activities;
e) Training and documentation;
f) All other deliverables required under this Contract.

3.4.3 The BOQ shall be submitted to the Project Manager and Engineer for review and acceptance following the approval of the Detailed Design Document and prior to the commencement of procurement or construction activities.

3.4.4 The BOQ shall be prepared in accordance with the applicable Eskom standards and shall include unit rates, quantities, and total costs for each item.

3.4.5 The Employer shall have fourteen (14) working days to review and provide comments on the BOQ. The Contractor shall address all comments and resubmit the revised BOQ for final acceptance.

3.4.6 No procurement, fabrication, or construction activities shall commence until the BOQ has been formally accepted by the Engineer and Project Manager.

3.5 DATA BOOK REQUIREMENTS

3.5.1 The Contractor shall compile, submit, and maintain a complete set of Data Books for all Works performed under this Contract. Data Books shall be submitted to the Supervisor for review and acceptance prior to project handover and shall form part of the final project deliverables.

3.5.2 Data Books shall be compiled in accordance with the following Eskom standards and procedures:
a) QM 169 – Contractor Data Book Specification;
b) Project Handover Documentation Management Procedure (240-66920003);
c) Project Documentation Deliverable Requirement Specification (240-65459834);
d) Technical Documentation Classification and Designation Standard (240-54179170).

3.5.3 The Contractor shall prepare and maintain a Master Document List (MDL) and Vendor Document Submission Schedule (VDSS) for all Data Book documentation, indicating the document number, title, revision, submission date, and review status. The MDL and VDSS shall be submitted to the Project Manager for acceptance at the commencement of the Works and updated regularly throughout the project.

3.5.4 Data Books shall be submitted in both hard copy and electronic format. Electronic copies shall be provided in PDF format on a suitable electronic medium (e.g., USB drive or CD/DVD) and shall be fully searchable with bookmarks for easy navigation.

3.5.5 Each Data Book shall include a Document Index listing all documents contained within the Data Book, with clear references to the applicable system, equipment, or component.

3.5.6 Data Books shall include, as a minimum, the following documentation (where applicable to the Works):

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a) General Documentation

1. Document List / Master Document Index;
2. Instruction for Work / Purchase Order;
3. Contract and Subcontract Documentation;
4. Vendor Document Submission Schedule (VDSS);
5. Project Handover Documentation Review Sheets.

b) Quality Control Documentation

6. Approved Inspection and Test Plans (ITPs);
7. Approved Quality Control Plans (QCPs);
8. Quality Control Procedures;
9. Non-conformance Reports (NCRs) and close-out records;
10. Concessions and Deviations;
11. Corrective and Preventive Action Reports;
12. Internal Release Notes;
13. Material Receipt and Inspection Records.

c) Engineering and Design Documentation

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14. Approved Design Drawings (including all revisions);

15. As-built Drawings (in accordance with Eskom Standard 240-86973501);

16. Fabrication Drawings;

17. Electrical Drawings and Schematics;

18. Instrument Loop Diagrams;

19. Cable Block Diagrams;

20. Cable Schedules (in accordance with Eskom Template 240-56176097);

21. Location Drawings (Instrument, Junction Box, Panel, Cable Routing);

22. Layout / General Assembly Drawings;

23. Instrument Hook-up Diagrams (in accordance with Eskom Standard 240-105730768);

24. Terminal Connection Diagrams;

25. Equipment Layout Drawings;

26. Structural Drawings and Mounting Details.

d) Technical Specifications and Data

27. Detailed Specifications;

28. Functional Specifications;

29. Component and Material Datasheets;

30. OEM Product Datasheets and Technical Manuals;

31. Equipment Nameplate Data;

32. Instrument Data Sheets;

33. Calibration System Design Documentation;

34. Power Supply Distribution Design;

35. Single Line Diagrams;

36. Cable Sizing Calculations;

37. Protection Coordination Study;

38. Earthing Design Documentation (in accordance with Eskom Standard 240-56356396).

e) Welding and Fabrication Documentation

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39. Weld Map;

40. Weld Matrix Sheet;

41. Weld Sequence;

42. Welding Procedure Specification (WPS);

43. Welding Consumables Certificates;

44. Welder Qualification Certificates;

45. Contractor's ISO 3834 Certificate;

46. NDT Contractor Approval (Eskom Approved);

47. Approved NDT Procedure;

48. NDT Technician Qualification Certificates;

49. NDT Reports / Results;

50. Material Certificates (including mill test certificates).

f) Installation and Construction Documentation

51. Method Statements;

52. Commissioning Procedures;

53. Installation Procedures and Checklists;

54. Rigging Studies and Lift Plans;

55. Temporary Works Design and Calculations;

56. Construction Programme and Schedules;

57. Progress Reports;

58. Site Inspection Reports;

59. Daily Diaries / Logs (manpower, equipment, activities, incidents);

60. Permit to Work Records.

g) Testing and Commissioning Documentation

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61. Factory Acceptance Test (FAT) Procedures and Reports;

62. Site Integration Test (SIT) Procedures and Reports;

63. Site Acceptance Test (SAT) Procedures and Reports;

64. Commissioning Test Procedures (CTP);

65. Commissioning Test Reports and Results;

66. Functional Test Sheets;

67. Calibration Certificates (traceable to national/international standards);

68. Certificate of Compliance (CoC) for Electrical Installations (SANS 10142-1);

69. Loop Check and Point-to-Point Verification Records.

h) Operation and Maintenance Documentation

70. Operating Philosophy;

71. Operating Manuals;

72. Maintenance Philosophy;

73. Preventive Maintenance Plan and Schedules;

74. Maintenance Manuals;

75. Troubleshooting and Fault-Finding Guide;

76. Safety Procedures and Instructions;

77. Critical Spares List (including part numbers, lead times, recommended quantities);

78. Recommended Spare Parts List;

79. Lubrication and Consumables Schedule.

i) Training Documentation

80. Training Programme and Curriculum;

81. Training Records and Attendance Registers;

82. Training Manuals and Course Materials;

83. Competency Assessment Records.

j) Handover and Close-out Documentation

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84. Completion Certificates;

85. Handover Documentation Review Sheets;

86. Final Acceptance Certificate;

87. Technical Queries and Engineering Responses;

88. Modifications and Change Records;

89. Concessions and Deviations;

90. Notifications and Correspondence with Project Manager/Employer;

91. Transport and Delivery Notifications.

3.5.7 The Contractor shall ensure that all Data Book documentation is approved and signed-off by the relevant parties (Contractor's Project Manager, Quality Manager, ECSA-registered Professional Engineer, and Employer's Supervisor) prior to inclusion in the final Data Books.

3.5.8 The Contractor shall submit draft Data Books for review and comment at least six (6) weeks prior to the scheduled project handover date. The Employer shall have four (4) weeks to review and provide comments. The Contractor shall address all comments and submit final Data Books at least one (2) week prior to handover.

3.5.9 Final Data Books shall be submitted in three (3) hard copies (bound and clearly labelled) and one (1) electronic copy (USB drive or CD/DVD with searchable PDFs).

3.5.10 Data Books shall be retained by the Contractor for the duration of the Defects Liability Period and shall be made available to the Employer upon request. At the end of the Defects Liability Period, all Data Books shall be handed over to the Employer.

3.5.11 All Data Book documentation shall be in the English language and shall use metric units of measurement.

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3.6 STANDARDS AND REFERENCE DOCUMENTS

The Contractor complies with the latest editions, including all amendments and revisions, of the following standards and reference documents. Where a conflict exists between these standards and the Employer's specifications, the Employer's specification takes precedence.

3.6.1 International Standards

Standard	Description
ISO 9001	Quality Management Systems
ISO 2859	Sampling procedures for inspection by attributes
ISO/IEC 82045	Document management
ISO 5167	Measurement of fluid flow by means of pressure differential devices
IEC 61511	Functional safety – Safety instrumented systems for the process industry sector
IEC 61207	Industrial-process control systems – Methods of evaluating the performance of transmitters
IEC 61010	Safety requirements for electrical equipment for measurement, control, and laboratory use
IEC 60079	Explosive atmospheres – Electrical equipment
IEC 81346	Industrial systems, installations and equipment – Structuring principles and reference designations
IEC 61326	Electrical equipment for measurement, control and laboratory use – EMC requirements
IEC 61000-5-2	Electromagnetic compatibility – Earthing and cabling
IEC 61207-1	Performance evaluation of gas analyzers and related instruments – Part 1: General
IEC 61207-2	Performance evaluation of gas analyzers – Part 2: Oxygen analyzers
IEC 61207-3	Performance evaluation of gas analyzers – Part 3: Paramagnetic oxygen analyzers
IEC 62381	Automation Systems in the Process Industry – FAT, SAT, and SIT
IEC 60529	Degrees of protection provided by enclosures (IP code)

3.6.2 South African National Standards (SANS)

Standard	Description
SANS 10142-1	The wiring of premises – Low-voltage installations
SANS 60529	Degrees of protection provided by enclosures (IP code)
SANS 1574	Performance and test requirements for bus systems
SANS 62305	Protection against lightning
SANS ISO 3834	Quality requirements for welding

3.6.3 Employer (Eskom) Standards and Procedures

Standard	Description
240-4332798	Engineering Policy

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240-53113685	Design Review Procedure
240-53114002	Engineering Change Management Procedure
240-53114026	Project Engineering Change Management Procedure
240-93576498	KKS Coding Standard
240-105730768	Instrumentation Hook-up Diagrams Standard
240-56227443	Requirements for Control and Power Cables for Power Stations
240-56356396	Earthing and Lightning Protection Standard
240-56176852	Essential Power Supplies for Power Stations Standard
240-76992014	Technical Document and Record Management Work Instruction
240-66920003	Project Handover Documentation Management Procedure
240-65459834	Project Documentation Deliverable Requirement Specification
240-54179170	Technical Documentation Classification and Designation Standard
240-86973501	Engineering Drawing Standard - Common Requirements
240-56355731	Environmental Conditions for Process Control Equipment
240-56176097	Cable Schedule Template
240-56241933	Control of Welding during Construction, Repair and Maintenance Activities Standard
240-40643427	Coding and Labelling Standard
240-105658000	Supplier Quality Management Specification
32-727	Eskom Safety, Health, Environment and Quality (SHEQ) Policy

3.6.4 EPRI Standards and Best Practices

Standard	Description
EPRI 1023087	Boiler Tube Failure Program Best Practices – Integrated Boiler Tube Failure Reduction / Cycle Chemistry Improvement Program
EPRI 1013098	Integrated Boiler Tube Failure Reduction / Cycle Chemistry Improvement Program (R.B. Dooley, EPRI Technical Report, May 2006)

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3.6.5 AUTHORISATION

This document has been seen and accepted by

Name & Surname	Designation

3.6.6 REVISIONS

Date	Rev.	Compiler	Remarks

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