`	**Scope of Works**	**Generation**

Title: **RFWT Balance Main Flow Meter Installation Project**

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PART 1: SCOPE OF WORK

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C3.1/2: EMPLOYER'S AND CONTRACTORS WORKS INFORMATION

Contents

1. Background

1. 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 P13 and P14 systems. The Water Treatment Plant (WTP) operates with the ABB Melody platform.
2. The *Employer's* Water Accounting and Management Framework Standard (240-10520080) requires the monitoring, management, accounting, and reporting of water usage to ensure that all major processes, including potable water and demineralised water, are balanced.
3. The Station experiences significant water losses and constraints. During periods of high demand, the levels in the central reserve tanks decrease without indication of which generating unit has drawn the water. This prevents accurate accounting of water usage, creates demineralised water shortages, and contributes to partial load losses.
4. The *Works* include the provision and installation of an Ultrasonic Flow Measurement System (UFMS) for each generating unit and four additional meters at the North and South Central Reserve Feed Water Tank (CRFWT) outlets. The UFMS measures forward and reverse flow to determine the volume of demineralised water supplied to each unit, enabling early identification of abnormal consumption and improved water management.
5. The UFMS is a monitoring system and does not form part of any automatic control loop. It is intended to improve visibility, accountability, and operational efficiency in water usage across the plant.
6. The *Works* include full integration of the UFMS into the existing ABB DCS. All DCS configuration, logic modifications, HMI mimic development, totalisation, alarms, diagnostics, and historian logging are carried out by ABB or an authorised ABB sales channel partner contracted directly by the *Contractor*. Integration activities are a critical path element of the project, and the *Contractor* is responsible for programming, managing, and coordinating all ABB works to ensure timely completion.
7. Integration to the ABB DCS includes signal termination, signal allocation, and provision of all technical data, loop terminations, and wiring from UFMS transmitters to the ABB interface points. The *Contractor* provides on-site support to ABB during configuration, testing, and commissioning, and assists with the development of totalisation logic, alarm settings, diagnostic points, and historian logging.
8. The *Contractor* ensures that ABB has all necessary access, permits, and information to complete their engineering, testing, and commissioning activities without delay. All *Works*

are carried out in accordance with ABB's requirements and the *Employer*'s applicable standards.

9. The Ultrasonic flowmeters are powered from the *Employer's* existing 380 V UPS systems located in EDS 123 and EDS 456, with available terminal points provided by the *Employer*. The *Works* require the *Contractor* to design, supply, install, route, terminate, test, and commission all cabling, distribution boards, and related equipment to ensure a reliable, UPS-backed power supply.
10. All plant, materials, and workmanship forming part of the *Works* comply with the latest editions of applicable *Employer*, national, and international standards, including SANS 10142-1, IEC 61511, IEC 61326, IEC 61010, ISO 9001, and *Employer*'s Standard 240-56356396.
11. All equipment provided under the *Works* is suitable for the environmental conditions at the point of installation, including temperature, humidity, vibration, dust, corrosive atmospheres, and electromagnetic interference, with a minimum ingress protection rating of IP67.
12. On *Completion* of the *Works*, the *Contractor* provides the *Employer* with an operational, fully integrated UFMS that supports plant-wide water balance monitoring, improves consumption accountability, reduces partial load losses, and ensures compliance with the *Employer's* water management standards.

1.1 High Level Description Works

The *Works* information includes the provision of a fully integrated Ultrasonic Flow Measurement System (UFMS) that meets the *Employers'* requirements:

1. The *Contractor* ensures that the design, engineering, procurement, manufacturing, factory acceptance testing, offloading on site, storage, installation and commissioning are catered for.
2. The *Contractor* ensures that the Ultrasonic Flowmeters are installed on the Balance Main Line between the Central Reserve Feed Water Tanks (CRFWT) and Reserve Feed Water Tank (RFWT) for each unit. See below figure indicating the exact locations where flow meters shall be installed.
3. The *Contractor* ensures that the Ultrasonic Flowmeters are installed at CRFWT outlets to the Balance Main Line.
4. The *Contractor* ensures that the UFMS has the reverse and forward flow measurement capability.

5. The *Contractor* ensures that the Ultrasonic Flowmeter is powered by 220 Vac. The 220 Vac power source shall be from a reliable electrical distribution board provided by the *Employer* in the EDS room. The *Contractor* ensures that they provide a local DB on the 184 level, 10m from where the Ultrasonic Flowmeter is to be installed.
6. The *Contractor* ensures that the Ultrasonic Flowmeter is interfaced to the existing ABB DCS P14 system for units 1,2, and 3 and P14 system for units 4,5 and 6.

1.2 Definitions

Terminology	Interpretation
Balance Main	The valve or valve manifold in the impulse line that is nearest to the instrument that is used to regulate or maintain hydraulic balance by regulating fluid
Design Freeze	An approach design engineers use amidst design development to minimize the risks related to change.
HMI/GUI – Interface for mimics	The human interface used for the operation and monitoring of a particular unit's C&I and vibration Monitoring system
Instrument	A mechanical, electrical, pneumatic or hydraulic device used to measure a process variable
KKS	Identification system for power plant
OEM	The OEM refers to the original equipment manufacturer. Within the context VMS project, it includes the DCS Manufacturer, Electrical OEM's (Power Distribution), VMS manufacturer and also the OEM's of the main turbine, boiler feed pump turbine and EFP's and is clarified in context of the work.
Reserve Feed water Tank	large tank that is used to store feed water for the unit as well as a site to discard excess water that may be in the system.
Specification	The document/s forming part of the contract in which are described the methods of executing the various items of work to be done, and the nature and quality of the materials to be supplied and includes technical schedules and drawings attached thereto as well as all samples and patterns
Ultrasonic Flow Measurement System (UFMS)	System comprising ultrasonic clamp-on flowmeters, associated cabling, junction boxes, power supplies, signal processing equipment, DCS interface, and all related components forming part of the *Works*.
Water Balance	A system equation that describes the amount of water in and out of a system or process.

1.3 Abbreviations

Abbreviation	Description
ABB	Asea Brown Boveri
C&I	Control and Instrumentation
CoC	Certificate of Compliance
CRFWT	Central Reserve Feed Water Tank
DB	Distribution Board
DCS	Distributed Control System
EDS	Engineering Diagnostic Station
EMC	Electromagnetic Compatibility
FAT	Factory Acceptance Test
GUI	Graphical User Interface
HMI	Human Machine Interface
IEC	International Electrotechnical Commission
ISO	International Standard Organization
ITP	Inspection Test Plan
I/O	Input/Output
JB	Junction Box
KKS	Power Plant Coding System
LoSS	Limit of Supply and Services
LV	Low Voltage
OEM	Original Equipment Manufacturer
P&ID	Piping and Instrumentation Diagram
PGIM	Power Generation Information Manager
RFWT	Reserve Feed Water Tank
SANS	South African National Standard
SAT	Site Acceptance Test
SHEQ	Safety Health Environmental and Quality
SIT	Site Integration Test
SPD	Surge Protection Devices
SRG	Signal Reference Grid
UFMS	Ultrasonic Flow Measurement System
UPS	Uninterruptible Power Supply
VDSS	Vendor Document Submission Schedule
WTP	Water Treatment Plant

2 The Detailed *Contractor*'s design as per *Employers'* requirements

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 UFMS as per the following:

1. The *Contractor* ensures that the UFMS is fully designed, engineered, procured, manufactured, factory tested, delivered to site, installed, integrated, site tested, and commissioned in accordance with the *Employer's* requirements.

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 UFMS forming part of the *Works*.
3. The *Contractor* is responsible for verifying and accounting for the pipe type, size, and associated technical design characteristics at the intended Ultrasonic Flowmeters installation locations during the detailed design phase and reconfirming during the procurement phase, before placing the order for the Ultrasonic Flowmeters to site.
4. The *Contractor* ensures that engineered characteristics of the UFMS are aligned with process matter to be measured, namely Demineralised Water.
5. The *Contractor* ensures that the Ultrasonic Flowmeters are powered by 220 Vac power supply. This is done in accordance with the LoSS diagram attached in the Appendix 2.
6. The *Contractor* ensures that the Ultrasonic Flowmeters are installed on the Balance Main Line between the RFWT and CRFWT for Units, 1-6. This is one clamp-on Ultrasonic Flowmeter that is installed at the RFWT outlet to Balance Main Line for each unit (Units 1-6). A plant layout drawing which shows arrangement of the RFWT in accordance with CRFWT as well as the boiler filling line is attached in Appendix 1.
7. The *Contractor* ensures that four (4) clamp-on Ultrasonic Flowmeters are installed, that is two (2) at the North CRFWT outlet and two (2) at the South CRFWT outlet to Balance Main Line, respectively.
8. The *Contractor* is responsible for ensuring that measurement data from the installed Ultrasonic Flowmeters is displayed in the 7 in 1 Unit Control Room, simulator room, and Water Treatment Plant (WTP) control room.
9. The *Contractor* ensures that measurement data is displayed On the HMI in the 7 in 1 control room.
10. The *Contractor* ensures that all Ultrasonic Flowmeters have the forward and reverse flow measurement capability, and this design characteristic is portrayed on the HMI display in 7 in 1 unit control room, simulator room and WTP.
11. The *Contractor* ensures that all Ultrasonic Flowmeters installed are powered from the UPS panels in the EDS 123 & 456. Provisions for such shall be made by the *Employer*. Details under section 2.8, Electrical Power Supply Requirements. Details are also displayed in the LoSS diagram, Appendix 2.
12. The *Contractor* is responsible for providing a field distribution board equipped with circuit breakers. Additionally, the *Contractor* supplies and terminates the necessary cables from

the 220V UPS distribution board (DB) in the EDS 123 & 456 to the field distribution board where the Ultrasonic Flowmeters will be powered. This scope of work includes:

a) Selecting and procuring a suitable field distribution board with an adequate number of circuit breakers to safely power the UFMS and associated equipment.

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 - in the C&I equipment room at the 220V UPS DB and at the field DB location.

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.

f) Providing as-built documentation detailing the installation, cable routing, and termination details for future reference.

13. The *Contractor* is responsible for ensuring that all Ultrasonic Flowmeters analogue 4-20mA signals are properly wired to the designated C&I junction boxes (JB). These 4-20mA signals shall be conveyed through the JBs and marshalling racks, which will enable the interface to the ABB DCS and the display of process mimics on the respective Human-Machine Interface (HMI) screens.
14. The *Contractor* provides all temporary *Works*, plant, tools, lifting equipment, scaffolding, permits, and safety measures necessary to carry out the *Works*.
15. The *Contractor* Coordinates all work with the *Employer*'s operations to minimise disruption.
16. The *Works* are accepted when:

a) All flowmeters pass SAT with measured 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 Manage*r.

2.2 Operating Philosophy

1. The Ultrasonic Flow Measurement System (UFMS) is implemented to monitor, account for, and alarm on flow into each Unit RFWT. Two central RFWTs receive Demin water from the WTP and supply this water to the individual Unit RFWTs.
2. The Unit RFWTs are hydraulically interconnected through a single balance flow line, with levels maintained via a balance main isolating valve. To facilitate accurate measurement and monitoring, an Ultrasonic Flowmeter transmitter shall be installed as part of the scope of the *Contractor*, at the inlet of each Unit RFWT.
3. Each transmitter measures the volumetric flow of water into the unit and converts it into a 4–20 mA analogue signal. This signal is routed via junction boxes and marshalling racks and interfaced into the existing ABB DCS.
4. The DCS processes these signals to display real-time flow rates on operator HMIs located in the Unit Control Rooms, the Water Treatment Plant Control Room, and the Simulator Training Facility.
5. In addition to real-time flow display, the DCS implements:
    a) Totalization Logic: Instantaneous flow signals are totalized to provide daily and cumulative flow volumes for each unit RFWT. This supports site-wide water accounting and reporting.
    b) Alarm Handling: Alarms are generated for abnormal flow conditions, including high flow, low flow, zero flow, and reverse flow scenarios, based on pre-configured thresholds within the DCS.
    c) Data Logging: Instantaneous and totalized flow data are continuously logged to the plant historian (Power Generation Information Manager – (PGIM)) to support performance analysis, operational reporting, and long-term trend monitoring.
    d) The UFMS operates as a monitoring system only and does not form part of any automatic control loop. Its primary function is to enhance water balance visibility and accountability across the generating units.

2.3 General Requirements for the *Contractors' Works*

1. The *Contractors'* design and engineering is carried out on site at Arnot Power Station.
2. The *Contractor* provides all equipment and services to fulfil all requirements specified in this *Works* information.

3. The *Contractor* ensures that all *Works* comply with the professional engineering practice and standards for Fossil Fuel Firing Regulations, 240-105453648 and is designed for the environment conditions prevailing at Arnot Power Station.
4. The *Contractor* completes and submits a detailed design package for review by the *Employer.*
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.
6. Where similar equipment or instruments are already installed at the plant and are functioning satisfactorily, the *Contractor* matches the new equipment to existing makes, models, communication protocols, and installation conventions, subject to availability and technical suitability.
7. The *Contractor* provides all temporary equipment, including power and signal cables, necessary to deliver a fully functional UFMS forming part of the *Works*."

2.4 Functional Requirements

1. The *Contractor* verifies that each signal indication on the ABB DCS display has the same accuracy as on the field monitoring and controlling panel displays with no more than < 1% deviation from each other.
2. The *Contractor* ensures that each signal indication on the ABB DCS display updates at the same delta value as the field monitoring and controlling panel displays.
3. The *Contractor* performs, as a minimum, the following engineering, design, configuration, and installation services related to the UFMS, in compliance with the applicable *Employer's* Standards and international standards including but not limited to IEC 61511, IEC 61207, ISO 5167, and IEC 61010:
    a) Detail design, including flowmeter sizing and selection, verification of pipework layout and dimensions, and assessment of hydraulic conditions (e.g., straight run lengths, flow profiles, and turbulence mitigation) at each measurement location, in accordance with ISO 5167 and IEC 61207-1.
    b) Procurement of UFMS components, including Ultrasonic Flowmeter transmitters, mounting accessories, signal cables, junction boxes, power supplies, surge protection devices, and all auxiliary equipment required to power the 220V AC Ultrasonic Flowmeters from the existing 220V UPS supply, in compliance with IEC 61010.

c) Factory Acceptance Testing (FAT) of the UFMS, including simulation of 4–20 mA outputs, verification of measurement range and accuracy, and calibration certificates traceable to national standards in compliance with IEC 61207-2.

d) Delivery to and offloading at site with appropriate mechanical and Electrostatic Discharge protection, handling procedures, and tagging of all equipment in accordance with ISO 2859.

e) Installation of the Ultrasonic Flowmeters and associated equipment, including mechanical mounting, electrical termination, signal cabling, environmental sealing, and earthing, in line with IEC 60079, SANS 10142-1, and Employers' installation practices

f) KKS labelling of all UFMS instruments, cables, junction boxes, and DCS input and output (I/O) points in accordance with *Employers'* standards and IEC 81346.

g) Interfacing with existing plant infrastructure, including signal routing through junction boxes and marshalling racks to the ABB 800xA DCS input modules, ensuring Electromagnetic Compatibility (EMC) compliance as per IEC 61326.

h) Configuration of UFMS signals into the ABB DCS, including signal scaling, development of totalization logic, alarm threshold configuration, HMI mimic development for Unit Control Room, Water Treatment Plant, and Simulator Room, and historian logging using ABB PGIM standards, in compliance with IEC 61511.

i) Simulation and loop-checking of all UFMS signals, including verification of flow accuracy, alarm conditions, and DCS display prior to commissioning.

j) Commissioning, functional testing, and optimisation of the UFMS under actual plant operating conditions, including validation of flow rates and diagnostics, in accordance with IEC 61207-3,

k) Training of the *Employer's* personnel in the operation, maintenance, and troubleshooting of the UFMS and its DCS interface.

l) Provision of all documentation, including as-built drawings, P&IDs, instrument data sheets, calibration certificates, signal lists, configuration backups, alarm setpoints, and training records, structured in accordance with ISO/IEC 82045.

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 and regulatory requirements.

o) Compliance with site safety rules and Eskom's SHEQ, 32-727 requirements, including the provision of all safety and plant signage, barricading, and equipment identification.

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.
5. The *Contractor* provides a detailed maintenance philosophy for the UFMS, including a preventive maintenance plan that covers all UFMS components such as flow transmitters, signal cabling, junction boxes, power supplies, interface hardware, and DCS configurations (The plan outlines inspection intervals, calibration requirements, cleaning procedures, fault diagnostics, and recommended spares, and aligns with the OEM's guidelines and the *Employer's* maintenance practices.
6. The *Contractor* provides critical spares list for the *Works.*
7. The *Contractor* provides the necessary periodic maintenance inspections required for the plant together with the maintenance philosophy.
8. The *Contractor* provides all required software, licences, and copyright or user agreements associated with the operation, configuration, diagnostics, and maintenance of the UFMS. This includes any proprietary software, calibration tools, or interface utilities necessary to support the long-term functionality and supportability of the system.
9. The *Contractor* does not commence any installation activities until the detailed design has been completed, submitted, and formally accepted by the *Employer*. Acceptance of the detailed design is be treated as a key milestone in the execution schedule of the project.
10. A detailed implementation plan is completed by the *Contractor* and accepted by the *Employer* before the design freeze.
11. The field work does not commence without official access from the *Employer*.

2.5 Field Instrumentation Technical Requirements

1. The *Contractor* supplies Ultrasonic Clamp-on Flowmeters as part of the UFMS. These flowmeters shall be selected and configured to suit the site-specific pipe material, size, wall thickness, and process media characteristics, and shall be suitable for non-invasive installation without requiring pipe cutting or process interruption. The flowmeters shall offer high accuracy and stable signal transmission. The Ultrasonic Flowmeters are to be installed

in accordance with Control & Instrumentation Field Enclosures and Cable Termination Standard, 240-56355815.

2. The *Contractor* installs each flowmeter according to OEM specifications, including:
    a) Surface cleaning and paint removal at transducer locations.
    b) Correct application of OEM-approved coupling compound.
    c) Stainless steel mounting hardware suitable for site conditions.
3. The *Contractor* verifies correct transducer alignment and signal quality during installation.
4. The *Contractor* ensures that all flowmeters supplied under this contract are fully compatible with the existing ABB DCS installed at Arnot Power Station. The *Contractor* is solely responsible for confirming and delivering this compatibility, including but not limited to signal type, communication protocol handling, and seamless integration with existing I/O modules or communication gateways.
5. The *Contractor* provides Ultrasonic Flowmeters that output 4-20mA analogue signals.
6. The *Contractor* provides an UFMS which is compatible with the following Piping and Process Media specifications:
    d) Pipe external Circumference of 222mm
    e) Pipe thickness of 5.4mm
    f) Ambient temperature of 25ºC
    g) Pipe material of Carbon Steel
    h) Process media type is demineralised water
    i) Process Media PH range 7 to 9
    j) Conductivity of process media ideally below 1 µS/cm
    k) Silica components of process media less than 0.02 ppm
    l) The Ultrasonic Flowmeter shall be rated at IP 67 rated and above
7. It remains the responsibility of the *Contractor* to verify the accuracy and suitability of the above parameters (Section 4.) for the purpose of detailed design, equipment selection, and installation. Any discrepancies, uncertainties, or deviations identified during verification is to be brought to the attention of the *Employer* in writing prior to proceeding with procurement or installation.

2.6 Field Instrumentation, Cabling and Infrastructure Requirements

1. The *Contractor* provides for power cabling required as part of the *Works* in compliance with SANS 10142-1 (Low Voltage Electrical Installations) and 240-56227443 (Requirements for Control and Power Cables for Power Stations Standard).
2. The *Contractor* provides all cable racking, conduits and trenching required to complete the *Works*, in accordance with SANS 60529 (Degrees of protection by enclosures), SANS 10142-1 and 240-56227443.
3. The *Contractor* makes use of existing cable racking where reasonably practical.
4. The *Contractor* designs and implements the wiring routes from the Ultrasonic Flowmeters to the designated C&I junction boxes,
5. The *Contractor* terminates the 4-20mA signal cables at both the Ultrasonic Flowmeter end and the junction box end, ensuring proper connections.
6. The *Contractor* integrates the 4-20mA signals from the junction boxes into the marshalling rack system.
7. The *Contractor* also terminates these 4-20mA signals at the marshalling cabinet end. The Contractor shall provide detailed documentation, including wiring diagrams and configuration details, for future maintenance and troubleshooting purposes.
8. The *Contractor* is responsible for the design, supply, installation, termination, labelling, testing, and commissioning of all UFMS signal and system communication bus cabling, complying with SANS 1574 (Performance and test requirements for bus systems) where applicable.
9. The *Contractor* ensures that all cables are concealed and routed through suitable conduit, trunking, or cable trays. No exposed cables are permitted, in accordance with SANS 10142-1 and SANS 60529.
10. The *Contractor* designs cable routing to separate control and instrumentation cables from power cables, considering electromagnetic interference and common mode failure risks, as defined in IEC 61326 and SANS 61000-5-2.
11. The *Contractor* ensures that the colour coding of all new cabling and wiring is consistent with the existing installed instrumentation colour coding.
12. The *Contractor* ensures that all cabling, cable racking, and conduits comply with *Employer'* Specification: 240-56227443 – Requirements for Control and Power Cables for Power Stations and all relevant SANS standards. Where any discrepancy arises between the

SANS standards and *Employer'* Specification 240-56227443, the *Employer's* specification takes precedence.

2.7 Interface with the ABB Units, WTP DCS and the Simulator Training Facility

1. The *Contractor,* through the DCS OEM contracted directly by the *Contractor* is responsible for the full integration of the UFMS into the existing ABB DCS. This includes all configuration, functional testing, commissioning, documentation, and handover activities related to ABB DCS integration, in accordance with the following requirements:

2.7.1. OEM Restriction and Engagement

1. The *Contractor* ensures not to perform any DCS configuration or logic modifications on the ABB DCS unless they are the Original Equipment Manufacturer (ABB) or a formally recognised ABB-authorised sales channel partner.
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. The *Contractor* is responsible for the full management, coordination, and funding of this engagement as part of the *Works.*
4. All liaison with ABB, including scope definition, scheduling, and submission of documentation, is to be managed by the *Contractor.*
5. The *Contractor* ensures that ABB or the authorised ABB partner delivers the work in full and on time. The *Contractor* provides all documentation, backups, test records, and configuration files at handover.

2.7.2 Responsibility and Accountability:

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.
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. The *Contractor* prevents any unauthorised access or modification to the ABB DCS configuration during execution of the *Works.*

2.7.3 Configuration of UFMS Signals in the ABB DCS:

1. The DCS OEM or channel partner carries out the configuration of UFMS signals in the ABB DCS, including:

a) Configuration of UFMS signals in the ABB P13 and P14 Unit and WTP Melody DCS

b) Development and implementation of flow totalisation logic (instantaneous, daily, and cumulative).

c) Development of ABB HMI graphics, including mimic diagrams, faceplates, and navigation faceplates for the Unit Control Room, WTP, and Simulator Room,

d) Update of the DCS signal database and application of KKS tag structure.

e) Integration of UFMS data into the ABB historian (PGIM).

f) Backup and restoration of modified ABB DCS configurations.

g) Verification of correct signal scaling and accurate display on the ABB HMI.

h) Configuration of alarm thresholds.

2.7.4 Simulation and Loop Checking of All UFMS Signals in the ABB DCS

1. The DCS OEM performs simulation and loop checking of all UFMS signals, including:

a) Verification of correct signal scaling and accurate display on the ABB HMI.

b) Testing of alarm conditions and diagnostic outputs to ensure correct functionality.

c) Confirmation that all signal data is correctly recorded in the ABB historian (PGIM).

2.7.5 Commissioning, Functional Testing, and Optimisation of the UFMS

1. The DCS OEM performs the commissioning, functional testing, and optimisation of the UFMS under actual plant operating conditions. This includes:

a) Validation of measured flow values and associated alarm functions.

b) Testing and adjustment of DCS response to ensure stable and reliable operation.

c) The *Contractor* ensures that all activities listed in this section, section 2.7 are delivered in full and to the satisfaction of the Employer, with clear documentation of

test results, configuration backups, and performance validations included as part of the final system handover.

2.7.6 Provision and Installation of Additional Integration Equipment:

1. Where additional equipment such as signal converters, protocol gateways, network switches, or any other interfacing hardware or software is required to enable the successful integration of the flowmeters into the existing ABB DCS to provide a fully functional UFMS, the *Contractor* is fully responsible for identifying, designing, supplying, installing, configuring, and commissioning all such equipment under this contract, ensuring full end-to-end functionality and compatibility with the ABB DCS.
2. The *Contracto*r installs all additional equipment specified in clause 7 of section 2.7 within the environmentally controlled Units or WTP C&I equipment room, unless the *Employer* gives written instructions to the contrary.

2.8 Electrical Power Supply Requirements

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, Wiring of Premises.
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. The *Contractor* ensures the Ultrasonic Flowmeters forming part of the *Works* is powered from a reliable power supply backed by a UPS in the event of AC power loss. The 380V UPS is located inside EDS 123/456. The *Employer* provides available terminal points, referenced by the KKS, to the *Contractor*.
4. Where required by the UFMS, the *Contractor* is responsible for providing and installing dedicated power distribution systems necessary for the proper functioning of the equipment supplied under the *Works.*
5. The *Contractor* verifies the operating parameters of the existing UPS for design purposes. 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.* The *Contractor* submits the final design to the *Project Manager* for acceptance before implementation.

6. The *Contractor* is fully responsible for the supply, installation, routing, and termination of all power cables forming part of the *Works.* This includes, but is not limited to, the cabling from the 220 V UPS DB located in the C&I equipment room (EDS) to the field distribution board, which the *Contractor* supplies as part of the *Works* and which provides power to the Ultrasonic Flowmeters. The *Contractor* also installs and terminates the cabling from the field distribution board to each individual Ultrasonic Flowmeter forming part of the *Works.*
7. The *Contractor* designs the cable routing and sizes the cables to efficiently transfer power from the 220V UPS DB to the field DB provided by the *Contractor* as part of the *Works*.
8. The *Contractor* provides and install the following: ± 200m of 600/1000v, general PVC or XLPE, single wire armoured cable to be used for each unit, to connect from the UPS, stationed in EDS 123/456 as outlined below by KKS. This cable shall also be terminated at the respective DBs outlined below by KKS:

    a) UPS 1 – 02 -10BTW01 Master, 02 -10BTW02 Slave to the DB +1 0BTW01 GH001. The Cable shall be terminated at any of the following points in the DB; breaker no: 8, 16, 17, 19, 30, 32, 33, 34, 35, 38, and 41.

    b) UPS 2 – 02 -20BTW01 Master, 02-20BTW01 Slave to the DB +2 0BTW01 GH001. The Cable shall be terminated at any of the following points in the DB; breaker no: 4, 5, 14, 16, 17, 18, 30, 32, 39, 41, 42, and 45.

    c) UPS 3 – 02 -30BTW01 Master, 02-30BTW01 Slave to the DB +3 0BTW01 GH001. The Cable shall be terminated at any of the following points in the DB; breaker no: 23.

    d) UPS 4 – 02 -40BTW01 Master, 02-40BTW01 Slave to the DB +4 0BTW01 GH001. The Cable shall be terminated at any of the following points in the DB; breaker no: 5, 9, 17, 18, 25, 33, 49 and 55.

    e) UPS 5 – 02 -50BTW01 Master, 02-50BTW01 Slave to the DB +4 0BTW01 GH001. The Cable shall be terminated at any of the following points in the DB; breaker no: 5, 25, and 47.

    f) UPS 6 – 02 -60BTW01 Master, 02-60BTW01 Slave to the DB +4 0BTW01 GH001. The Cable shall be terminated at any of the following points in the DB; breaker no: 9 and 30.

9. The *Contractor* ensures proper labelling and identification of the circuits to facilitate maintenance and troubleshooting.
10. The *Contractor* tests the complete power distribution system to verify proper functionality and compliance with relevant electrical standards and regulations.

11. The *Contractor* provides as-built documentation detailing the installation, cable routing, and termination details for future reference.
12. All power cables shall compliance with applicable *Employers'* specifications and relevant SANS standards.

2.9 Cabling, Termination, Routing and Racking.

1. The Ultrasonic Flowmeter signals shall be wired using a UVG02 cable to a C&I Junction Box as per the following KKS:

    a) Unit 1 RFWT – 10HAD10GB001

    b) Unit 2 RFWT – 20HAD10GB001

    c) Unit 3 RFWT – 30HAD10GB001

    d) Unit 4 RFWT – 40HAD10GB001

    e) Unit 5 RFWT – 50HAD10GB001

    f) Unit 6 RFWT – 60HAD10GB001

    g) South CRFWT – 40HAD10GB001

    h) North CRFWT – 30HAD10GB001

2. The *Contractor* ensures that the Ultrasonic Flowmeters are wired from the above-mentioned C&I Junction Box via a UVG02 cable and terminated at the following cubicles and respective module cards:

    a) Unit 1 RFWT – 10CBA04GB028, 81EU01/R1210

    b) Unit 2 RFWT – 20CBA04GB028, 81EU01/R1210

    c) Unit 3 RFWT – 30CBA04GB028, 81EU01/R1210

    d) Unit 4 RFWT– 40CBA04GB044, 81EU01/R1210

    e) Unit 5 RFWT – 50CBA04GB028, 81EU01/R1210

    f) Unit 6 RFWT – 60CBA04GB028, 81EU01/R1210

    g) South CRFWT -- 40CBA04GB044, 81EU01/R1210 (EDS 456)

    h) North CRFWT -- 30CBA04GB028, 81EU01/R1210 (EDS 123)

2.10 Earthing Design Function Requirements

1. The *Contracto*r provides a complete and coordinated earthing design for all electrical and instrumentation equipment forming part of the *Works,* including but not limited to the flow transmitters, junction boxes, signal converters, field distribution boards, communication equipment, and DCS interface points.

2. The *Contractor* submits an earthing and bonding philosophy document specific to the UFMS installation for review and acceptance by the Employer prior to implementation. The philosophy shall define the earthing methodology (TN-S, TN-C-S, TT, etc.), signal reference grid (SRG) integration, equipotential bonding approach, and segregation between power and instrumentation earthing systems.

3. The *Contractor* ensures that all necessary functional earthing is provided to eliminate electromagnetic interference (EMI), reduce signal noise, and protect low-level analogue signals, including the 4–20 mA circuits, from transient voltages and ground loops.

4. 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 (Wiring of premises – Low-voltage installations).

5. The *Contractor* provides an earthing design that includes surge protection devices (SPDs) at all locations where UFMS cabling enters or exits buildings or control panels, as part of the *Works*.

6. The *Contractor* tests and documents the earth impedance/resistance at all relevant UFMS connection points. Results shall be submitted to the *Project Manager* for verification before energisation or commissioning.

7. The *Contractor* ensures that earthing of shielded signal cables is done at one point only (typically at the marshalling panel or DCS interface), as per signal integrity best practices and ABB DCS system integration requirements.

2.11 Environmental Requirements

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, including but not limited to indoor/outdoor exposure, dust, moisture, corrosive atmospheres, and electromagnetic interference.

2. The *Contractor* ensures that all UFMS equipment, including Ultrasonic Flowmeters, signal conditioning devices, cabling, and auxiliary components, is rated to operate reliably within the expected environmental conditions at the point of installation. These include but are not limited to temperature, humidity, vibration, mechanical shock, and airborne contaminants.

3. The *Contractor* carries out all installation, commissioning, and related *Works* activities in accordance with *Employer's* Safety, Health, Environmental, and Quality (SHEQ) requirements, including site-specific SHE files. All *Works* complies with the Occupational Health and Safety Act (Act No. 85 of 1993), the Construction Regulations, and any other applicable national legislation.

4. The *Contractor* shall ensure that all field-mounted equipment (e.g. flowmeters, junction boxes, local displays) meets a minimum ingress protection rating of IP67 or higher, unless otherwise specified. Enclosures and fittings must also meet minimum IK08 mechanical impact protection in high-risk areas.

5. The *Contractor* designs the flowmeters to operates reliably in:

    a) Ambient temperature: –5 °C to +50 °C.

    b) Relative humidity: up to 95% non-condensing.

    c) Vibration: IEC 60068-2-6 (power station environment).

    d) Ingress protection: IP65 minimum.

2.12 Maintenance Philosophy

1. The *Contractor* is responsible for developing and submitting a comprehensive Maintenance Philosophy and Preventative Maintenance Plan for the Ultrasonic Flow Measurement System (UFMS) and all associated instrumentation, power, and communication components forming part of the *Works*. The Maintenance Philosophy shall include:

e) Recommended maintenance intervals for sensors, transmitters, signal conditioning units, and local/remote HMIs.

f) Cleaning schedules for transducer faces exposed to potential fouling (e.g., water, dust, chemical vapour).

g) Diagnostic verification methods and frequency, including signal strength and zero/span drift checks.

h) Procedures for firmware and configuration file backups and version control.

i) Battery backup maintenance requirements (where applicable).

j) Interface testing with DCS and Historian systems.

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. The *Contractor* compiles and submit a detailed Critical Spares List for all UFMS components provided under the *Works.* The list shall include:

a) Spare parts for each type of flowmeter (e.g., transducers, transmitter modules, preamps),

b) Spare signal and power interface components,

c) Cabling and connector kits,

d) Fuses, relays, surge protection devices,

e) Local display or HMI components.

4. The *Contractor* provides a detailed maintenance philosophy for the modified part of the plant which includes a preventative maintenance plan for all plant areas forming part of the project scope. This detailed maintenance philosophy is to contain a detailed P&ID diagram.

5. The *Contractor* provides a critical spares list for the *Works*.

6. The *Contractor* provides relevant training to the maintenance and engineering team to ensure that all periodic maintenance inspections required for the modified plant together with the maintenance philosophy are carried out effectively.

2.13 Factory Acceptance Testing

1. The *Contractor* is responsible for developing test procedures to demonstrate the integrity of the system.
2. These procedures are submitted to the *Employer* for written approval.
3. The test procedures shall include plant simulation tests and shall be witnessed by the *Employer.*
4. The *Contractor* ensures that the technical personnel from the *Employer* are available during installation tests to correct any discrepancies immediately. The discrepancies are to be corrected by the *Contractor.*
5. The *Contractor* ensures that the FAT is submitted as part of the detailed design to the Employer

2.14 Spare Parts

1. The *Contractor* provides spare parts in accordance with the recommended spares list. A quote for the spare parts should form part of the submission by the *Contractor.*
2. The *Contractor* provides a listing of recommended spare parts.
3. The *Contractor* ensures that attention is given to equipment with a high rate of failure as long as equipment with long delivery times.

2.15 Training

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*.
2. Training provided by the *Contractor* is directly applicable to the actual equipment supplied for the *Works*. Generalised training based on similar equipment is not acceptable. All training will consist of both theoretical and practical training. The training is to be structured

such that competency tests are done at the end of the training sessions on all the training participants

3. At design freeze, the *Contractor* submits to the *Project Manager* for acceptance a detailed training programme as well as a prospectus for each course. The training schedule is incorporated in the Accepted Programme

4. The *Contractor* ensures that the preferred venue for any training course is Arnot Power Station. If due to any reason this is not possible, then the *Contractor* shall state at what location the course would be held.

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

6. The *Contractor* ensures that the advanced level course is orientated toward engineering personnel for all system changes and shall include items over and above those covered in the basic course.

2.16 Limits of Supply and Services

1. The *Contractor* provides System Engineering *Works* on the ABB DCS control system. The *Contractor* liases 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. See appendix for loss diagram for *Works* on the ABB DCS.

2. The Removing of existing equipment is fully covered by the *Contractor's* scope of work.

3. The supply and installation of the UFMS is fully covered by the *Contractors'* scope of work. See Appendix 2 for LoSS diagram for installation and commissioning Works.

4. The commissioning of the UFMS project shall be fully covered by the *Contractor's* scope of work. See Appendix 2 for LoSS diagram for installation and commissioning *Works.*

5. The *Contractor* ensures that UFMS is powered from UPS located in the EDS room. The Termination points on the UPS is provided by the *Employer.* The *Contractor* ensures that local DB is installed in an approximate distance from the Ultrasonic Flowmeters. (10m). See Appendix 2 for LoSS diagram for power requirements *Works*.

2.17 Performance Requirements

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

2.18 Procedure For Submission and acceptance of *Contractors* Design

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

2. The *Contractor* supplies the documentation in item 3 of section 2.18 below, as the minimum requirements of this specification in the design package before any manufacturing, construction or commissioning commences:

3. The *Contractor* ensures Vendor Document Submittal Schedule (VDSS) indicating when all documents are submitted, the following is to be contained in the list:

    a) Drawing Register indicating when drawings shall be submitted.

    b) Complete detailed design file.

    c) Functional Specifications.

    d) Component material datasheets.

    e) Constructability Assessment.

    f) Quality Control Procedures.

    g) Quality Control Plan and Inspection and Test Plan.

    h) Method Statements.

    i) Commissioning procedures.

    j) Assembly procedures.

    k) Technical, Operation and Maintenance Manuals of all plant equipment.

    l) Operating Philosophies as per the *Contractors* detailed design of the *Works*

    m) Maintenance Philosophy.

    n) Maintenance schedules.

    o) Instrument/ Signal schedule.

    p) Electrical Hook-up diagrams.

q) LOSS diagrams.

r) Electrical termination schedules.

s) Critical Spares List.

t) Operating, Maintenance and Engineering Training Manuals.

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. The *Contractor* ensures that 10 days are provided for review of the VDSS, this is indicated on the VDSS programme. If after 10 days, the Employer is not satisfied, more time is to be provided to the *Contractor* by the *Employer* for re-works.

2.19 Testing and Commissioning

1. The *Contractor* ensures the following:

a) Testing and commissioning shall be included as a minimum:

b) The services of skilled personnel to supervise the testing and commissioning and making ready for the operation of the *Works* as required for partial and full duty operation.

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, who shall remain in attendance until such time as the *Works* are functioning to the Employer's satisfaction.

e) A requirement of these trials is one 72-hour test period to determine that all activities as laid down in the operating manuals are correct and are carried out in the correct sequence and to determine that all the essential items have been provided as outlined in this scope of work.

f) The *Contractor* supplies all data books with signed ITPs and as built drawings of the *Works.*

g) Commissioning of the system shall be done by the *Contractor's* staff with the *Employer's* dedicated operations/commissioning staff.

h) The *Contractor* submits a commissioning schedule and program for acceptance to the *Employer* by the contract date.

i) Before the UFMS is placed in service the *Contractor* certifies that it is in a suitable and safe condition.

j) The *Contractor* is responsible for the commissioning of all the flow measuring instrument system UFMS and materials he/she shall supply to the requirements of this specification to the satisfaction of the *Project Manager* and the *Employer's* representatives. Where various components are already in place or are supplied by the *Employer* to form an integrated system, the *Contractor* at the time of commissioning, shall carry the responsibility for the correct functioning of the whole system.

k) In the event of incorrect functioning, the *Contractor* determines the cause and shall correct the defect, if the defect is within plant and equipment of his/her own supply. The *Contractor*, at the time of commissioning, has the agreement, or alternatively, the attendance of the *Project Manager* involved in a particular phase, before proceeding with commissioning. Consequently, the *Contractor* assures himself/herself as to the safety of his/her own plant and equipment in respect of any commissioning test and in the event of damage accept responsibility for such plant and equipment.

l) The *Contractor* shall commission the *Works* and ensures conformance to the *Employer's* performance requirements for the *Works*. The *Employer* takes over sections of the system as required once the system performance requirements have been verified by the *Contractor.*

m) The *Contractor* provides a detailed Commissioning Test Procedure (CTP) for review and acceptance by the *Project Manager* prior to commissioning. The CTP includes testing of signal scaling, totalised flow accuracy, alarm generation, historian logging, communication interface integrity, and simulated fault scenarios. All commissioning results are submitted in a structured format and form part of the handover documentation.

n) The *Contractor* ensures that commissioning of the ABB DCS is carried out fully by an ABB sales channel partner or ABB.

o) The *Contractor* performs functional tests with live flow to verify accuracy within specified limits.

2.20 Plant and Material Requirements to be included in the *Works Information*.

1. The *Contractor* prepares and submits a project Inspection and Test Plan (ITP) for all plant and materials included in the scope. The project ITP shall detail all elements of the plant and shall itemise the required quality levels for each of these components.

2. The *Contractor* indicates in the project ITP which items are of a proprietary nature where the level of certification is limited to standard documentation and certificates of conformity. The *Contractor* shall use only ISO 9001 accredited suppliers for these products. Evidence of ISO 9001 certification shall be supplied with the delivery documentation. Failure to include this certification at the time of delivery shall result in rejection of the plant and materials by the *Employer.*

2.21 As-built Drawings, Operating Manuals and Maintenance Schedules.

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.*

2. The *Contractor* ensures the following:

    a) Makes use of a system compatible with the *Employer's* Micro station (Version 8i) CAD for all drawings supplied to the *Employer* in electronic medium (e.g. disks) in addition to prints. Additionally, all drawings shall be supplied in Adobe PDF format.

    b) Implements and maintains an updated drawing register, the format of which shall be submitted to the *Employer* for acceptance. Updates are submitted on a regular basis or when significant changes are made.

    c) Submit 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, without delay on request by the *Employer*.

2.22 Technical, Operating and Maintenance Manuals.

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

2. The maintenance manuals state explicitly the maintenance requirements for each piece of equipment. Copies of the first draft manuals as well as all “as built” drawings are submitted to the *Employer* for review and acceptance.

3. Manuals are in English and each manual is complete with the Power Station’s name, contract number and index. The *Contractor* also provides an electronic copy of these documents.

4. The manuals indicate the level of responsibility of the operating personnel for each action in the procedures. Included in these manuals are the following:

    a) Maintenance procedures and instructions for specific plant and equipment.

    b) All drawings required for component location, dismantling and re-assembly for maintenance.

    c) Equipment details such as make, model, type, specifications, etc.

    d) Detailed parts lists and ordering instructions pertaining to storage of spare parts or to their shelf life.

    e) Catalogues, schedules, and other product support documents.

    f) Troubleshooting and fault-finding guide.

    g) Safety procedures and instructions.

    h) All special tools and equipment required for maintaining and operating the *Works*.

5. The technical manuals include fully detailed descriptions, as-built drawings, diagrams, illustrations, schedules, and data for use by *Employers’* technical staff to evaluate performance, trace faults, adjust, maintain and fully understand the plant and to allow satisfactory training of junior staff in conjunction with the operating manuals.

6. The operating manuals is set out in simple terms in ordinal, tabular or pictorial form to provide factual and concise descriptions of:

    a) What problems can occur and how they are overcome.

    b) A routine visual plants inspection procedure.

7. Detailed maintenance procedures, covering removal, dismantling, replacement of parts, re-erection, checking, and reassembly and re-commissioning shall be included for all equipment. The re-commissioning shall be included for all equipment.

8. The maintenance manual is fully comprehensive and cover all plant and materials installed. As the manuals shall be frequently used for training and maintenance, they shall be prepared similarly to those described for the operating instruction manuals for use by operating personnel.

2.23 Plant and Materials

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 QM-58. The QMS shall comply with the requirements of ISO 9001.

    b) The *Contractor* and all of the *Contractors'* suppliers holds a valid certificate of compliance for their QMS to the requirements of ISO 9001:2008. The *Employer* may at his sole discretion carry out an audit any supplier or sub-supplier QMS for compliance.

    c) Documents are submitted for review and acceptance by the *Employer* prior to the commencement of work.

    d) The *Contractor* submits a fully detailed Quality Control Plan / ITP for acceptance in accordance with the Vendor Document Submission Schedule (VDSS).

    e) No work is allowed on Site unless the *Employer* accepts the Quality Control Plan.

    f) The *Contractor* utilises the *Employer's* quality documentation forms for requesting access, erection checks etc. These request forms are to be

submitted to the Supervisor at least one week prior to the requested activity, or as agreed to by the *Project Manager*.

g) Apart from any statutory data packages required, the *Contractor* also compiles a data package of the relevant drawings, test certificates etc. for each section of work which is to be reviewed and signed off by the Supervisor at erection stage prior to the commencement of the commissioning phase.

2. Plant & Materials provided “free issue” by the *Employer*:

a) No “free issue” items shall be supplied. All Plant Materials are to be provided by the *Contractor.*

b) All *Works* is to be conducted in accordance with the LoSS.

3. *Contractor’s* procurement of Plant and Materials

a) The *Contractor* procures all Plant and Materials required for constructing, installing and commissioning the *Works.*

b) The *Contractor* ensures:

I. *Contractor* promptly unloads shipments and promptly releases carrier equipment.

II. Ensures that all the Plant and Materials are inspected. The *Contractor* shall notify the *Project Manager* who instructs designated *Employer’s* representatives to inspect the Plant and Materials at the factory, or the Contractor’s premises, before it is transported to the Site.

III. Ensures that all relevant factory tests are witnessed and accepted by the designated *Employer’s* representatives. Any deviations from accepted drawings, standards or specifications are noted and reported to the *Contractor* by the above-mentioned representatives. A copy of the deviations is forwarded to the *Project Manager* for record keeping. The *Project Manager* follows up with the *Contractor* to ensure that deviations are successfully corrected.

IV. Submits calibration certificates of all test equipment used for testing of any electrical equipment to the *Project Manager.*

4. Spares and consumables:

    a) The *Contractor* supplies, on acceptance by the *Project Manager,* a set of spares considered to be essential as part of the *Works*.

    b) The *Contractor* submits, on completion of the design, a detailed listing of the recommended spares and prices for the *Project Manager's* acceptance to comply with the requirement.

    c) The prices quoted include for packing, delivery to and off-loading at site, inspection and testing and adequate protection against corrosion, damage and weathering during transit and storage.

5. Tests and inspections before delivery

    a) The *Contractor* gives at least 72 hours advance notification to the Supervisor or the Authority for inspection/test and hold or witness points, which require their attendance. The *Contractor* confirms readiness for inspection at least 24 hours prior to the test.

    b) The *Contractor* ensures that all work has been fully inspected, accepted and documented prior to requesting any inspection by the Supervisor.

    c) The *Employer* carries out quality inspections at his discretion.

    d) All inspections and testing to be performed in accordance with the Quality Control Procedure developed by the *Contractor.*

    e) The *Employer* ensures that access to the *Contractor's* premises for the purposes of work is granted:

    f) Establishing compliance with the contractual requirements by means of inspections, surveillance and audits.

    g) Witnessing the performance of any tests.

    h) The *Contractor* obtains clearance from the *Employer* or the *Employer's* agent before despatching of the equipment. This factory release inspection does not release the *Contractor* of any of his obligations under the contract.

    i) The Ultrasonic Flowmeter shall not be released for dispatch without the AS MANUFACTURED documentation and drawings accompanying them.

6. Marking Plant and Materials outside the Working Areas.

    a) All equipment to be safely stored as per the OHS Act 85 of 1993

    b) All plant and equipment to be removed from the designated area can only be removed with the permission of the *Contractor* and *Employer.*

7. *Contractor's* Equipment (Including Temporary *Works*).

    a) The *Contractor* is liable for all plant & equipment in the designated area under his control. The *Employer* is not responsible for any loss or damage to the equipment.

3 Configuration and Documentation Management

3.1 Documentation Management

1. General Requirements:

    a) The *Contractor* includes the *Employer's* document number in the title block. This requirement only applies to design documents developed by the *Contractor* and his Sub-*Contractors*. It does not apply to documents developed by manufacturers for equipment and material.

    b) The project name is listed on all documents, including manufacturers' drawings. Tag numbers and equipment names shall be listed on all manufacturers' drawings.

    c) The language of all documentation is in the English language. The units of measure shall be metric.

    d) The *Contractor* retains project design calculations and information for the entire life cycle of the plant and provides these to the *Employer* on prior written notice at any time notwithstanding the expiry or termination of the contract.

2. Document Identification:

    a) The *Contractor* is required to submit the Vendor Document Submission Schedule (VDSS) as per agreed dates with the *Project Manager*. The *Project Manager* shall pre-allocate document numbers on the VDSS if possible and send back to the *Contractor.*

b) The VDSS is revisable, and changes shall be discussed and agreed upon by all parties. Changes in the VDSS can be additional documentation to be submitted, changes in submission dates or corrections in documentation descriptions, document numbers, etc. The *Contractor* shall provide his own document numbering system for the VDSS.

3. Document Submission:

a) All project documents must be submitted to the delegated *Project Manager* with transmittal note according to Project / Plant Specific Technical Documents and Records Management Work Instruction (240-76992014). In order to portray a consistent image it is important that all documents used within the project follow the same standards of layout, style and formatting as described in the Work Instruction.

b) The *Contractor* is required to submit documents as electronic and hard copies, and both copies must be delivered to the *Employer's* Representative with a transmittal note.

c) In addition, the *Contractor* is provided with the following standards which must be adhered to:

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

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

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

4. SharePoint Transmittal

a) The *Contractor* shall submit all documentation to the *Employer* Representative as well as the Project's Documentation Centre in the following media:

I. Electronic copies shall be submitted to *Employers'* Documentation Centre through SharePoint transmittal site that will be provided during contract award.

II. Hard copies shall be submitted to the *Employers'* Representative accompanied by the Transmittal Note.

5. Drawings

    a) The creation, issuing and control of all Engineering Drawings will be in AutoCad and Inventor 2025, in accordance with the latest revision of 240-86973501 (Engineering Drawing Standards – Common Requirements) to be supplied as part of the enquiry documents. An electronic copy of all drawings shall be issued to the *Project Manager.*

    b) All *Contractors* are required to submit electronic drawings in, or any other electronic format shall be accepted. Drawings issued to *Employer* may not be "Write Protected" or encrypted.

    c) The *Contractor* shall supply the *Project Manager* with a complete list of drawings, upon which the *Project Manager* will supply Eskom drawing numbers.

3.2 Configuration Management

1. Plant Coding Allocation

    a) Coding of the design shall be based on the KKS coding system, and the *Project Manager* shall undertake the coding in line with its standards:

        I. 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 and where practical to spare parts list/manuals.

        II. The *Contractor* is required to include allocated coding to the electronic design drawings.

2. Engineering Change Management

    a) All Design change management shall be performed in in line with the Eskom Project Change Management Procedure (240-53114002) and the *Employer* ensures that *Contractor* is provided with latest revisions of this procedure.

    b) Any uncertainty regarding this procedure should be clarified with the *Employer* and clarification updates should be reflected in updated versions of this procedure.

3. Design Review Documentation

a) The *Contractor* conducts design reviews as per the *Contractors* official design review procedure:

I. *Contractor* ensures takes note of the *Employers* Design Review Procedure (240-53113685) and participates in all design reviews as specified by the *Employer.*

II. The *Employer* may “Accept”; “Accept with Comments” or “Rejected”. If required, the *Contractor* makes the necessary revisions on the documentation and ensures acceptance is obtained from *Employer.* The *Contractor* includes these design reviews as part of the schedule and suggests appropriate timing for such reviews.

4. 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:

1. International Standards

a) ISO 9001 – Quality Management Systems.
b) ISO 2859 – Sampling procedures for inspection by attributes.
c) ISO/IEC 82045 – Document management.
d) ISO 5167 – Measurement of fluid flow by means of pressure differential devices.
e) IEC 61511 – Functional safety – Safety instrumented systems for the process industry sector.
f) IEC 61207 – Industrial-process control systems – Methods of evaluating the performance of transmitters.
g) IEC 61010 – Safety requirements for electrical equipment for measurement, control, and laboratory use.
h) IEC 60079 – Explosive atmospheres – Electrical equipment.
i) IEC 81346 – Industrial systems, installations and equipment – Structuring principles and reference designations.
j) IEC 61326 – Electrical equipment for measurement, control and laboratory use – EMC requirements.
k) IEC 61000-5-2 – Electromagnetic compatibility – Earthing and cabling.

l) IEC 61207-1, IEC 61207-2, IEC 61207-3 – Performance evaluation of gas analyzers and related instruments.

m) SANS/IEC 62305 – Protection against lightning.

2. South African National Standards (SANS)

a) SANS 10142-1 – The wiring of premises – Low-voltage installations.

b) SANS 60529 – Degrees of protection provided by enclosures (IP code).

c) SANS 1574 – Performance and test requirements for bus systems.

3. *Employer* Standards and Procedures

a) 240-4332798 – Engineering Policy.

b) 474-34 – Project Engineering Change Procedure.

c) 32-727 - Eskom's SHEQ Policy Standard.

d) 240-53114002 – Engineering Change Management Procedure.

e) 240-53113685 – Design Review Procedure.

f) 240-10520080 – Water Accounting and Management Standard.

g) 240-56356396 – Earthing and Lightning Protection Standard.

h) 240-55714363 – Coal-Fired Power Stations Lighting and Small Power Installation Standard.

i) 240-56227443 – Requirements for Control and Power Cables for Power Stations Standard.

j) 240-76992014 – Project / Plant Specific Technical Documents and Records Management Work Instruction.

k) 240-66920003 – Project Handover Documentation Management Procedure.

l) 240-65459834 – Project Documentation Deliverable Requirement Specification.

m) 240-54179170 – Technical Documentation Classification and Designation Standard.

n) 240-86973501 – Engineering Drawing Standards – Common Requirements.

o) 240-105453648 - Standard for Fossil Fuel Firing Regulations

p) QM-58 – Quality Management System Requirements.

4.1 Authorisation

This document has been seen and accepted by:

Name & Surname	Designation
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4.2 Revisions

Date	Rev.	Compiler	Remarks
July 2025	0	Sibusiso Hlatshwayo	Creation of document

4.3 Development Team

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

- Sibusiso Hlatshwayo
- Thapelo Thaledi

4.4 Acknowledgements

- Amanda Dube
- Thapelo Theledi