

	Template	Generation Engineering
---	-----------------	-------------------------------

Title: Generation Replacement of Fuel Oil Flowmeters Technical Specification	Unique Identifier:	380-137046
	Alternative Reference Number:	21569460-015
	Area of Applicability:	Generation, Engineering
	Documentation Type:	Specification
	Revision:	0
	Total Pages:	17
	Next Review Date:	N/A
	Disclosure Classification:	CONTROLLED DISCLOSURE

CONTENTS

	Page
1. INTRODUCTION	4
2. SUPPORTING CLAUSES	4
2.1 SCOPE	4
2.1.1 Purpose	4
2.1.2 Applicability	4
2.2 NORMATIVE/INFORMATIVE REFERENCES	4
2.2.1 Normative	4
2.2.2 Informative	5
2.3 DEFINITIONS	5
2.3.1 Disclosure Classification	5
2.4 ABBREVIATIONS	5
2.5 ROLES AND RESPONSIBILITIES	6
2.6 PROCESS FOR MONITORING	6
2.7 RELATED/SUPPORTING DOCUMENTS	6
3. TECHNICAL SPECIFICATION	6
3.1 TECHNICAL REQUIREMENTS	6
3.1.1 Details of Plant	7
3.1.2 Scope of Works	7
3.1.2.1 Additional Information	8
3.1.2.1.1 Fuel Oil flowmeters	8
3.1.2.2 Level Measurement	9
3.1.2.3 Monitoring System	9
3.1.3 Design Requirements	11
3.1.3.1 Flowmeters	11
3.1.3.2 Level Instrument	11
3.1.3.3 Cabling	11
3.1.6 Alarm and Trends	12
3.3.2 Operating Specification	12
3.1.3 Plant Schematic Display	12
3.1.4 Interfaces	13
3.1.5 Manufacturing Requirements	13
3.1.6 Construction Requirements	13
3.1.7 Commissioning Requirements	13
3.1.8 Testing Requirements	14
3.1.9 Operating Requirements	14
3.1.10 Maintenance Requirements	14
3.1.11 Handover Requirements	14
3.1.12 Decommissioning Requirements	15
3.2 GENERAL REQUIREMENTS	15
3.2.1 Health & Safety requirements	15
3.2.2 Quality requirements	15
3.2.3 Environmental requirements	15
3.2.3.1 Earthing	15
3.2.4 Documentation requirements	15
3.2.5 Communication requirements	16
3.2.6 Other requirements (Process/Legislative/Contractual)	16
4. AUTHORISATION	16
5. REVISIONS	17
6. DEVELOPMENT TEAM	17
7. ACKNOWLEDGEMENTS	17

CONTROLLED DISCLOSURE

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

CONTROLLED DISCLOSURE

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

1. INTRODUCTION

This technical specification document covers the minimum requirements for the engineering change for the Replacement of Fuel Oil Flowmeters at Hendrina Power Station. It sets to outline the technical requirements identified by the employer for the contractor to implement. This project is also part of the FOMS (Fuel OIL Management System) and the FOMS requirements should addressed in this project. The project will be implemented on units 2, 4, 5, 6, 7, and 10 and on the outside plant on the offloading bay.

2. SUPPORTING CLAUSES

2.1 SCOPE

This document provides an overview of the engineering processes followed and the system specifications overview and status at the end of the technical specification phase. This document includes the results of technical assessments to determine the ability of the design to meet technical requirements, technical risks and lessons learned during the specification process.

This document does not provide design cost, schedule, or other project management type information, instead it provides the scope of the project with respect to the full usage of the proposed system usage.

2.1.1 Purpose

This document summarises the technical specification for the replacement of the fuel oil flow meters at Hendrina Power Station Units 2, 4, 5, 6, 7, 10, and on both North and South fuel oil offloading bays on the outside plant. The specification will form part of the contractual documents to help minimise project risks and provide support should there be any legal dispute between the employer and the prospective contractor.

2.1.2 Applicability

This document is applicable to Hendrina Power Station North and South fuel oil plants.

2.2 NORMATIVE/INFORMATIVE REFERENCES

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

2.2.1 Normative

- [1] HSPPO/246 R18 – Fossil Fuel Firing Regulations Units 1-10 (Hendrina Specific)
- [2] 240-105453648 Rev1 – Fossil Fuel Firing Regulations
- [3] 240-53114026 – Project Engineering Change Procedure
- [4] 240-56355754: Field Instrument Installation Standard
- [5] 240-56355815: Control & Instrument Installation field enclosures and Cable Termination

CONTROLLED DISCLOSURE

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

- [6] HSPPC001 Fuel Oil Management Work Instruction
- [7] 240-83570075: Group IT Business Requirement Specification (BRS)
- [8] 240-70413291: Specification for Electrical Terminal Blocks.
- [9] 240-64636794: for Wiring and Cable marking in Substations

2.2.2 Informative

- [10] 240-53114002 – Engineering Change Management Procedure
- [11] HSPPIN/003 - Waste Management Procedure.

2.3 DEFINITIONS

Definition	Description
Accuracy	The combined error of nonlinearity, repeatability and hysteresis expressed as a percent of full-scale output.
Coriolis flow meters	Flow meters that measure real mass flow and are not dependent of physical properties of the fluid
Fuel Oil Flow Meter	An instrument used to measure the amount of fuel oil passing through it
Obsolete	No longer supported by the OEM, having been replaced by something newer and better, more cost effective or profitable
Oil burner	A device which provides ignition energy for a main fuel burner.

2.3.1 Disclosure Classification

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

2.4 ABBREVIATIONS

Abbreviation	Description
C&I	Control and Instrumentation
DCS	Distributed Control System
PLC	Programmable Logic Controller
SCADA	Supervisory Control and Data Acquisition
EAL	Eskom Academy of Learning
FFFR	Fossil Fuel Firing Regulations
HMI	Human Interface Machine
IP	Ingress Protection
PLCM	Project Life Cycle Model
P&ID	Pipe and Instrumentation Diagram

CONTROLLED DISCLOSURE

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

Abbreviation	Description
C&I	Control and Instrumentation
BRS	Business Requirement Specification
FOMS	Fuel Oil Management System
OEM	Original Equipment Manufacture

2.5 ROLES AND RESPONSIBILITIES

C&I Maintenance and engineering departments- Provide all C&I technical information required to define all the specification that may be required by the contractor.

Auxiliary Engineering- Provides all technical information for the contractor regarding the mechanical specification such as tank specifications, pipework information, etc.

Boiler Engineering- Provides Unitised flowmeter information such as pipe specifications, and flowmeter information including fuel oil specification.

2.6 PROCESS FOR MONITORING

ECM process has been utilised as a guide to conduct the engineering change at hand for all the previous design phases. The ECM process will continue to be utilised until project completion as a guiding procedure.

2.7 RELATED/SUPPORTING DOCUMENTS

Specification for Fuel Oils for Coal Fired Boilers Standards

3. TECHNICAL SPECIFICATION

3.1 TECHNICAL REQUIREMENTS

CONTROLLED DISCLOSURE

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

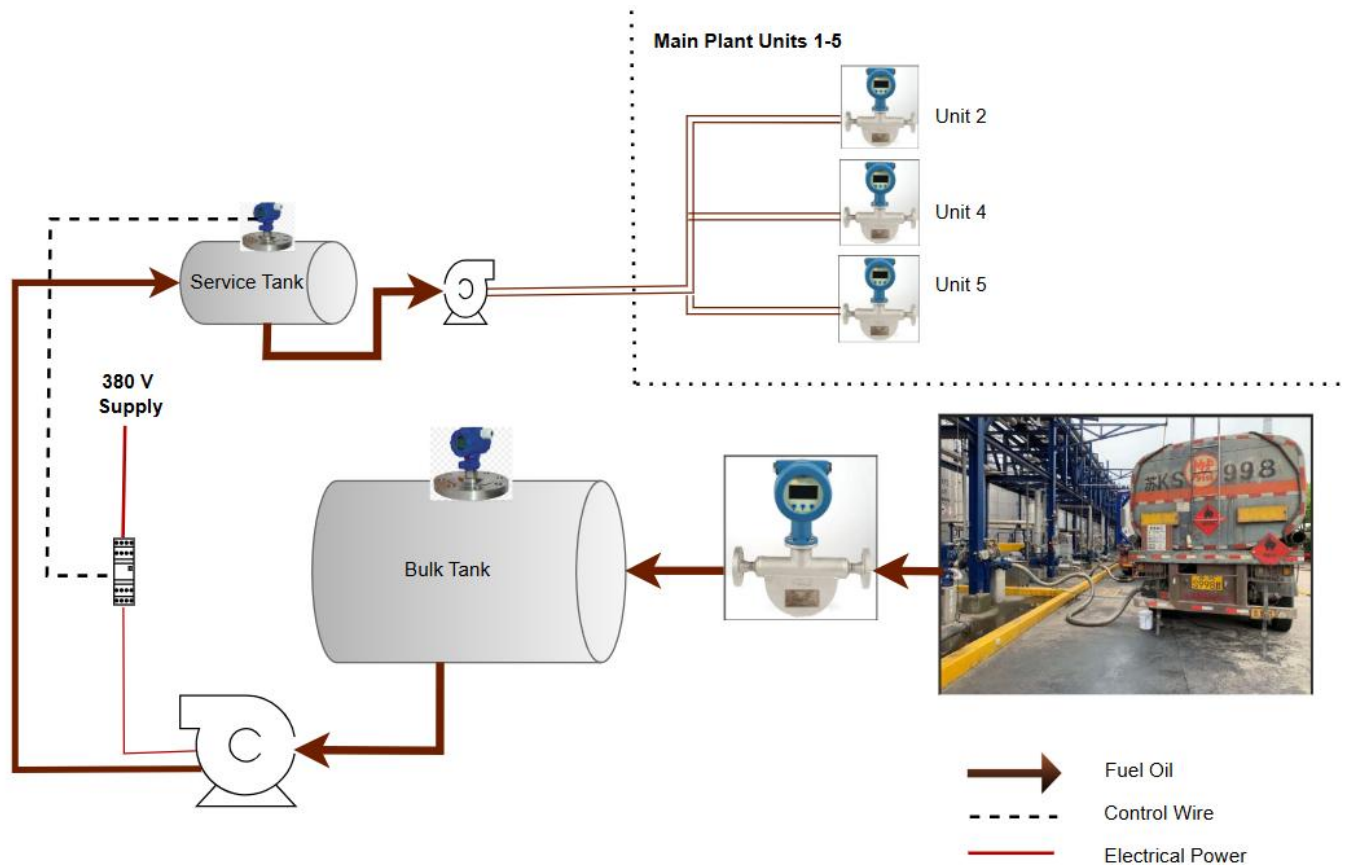


Figure 1: Proposed Fuel Oil System

3.1.1 Details of Plant

The existing infrastructure will be utilised with minimal modifications to fit in the installation of the new Coriolis flow meters. The process will be through the relevant stakeholders and the contractor which will be appointed for the installation. Work is to be carried out on all fuel oil flowmeters, fuel oil tanks, and bulk fuel oil pump motors that exist in the plant with minimal mechanical and electrical modifications. A contract will be awarded, and the appointed contractor shall design, install, and provide operating and maintenance guides as per OEM requirements.

3.1.2 Scope of Works

The procurement strategy for the project will be through an open tender process. The appointed contractor will be expected to:

- Provide a detail design as per customer requirements.

CONTROLLED DISCLOSURE

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

- Remove the old equipment from the plant and hand to the employer for scrapping.
- Supply and install the Coriolis mass oil flow meters and all required material as per approved design.
- Supply and install all required equipment for level monitoring of the fuel oil.
- Test and commission the system in the plant.
- Train Eskom personnel on operating and maintenance of the system.
- Provide maintenance strategy for the flowmeters and level instruments.
- Provide drawings.
- Provide manuals and all relevant documentation.

The proposed change entails an installation of a Fuel Oil management system. The following are some of the requirements for the system:

- Fuel oil consumption must be measured on all Hendrina Power station units.
- Fuel oil delivery (at the off-loading bay) must be measured, i.e fuel oil delivered by the truck must be monitored.
- The amount of fuel oil in the bulk storage tanks and service tanks must be known, i.e level measurement of fuel oil in the tanks.
- A control panel shall be installed at the Fuel oil plant for monitoring of the fuel oil system parameters.
- The Flowmeters at the units shall transmit a 4-20 mA signal which will interface with each unit's DCS for monitoring and alarming at the control room.
- Fuel Oil Level must be controlled at the service tanks:
 - A high-level switch must stop the supply pumps if high level is reached.

3.1.2.1 Additional Information

3.1.2.1.1 Fuel Oil flowmeters

Old and obsolete fuel oil flowmeters are still in the plant and non-operational. The new flowmeters shall be installed where the old flowmeters will be removed from. During design, care shall be taken to ensure that the new flowmeters fit perfectly in-line with the existing fuel oil pipes/lines. The current obsolete fuel oil flowmeters must be replaced with the Coriolis mass flow meters as per the table below:

Plant Area	Quantity
Unit 2	1
Unit 4	1
Unit 5	1
Unit 6	2
Unit 7	2
Unit 10	2
North bulk fuel oil pumphouse	1
South bulk fuel oil pumphouse	1

CONTROLLED DISCLOSURE

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

Total	11
--------------	-----------

3.1.2.2 Level Measurement

Level measurements on the fuel oil storage tanks are required for fuel oil management. The following shall be adhered to or considered during the design phase:

- Replace level measurement instruments on both North and South Fuel Oil tanks as per table below.
- The level measurement must have a high-level alarm and trip to prevent fuel oil overflow and low-level alarm and trip to prevent fuel oil pump possibly cavitating.
- Each tank level capacity is 100 000 Liters.
- Level transmitters should have an IP67 rating.

Plant Area	Quantity
North bulk fuel oil tanks	4
North Service tanks	2
South bulk fuel oil tanks	4
South Service tanks	2
Total	12

3.1.2.3 Monitoring System

The Fuel Oil System has North and South Fuel oil tanks with off-loading bays, this is located on the outside plant. The tanks and off-loading fuel oil parameters shall be monitored locally on a panel. Locally, the panel shall monitor all available local parameters including off-loading fuel oil flow (L/sec), quantity (Litres), Tank levels (Meters) with graphical representation, and fuel oil Consumption that is being dispatched into the units in real time (L/sec). Locally, the following requirements shall be adhered to:

- Replace/ upgrade the Telemetry (local panel) fuel oil tank monitoring system with a newer monitoring system at both the North and South fuel oil systems.
- The system must be a Human Machine Interface (HMI).

CONTROLLED DISCLOSURE

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

Additionally, Fuel oil flow shall be monitored on the DCS of each unit with relevant alarms for flow. This shall be achieved by utilising a 4-20 mA output signal to the DCS for the fuel oil flow parameters.



Figure 2: Units 6, 7, and 10 flow meters to be replaced



Figure 3: Unit 2, 4, and 5 flow meters to be replaced

CONTROLLED DISCLOSURE

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

3.1.3 Design Requirements

Electrical power shall be provided for the flowmeters as the meters require both electrical power and communications cables to meet system requirements. Temperature and pressure compensation must be considered as this affects the fuel oil viscosity which affects the flow measurement accuracy. There shall be a dedicated auxiliary power supply distribution module with a suitably sized incomer isolator and suitably sized load MCBs per piece of equipment.

3.1.3.1 Flowmeters

- Off-loading flowmeters should have range from 0-200 L/s
- Unitised flowmeters should have range from 0-500 L/s
- Operating Temperature of above 100 °C
- Flowmeter must be able to handle Operating Pressure of 5 MPa
- The flowmeter housing shall be ingress protected IP65.
- Tank level shall be displayed in both meters and in kilograms
- Material shall be at minimum carbon steel

3.1.3.2 Level Instrument

- Shall be 24V DC with 4-20 mA output.
- Shall have an accuracy +/- 0.5 %
- Instrument shall be protected from ingress with minimum IP67 rating housing.
- Instrument shall be able to measure accurately, the level at 0mm and at full level of the tank.

3.1.3.3 Cabling.

- On units 1-5, new 4-20mA transmission cables must be installed.
- On units 6-10, existing cables which are still in good condition must be used. Tear or brittle cables shall be replaced with new cabling.
- On North and South bulk fuel oil plants, new 4-20mA transmission cables must be installed.
- All wiring shall meet the requirements of Eskom's Standard 240-64636794 for Wiring and Cable marking in Substations.
- Terminal blocks must be in accordance with Eskom standard 240-70413291, Specification for Electrical Terminal Blocks.
- All wiring shall be concealed inside trunking or conduit. No exposed wiring will be accepted except at sites where suitable cable trays are installed.
- Cabling in roof or floor voids shall be installed in cable trays.
- Cabling in trays shall be tied off at a maximum of 1.5m interval.

CONTROLLED DISCLOSURE

- Cabling in manholes shall be kept above the manhole floor level to avoid water contact.
- Cables shall be handled with care and not pulled with excessive force that may cause internal damage.

3.3.1.5 Control System.

- The existing FUM Modules shall be utilised.
- Unitised flow meters should be interfaced into the existing DCS.
- A local HMI screen should be installed in the outside plant and the North and South fuel oil plants flow meters should be interfaced to this HMI system.
- Logic design should be done as per Siemens Teleperm XP.

3.3.1.6 Alarm and Trends

- High fuel oil supply usage should sound an alarm.
- Low flow cut-off of the Fuel Oil supply and/or return Coriolis meter should sound an alarm.
- Faulty fuel oil signal should sound an alarm.
- Failure of Fuel Oil Supply and/or Return Coriolis meter sound an alarm.
- Whenever there is no fuel oil usage on a specific unit, but the operator screen indicates fuel oil flow, an alarm should sound on the operator screen.
- Alarm and event logs to be configured in the DCS, HMI and Plant Historian to have all the information from the alarm and event displays relating to the fuel oil usage.
- Trending of fuel oil usage must be available on operating screens, HMI, and historian.

3.3.2 Operating Specification

- Fuel oil consumption should be indicated on the DCS and HMI.
- Fuel oil high consumption, instruments faults and failures should be alarmed.
- Outside plant offloading bay and fuel oil consumption and tank level indications should be indicated on an HMI screen for monitoring.

3.1.3 Plant Schematic Display

- Display all the tanks and their tank mass inventory levels in metric tonnes.
- Tank alarm levels relating to high-high, high, and low levels indicated alongside (Bar display with associated markers).

CONTROLLED DISCLOSURE

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

- Where functionality exist, that the content of the tank or bar is to change colour according to the associated alarm priority.
- Tank measurements to indicate healthy, disturbed, or simulated status, correlating to the associated alarm and event generation displays (and logs) content.
- Display the instantaneous usage mass flow signals, the separate supply and return flow rates in metric tonnes.
- When mass flow supply, mass flow return or mass usage signals are healthy, in alarm, disturbed or simulated status it is clearly indicated on the display. The statuses are reflected in alarm and event generation displays and logs.
- The quality and inhibit tag statuses are indicated per Coriolis mass flow meter.

3.1.4 Interfaces

- Flow meters at the Units to be interfaced with each Unit DCS.

3.1.5 Manufacturing Requirements

All system components manufactured must meet the following at minimum requirements:

- A182 - A182/A182M-99 - Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
- Flange connection: DN50 (2") with connection size DN50 (2") Weld neck flange EN1092 – 1 B1 pressure PN40 AISI 316L.
- Bulk fuel oil plant north: Pipe Diameter (ID): 150mm, material: carbon steel, pressure rating: 40bar.
- Bulk fuel oil plant south: Pipe Diameter (ID): 200mm, material: carbon steel, pressure rating: 40bar.
- Clear indication by arrow must be available on the flowmeter body. This ensures that installation of the flowmeter is in the direction of the fluid flow.

3.1.6 Construction Requirements

Due to system constraints, no modifications shall be done in the plant/on site. All equipment shall be prepared upfront for the day of installation.

Installations of fuel oil flowmeters shall be done during maintenance opportunities on each unit. Bypass lines shall be used for fuel oil truck offloading during flowmeter installation on the bulk tanks fuel oil pumphouses.

Bulk tanks are tilted as per base design, this was to ensure moisture is removed from the tank. Therefore, a tilt angle shall be established to account for the tilt angle for accurate level measurement for level monitoring of the fuel oil in the bulk tank. All instruments installed shall be have non corrosive properties and shall be able handle high operating pressures and temperatures.

3.1.7 Commissioning Requirements

Commissioning of the System includes adjusting all necessary settings to ensure that the installation meets all the functional requirements.

CONTROLLED DISCLOSURE

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

The main truck off-loading line shall be bypassed during the period of offloading flowmeter installation. Operation of isolating valves shall be ensured to be sufficient prior to the installation. Ensure isolating valves are working sufficiently and blanking of the line shall be utilised if necessary.

3.1.8 Testing Requirements

The appointed contractor will be expected to:

- Submit calibration certificates for all the flow meters before installation.
- Submit calibration certificate for all the tank level transmitters/switches before installation.
- Install and commission the system.
- Attend to any defects that may rise during the commissioning stage and as per warranty guarantees.
- Test the whole system operation by simulating parameters to ensure system operation.
- Verify DCS alarms that shall be installed

3.1.9 Operating Requirements

As part of the requirements, the appointed contractor shall train all operating personnel on the system operations. Furthermore, all operating documentation required for the system shall be submitted.

3.1.10 Maintenance Requirements

- Comprehensive training should be arranged for all maintenance personnel on how to work with the system and its components.
- Clear boundaries should be established to mark the limits of responsibility when different departments are required to execute work on the system.
- Spares for the new system should be catalogued and made stock items before the project is handed over to the maintenance department.
- Maintenance strategy to be updated to include the newly installed components before handover to the maintenance department.
- Loop drawings and P&ID drawings to be updated to reflect the as build plant status before hand over to the maintenance department.
- Quality inspection plans to be included in the hand over package to the maintenance department.

3.1.11 Handover Requirements

- A comprehensive training shall be provided to all identified Eskom personnel. OEM maintenance strategies shall be provided.
- Maintenance strategy to be updated to include the newly installed components before handover.
- Special tools required for maintenance should be supplied as part of the project.
- Clear boundaries should be established to mark the limits of responsibility when different departments are required to execute work on the system.

CONTROLLED DISCLOSURE

- Spares for the new system should be catalogued and made stock item before the project is handed over to Eskom.
- Loop drawings and P&ID drawings to be updated to reflect as build plant status before hand over.

3.1.12 Decommissioning Requirements

All instruments to be upgraded are non-functional. Care should be taken when the old equipment is uninstalled from the plant for the new instruments.

The contractor will be responsible for removal of the old equipment as part of the decommissioning scope. The removed equipment will be handed to the employer.

3.2 GENERAL REQUIREMENTS

3.2.1 Health & Safety requirements

Fire safety requirements at minimum shall meet the following:

- Cutting and welding sparks may be present, therefore all the work done must adhere to the plant safety regulations and hot work permit requirements.
- All instruments supplied and installed must be Ex rated for zone 2 explosion group IIA.

3.2.2 Quality requirements

Quality Inspection Documentation shall be generated for the design, installation, commissioning, and testing of the fuel oil system. The requirements on the quality inspection shall include but not limited to:

- Witnessing by the Eskom project manager and stakeholders during installation.
- Hold points for testing and commissioning of the system.

3.2.3 Environmental requirements

Signal, voltage and electromagnetic radiation levels in readily accessible areas shall not be dangerous. System and its components shall comply with requirements of SANS 61000-1-2.

3.2.3.1 Earthing

The Earthing of the system shall comply with Eskom's earthing standards below:

240 – 56872313 – Radio Station Earthing and Bonding.

240 – 56356396 – Earthing and Lightning Protection Standard.

3.2.4 Documentation requirements

On completion of the installation the appointed contractor(s) shall provide Eskom with documentation that includes but not limited to:

- Detailed as-built drawings of the installation including all electrical, electronic, and mechanical diagrams necessary for operation and maintenance of the system.
- Manuals and training for the Fuel oil flowmeter system.
- Manufacturer's technical and maintenance specifications for each item of equipment installed.
- All documents shall be provided in soft and hard copy signed copies on signed original copies. The hard copy shall be an original copy and be fully signed. Soft copies shall be provided in files in 'dgn' MicroStation format. Databooks/ equipment specifications are also required.

CONTROLLED DISCLOSURE

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

3.2.5 Communication requirements

Detailed design from the appointed contractor will be reviewed and accepted by Eskom Engineer.

3.2.6 Other requirements (Process/Legislative/Contractual)

- To ensure quality workmanship and sound installation practice, it is imperative that the contractor adheres to the specifications and standards supplied by Eskom. Should there be any uncertainty with regards to the specifications; the contractor is to contact the Eskom employee responsible for the project for guidance.
- Only contractors with experience in Fuel oil monitoring systems shall do installations. To this end the tenderer shall provide a CV of relevant experience and references.
- All installers shall adhere to the OHS Act (Occupational Health and Safety Act) when installing the system. Contractors and sub-contractors shall meet the requirements specified by Eskom Health and Safety specifications
- All equipment shall have a mechanical earth connected to the site earth according to Eskom standards.
- All equipment shall be labelled in accordance with the design diagrams, with durable, weather resistant labels.
- Cable and wiring marking shall be in accordance with Eskom standard 240-64636794, Standard for Wiring and Cable Marking in Substations.
- All cables and wires shall be marked with a unique identification, at all terminations, in accordance with the cabling and wiring diagrams supplied.

4. AUTHORISATION

This document has been seen and accepted by:

Name & Surname	Designation

CONTROLLED DISCLOSURE

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

5. REVISIONS

Date	Rev.	Compiler	Remarks
April 2025	0		Technical Specification generated for fuel oil flowmeter installation

6. DEVELOPMENT TEAM

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

7. ACKNOWLEDGEMENTS

CONTROLLED DISCLOSURE

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