

 Eskom	Specification	Peaking
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Title: **Technical Specification for a Fixed Hydrogen Gas Detection System for Drakensberg and Ingula Power Station Battery Rooms**

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1. INTRODUCTION

Drakensberg Pumped Storage Power Station has a nominal generating capacity of 1000MW which is produced from four 250MW Francis type vertical turbine generator sets. The power station is situated underground, in the Northern Drakensberg Mountains in KwaZulu-Natal, approximately 30km from the town of Bergville. Its four units were commissioned between 1979 and 1981.

The GPS Coordinates for the site are as follows:

-28.56468 (Latitude), 29.08408 (Longitude)

Ingula Pumped Storage Power Station has a nominal generating capacity of 1332MW which is produced from four 333MW Francis type vertical turbine generator sets. The power station is situated underground, in the Northern Ingula Mountains in KwaZulu-Natal, approximately 50km from the town of Ladysmith.

The GPS Coordinates for the site are as follows:

-28.28078 (Latitude), 29.58795 (Longitude)

Drakensberg and Ingula Power Stations contain battery rooms that houses lead acid batteries which provide backup power to essential power station equipment and ancillaries. The respective two battery rooms have been classified as Zone 2 according to *SANS 10108 "The classification of hazardous locations and the selection of equipment for use in such locations"*. The Drakensberg Pumped Storage Scheme battery room houses lead acid batteries manufactured by First National Batteries (Faure-x) FHP21, FCP13, YHP21 respectively consisting of 304 cells, with a cell capacity of 1310 Ah, 192 Ah, 1072 Ah respectively. The Ingula Pumped Storage Scheme battery room houses lead acid batteries manufactured by Hoppecke VM 2 consisting of 212 cells, with a cell capacity of 1920 Ah.

In 2024, a STARR audit revealed that the battery rooms at both stations do not meet the requirements as detailed in the Eskom Battery Room Standard 240-56177186. A recommendation was made for the installation of a hydrogen gas detection system in both battery rooms respectively. The function of the hydrogen detection system is to continuously monitor and detect the percentage of hydrogen gas in the battery room regardless of the background surrounding gas.

This document details the technical specifications for the design, manufacture, supply, delivery, installation, testing and commissioning of fully functional fixed hydrogen detection systems for Drakensberg and Ingula Power Station Battery Rooms.

2. SUPPORTING CLAUSES

2.1 SCOPE

This document covers the technical specifications for the design, manufacture, supply, delivery, installation, testing and commissioning of fully functional fixed hydrogen detection systems for Drakensberg and Ingula Power Station Battery Rooms.

2.1.1 Purpose

The purpose of this document is to detail scope of the *Works* and *Employer's* technical requirements for the design, manufacture, supply, delivery, installation, testing and commissioning of fully functional fixed hydrogen detection systems for Drakensberg and Ingula Power Station Battery Rooms.

2.1.2 Applicability

The requirements defined in this document apply to the whole of the *Works* for the fixed hydrogen gas detection systems for Drakensberg and Ingula Power Stations Battery Rooms.

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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] OHS Act Occupational Health and Safety Act No. 85 of 1993
- [2] ISO 9001 Quality Management Systems
- [3] 240-53114002 Engineering Change Management Procedure
- [4] 240-105658000 Supplier Contract Quality Requirements Specification
- [5] 240-56737448 Fire Detection and Life Safety Design Standard
- [6] 240-62196227 Eskom Life-saving Rules Directive 23-421
- [7] 240-150642762 Generation Plant Safety Regulations
- [8] 240-56227413 Hydrogen System Standard
- [9] 240-56177186 Battery Room Standard
- [10] 240-56355754 Field Equipment Installation Standard
- [11] 240-100656734 Eskom Work Package Template
- [12] 240-86973501 Engineering drawing standard – common requirement
- [13] 240-72344727 C&I Control System Architecture Guideline
- [14] 240-56227589 List of Approved Electronic Devices to be used on Eskom Power Stations Standard
- [15] 240-56356396 Earthing and Lightning Protection Standard
- [16] 240-56355815 Junction Boxes and Cable Termination Standard
- [17] 200-16714 Procedure – Commissioning Procedure
- [18] 200-4190 Application for KKS Coding

2.2.2 Informative

- [19] ARP 0108:2018 Guide to the Regulatory Requirements for Explosion-protected Apparatus
- [20] SANS 10108:2023 The classification of hazardous locations and the selection of equipment for use in such locations
- [21] SANS 10086-2:2013 The installation, inspection and maintenance of equipment used in explosive atmospheres Part 2: Electrical equipment installed underground in mines
- [22] SANS 60079-25:2020 Explosive Atmosphere Part 25: Intrinsically safe electrical systems
- [23] SANS 60079-29-1 Explosive atmospheres Part 29-1: Gas detectors - Performance requirements of detectors for flammable gases.
- [24] SANS 60079-29-2 Explosive atmospheres Part 29-2: Gas detectors - Selection, installation, use and maintenance of detectors for flammable gases and oxygen
- [25] SANS 60079-29-3 Explosive atmospheres - Part 29-3: Gas detectors - Guidance on functional safety of fixed gas detection systems.
- [26] SANS 60079-29-4 Explosive atmospheres - Part 29-4: Gas detectors - Performance requirements of open path detectors for flammable gases

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- [27] SANS 60079-14:2014 Explosive atmospheres Part 14: Electrical installations design, selection and erection
- [28] SANS 10139:2021 Code of practice for design, installation, commissioning and maintenance of fire detection and alarm systems in non-domestic premises.
- [29] SANS 50054-10 Fire detection and fire alarm systems
- [30] SANS 7240-16:2008 Sound system control and indicating equipment
- [31] SANS 10142-1 The Wiring of Premises, Part 1 – Low-Voltage Installations
- [32] 31A/5154 Stakeholder Requirements Definition for the installation of a Hydrogen (H₂) gas detection system for the Battery rooms at Drakensberg and Ingula Pumped Storage Scheme
- [33] 31A/4981 Ingula PS Battery Room Hydrogen Detection Assessment Report
- [34] 31A/4981 Drakensberg Battery Room H₂ Detection Investigation Report
- [35] 0.48/3216 Drakensberg Battery Room Layout Drawing
- [36] 0.83/24 102 Sheet 4 Ingula Battery Room Layout Drawing

2.2.3 Disclosure Classification

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

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3. DESCRIPTION OF THE WORKS

3.1 Executive overview

The *Works* make provision for the design, manufacture, supply, delivery to the site, installation, testing and commissioning of the complete, fully functional and fully integrated solutions at Drakensberg and Ingula Pumped Storage Schemes that consists of the following:

- A Fixed Hydrogen Detection System for the Drakensberg Power Station Battery Room.
- A Fixed Hydrogen Detection System for the Ingula Power Station Battery Room.

Drakensberg Pumped Storage Power Station has a nominal generating capacity of 1000MW which is produced from four 250MW Francis type vertical turbine generator sets. The power station is situated underground, in the Northern Drakensberg Mountains in KwaZulu-Natal, approximately 30km from the town of Bergville. Its four units were commissioned between 1979 and 1981.

The GPS Coordinates for the site are as follows:

-28.56468 (Latitude), 29.08408 (Longitude)

Ingula Pumped Storage Power Station has a nominal generating capacity of 1332MW which is produced from four 333MW Francis type vertical turbine generator sets. The power station is situated underground, in the Northern Ingula Mountains in KwaZulu-Natal, approximately 50km from the town of Ladysmith.

The GPS Coordinates for the site are as follows:

-28.28078 (Latitude), 29.58795 (Longitude)

3.2 Employer's objectives and purpose of the works

3.2.1 Purpose of the Works

The purpose of the *works* is to ensure that the battery rooms at Drakensberg and Ingula Power Stations have fully functional fixed hydrogen detection systems to detect and alert upon release of hydrogen and prevent an explosive atmosphere from being generated.

3.2.2 Employer's objective

The *Employer's* objective is to equip the battery rooms with a means of hydrogen detection and alarming for the sites by installing fixed hydrogen detection systems in the battery rooms at Drakensberg and Ingula Power Stations. The new fully functional systems shall comply with all relevant battery room hydrogen detection safety standards and regulations.

3.2.3 Contractor's scope of supply

The scope of supply includes, but is not limited to the following:

- a) Design, manufacture, transport and delivery to site, offloading and installation, testing and commissioning of a fully functional hydrogen detection system for the battery room at Drakensberg Power Station, consisting as a minimum of:
 - Explosion-Proof Fixed Point Type Hydrogen Detectors

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- Explosion-Proof Transmitters
 - Hydrogen Detection Controller
 - Audible and Visual Alarm Notification Devices
 - 24V DC Power Supply with Battery Back-up
 - Bosal Conduit
 - Fire Alarm Cabling
 - Power Supply Cabling
 - Comms Module & Interface Cabling
 - Interface Modules
 - Isolator/Zener Barrier
- b) Design, manufacture, transport and delivery to site, offloading and installation, testing and commissioning of a fully functional hydrogen detection system for the battery room at Ingula Power Station, consisting as a minimum of:
- Explosion-Proof Fixed Point Type Hydrogen Detectors
 - Explosion-Proof Transmitters
 - Hydrogen Detection Controller
 - Audible and Visual Alarm Notification Devices
 - 24V DC Power Supply with Battery Back-up
 - Bosal Conduit
 - Fire Alarm Cabling
 - Power Supply Cabling
 - Comms Module & Interface Cabling
 - Interface Modules
 - Isolator/Zener Barrier
- c) Provide all technical documentation (drawings, manuals, other documentation, etc.).
- d) Provide detailed fault-finding guides of the Hydrogen Detection Systems that includes:
- All of the different types of faults
 - The indications relating to the faults
 - Probable causes
 - Corrective action
- e) Provide labelling of equipment.
- f) Provide all necessary equipment, tools & material required to complete the *Works*.
- g) Provide PPE (Personal Protective Equipment) for each *Contractor* person working on site.
- h) Provide supervision and resources to complete the *Works*.
- i) Provide safety file, method statements, installation procedures, check sheets and quality plans prior to installation, allowing for enough time to be reviewed by the *Employer*.

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- j) Provide operating, maintenance and engineering training.
- k) Provide technical data sheets for all equipment.
- l) Provide certification of the equipment.
- m) Cold commission the entire systems.
- n) Hot commission the entire systems.
- o) Provide a maintenance plan for the newly-supplied hydrogen detection systems. The maintenance plan includes procedures for:
 - Condition monitoring
 - Preventative maintenance
- p) Provide a complete list of spares
- q) Provide Operations, Maintenance and Training Manuals.
- r) Provide As-Built Drawings.
- s) Provide testing equipment.
- t) Provide Training for Operations and Maintenance Personnel.
- u) Provide a Certificate of Compliance (COC) after installation of the Hydrogen Detection System

3.2.4 Contractor's scope of work

The scope of work includes, but is not limited to the following:

- Transportation of hydrogen detection equipment, tools, materials, and consumables required for the installation of the *works*.
- Loading and offloading of the equipment, tools, and materials.
- Installation of the hydrogen detection system.
- Provide integration of the Hydrogen Detection System with the following systems:
 - a. Stations Fire Alarm System
 - i. This role requires the design of the following:
 - The integration of all hardwired signals between the Hydrogen Detection Controller and the existing Aritech FP2000 Fire Alarm Panel (for Drakensberg) and Ziton ZP3 Fire Alarm Panel (for Ingula).
 - The integration of all hardwired signals between the 24V DC Power Supply and the existing Aritech FP2000 Fire Alarm Panel (for Drakensberg) and Ziton ZP3 Fire Alarm Panel (for Ingula).
 - Provision is made for integration of the Hydrogen Detection Controller to an I/O module to enable future integration with the Station Fire Alarm System. The Contractor ensures full installation up to the I/O Unit.
 - Provision is made for integration of the fault conditions from the 24V DC Power Supply to an I/O module(s) to enable future integration with the Station Fire Alarm System. The Contractor ensures full installation up to the I/O Unit.
 - b. Uninterruptable Power Supply (UPS) / Essential System

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- i. This role requires the design, testing and commissioning of the following:
 - The integration of the Controller Power Supply with the Essential Supply Services (Inverter) to enable essential supply for the panel.
- c. SCADA System
 - i. This role requires the design, testing and commissioning of the following:
 - The integration of the Hydrogen Detection Controller with the SCADA System to enable display of alarms and fault indications on the SCADA.
 - Commissioning and functional testing of newly installed hydrogen detection system as per OEM requirements.
 - Labelling of installation as per Eskom Labelling Standard.
 - Submission of “As Built” drawings on completion of all works.
 - The verification and certification of the hydrogen detection system installation in the hazardous location is performed by a registered person as Master Installation Electrician in terms of regulation 11(2) of Electrical Installation Regulations in the OHS Act. which shall issue a Certificate of Compliance.

3.3 Interpretation and terminology

The following definitions are used:

Definition	Meaning given to the definition
Equipment group	classification system of electrical apparatus related to the explosive atmosphere for which they are intended to be used in either of the following: a) Group I: electrical equipment for mines susceptible to firedamp; b) Group II (which can be divided into subgroups): electrical equipment for places with an explosive gas atmosphere, other than mines susceptible to firedamp; and c) Group III (which can be divided into subgroups): electrical equipment for places with an explosive dust atmosphere
Explosive atmosphere	mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapour, dust, fibres, or flyings which, after ignition, permits self-sustaining propagation
Hazardous area/ location	Area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment
Hydrogen gas (H ₂)	Under standard conditions, hydrogen is a gas of diatomic molecules with the formula H ₂ , called dihydrogen, or sometimes hydrogen gas, at the right concentration mixed with oxygen can be highly flammable with an

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	almost invisible flame. It can also cause suffocation if it displaces oxygen and frostbite in its liquid state.
Lower explosive limit	Concentration of flammable gas or vapour in air, below which an explosive gas atmosphere will not be formed
System	An integrated set of constituent pieces that are combined in an operational or support environment to accomplish a defined objective. These pieces include people, hardware, software, firmware, information, procedures, facilities, services and other support facets.
Zone 2 (location)	Area in which an explosive gas atmosphere is not likely to occur in normal operation, but if it does occur, will persist for a short period only

The following abbreviations are used:

Abbreviation	Meaning given to the abbreviation
Ah	Amp hour
C&I	Control and Instrumentation
DC	Direct Current
DRP	Drakensberg Pumped Storage Scheme
ECN	Engineering Change Notification
EDWL	Engineering Design Work Lead
FAT	Factory Acceptance Testing
ING	Ingula Pumped Storage Scheme
I/O	Input Output
KKS	Kraftwerk-Kenzeichnungs system
LDE	Lead Discipline Engineer
LEL	Lower Explosive Limit
LFL	Lower Flammable Limit

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m3/s	Cubic meters per second
mm	Millimetres
OHS	Occupational Health and Safety
PQP	Project Quality Plan
SANS	South African National Standards
SCADA	Supervisory Control and Data Acquisition
SRD	Stakeholder Requirements Definition
°C	Degrees Celsius

4. MANAGEMENT AND START UP

4.1 Engineering quality assurance requirements

The *Contractor* submits a detailed Quality Management Programme in accordance with the requirements of Eskom's Supplier Quality Management Specification – 240-105658000: Category 1 as a tender returnable. QMP includes additional activities not covered in the Supplier Quality Management Specification but not limited to:

- Documentation and Detail Design
- Procurement of components
- Inspection and Test plan
- Factory Acceptance Testing
- Installation & Commissioning
- Hand Over to Employer.

4.2 Training workshops and technology transfer

The *Contractor* provides all necessary manuals, drawings, and notes with regards to the operation and maintenance of the hydrogen gas detection system assembly including the control system. An instructor shall be provided by the *Contractor* to train the *Employer's* operations and maintenance personnel on the documents as specified above and on how to operate and perform maintenance on the hydrogen gas detection system assembly and accessories when required. The training takes place at Drakensberg Power Station & Ingula Power Station. All training material to be included in the hand over data pack and proof of competence provided in accordance with the Contractor Quality Management System.

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5. ENGINEERING AND THE *CONTRACTORS* DESIGN

5.1 *EMPLOYERS* DESIGN

The hydrogen detection installation is in line with the *Employer's* standards, engineering, maintenance and operating philosophies and local & international standards.

The *Works* comply with good fire safety engineering practice and standards for battery room hydrogen detection and is designed for the safety and health conditions present at Drakensberg and Ingula Pumped Storage Schemes.

5.1.1 Engineering Philosophy

The *works* entails the installation of fixed hydrogen detection systems in the Battery Rooms. Hydrogen detection is in accordance with the requirements of Eskom and SANS Standards. The type of detection provided is based on the hazards present and the need for early warning detection as determined by analysis. Maintenance of the hydrogen detection system is in accordance with the manufacturer's recommendations and the requirements of Eskom and SANS Standards.

5.1.2 Maintenance Philosophy

The maintenance on the hydrogen detection system in general is low and minimal human intervention is required. The strategy for the system consists of a combination of corrective and preventative type maintenance. The *Employer* implements all maintenance activities that must be performed on pre-determined intervals as well as attend to failures on the system. Maintenance philosophies ensure long-term health and reliability of the system.

5.1.3 Operating Philosophy

The hydrogen detection system is built around a controller that is located outside the battery room. The controller is connected to hydrogen detectors that are strategically positioned in the battery room to monitor the amount of hydrogen released from the batteries and alarm at preset values. Audible and visual alarm notification devices are located both inside and outside of the battery to alert when alarm limits are reached. The hydrogen detectors continually monitor battery room and interact with the controller.

5.2 PARTS OF THE WORKS WHICH THE *CONTRACTOR* IS TO DESIGN

5.2.1 General Design Requirements

- The *Employer's* battery room layout drawings, ventilation system arrangement and information from an on-site engineering study are the basis for the *Contractor's* design of the *Works*.
- The *Contractor* performs a site evaluation to obtain an indication of the room layout, environmental conditions, ventilation arrangements, possible detector location, and location for mounting of detectors, controller and panels.
- Based on the site evaluation and information contained in this Technical Specification, the *Contractor* develops a design of the Hydrogen Detection System that includes calculations, specifications, integration requirements, layout drawings, termination diagrams, procedures, manuals, etc. that is provided to the *Employer* for review and acceptance.

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- The Hydrogen Detection System is listed as a complete system suitable for use in explosive gas atmospheres with Factory Mutual, EX and ATEX Certification and is designed to meet the requirements of:
 - 240-56737448 - Fire Detection and Life Safety Design Standard
 - 240-56227413 - Hydrogen System Standard
 - 240-56177186 - Battery Room Standard
 - ARP 0108:2018 - Guide to the Regulatory Requirements for Explosion-protected Apparatus
 - SANS 10108:2023 - The classification of hazardous locations and the selection of equipment for use in such locations
 - SANS 10086-2:2013 The installation, inspection and maintenance of equipment used in explosive atmospheres Part 2: Electrical equipment installed underground in mines
 - SANS 60079-25:2020 Explosive Atmosphere Part 25: Intrinsically safe electrical systems
 - SANS 60079-29-1 Explosive atmospheres Part 29-1: Gas detectors - Performance requirements of detectors for flammable gases
 - SANS 60079-29-2 Explosive atmospheres Part 29-2: Gas detectors - Selection, installation, use and maintenance of detectors for flammable gases and oxygen
 - SANS 60079-29-3 Explosive atmospheres - Part 29-3: Gas detectors - Guidance on functional safety of fixed gas detection systems
 - SANS 60079-29-4 Explosive atmospheres - Part 29-4: Gas detectors - Performance requirements of open path detectors for flammable gases
 - SANS 60079-14:2014 Explosive atmospheres Part 14: Electrical installations design, selection and erection
 - SANS 10139:2021 Code of practice for design, installation, commissioning and maintenance of fire detection and alarm systems in non-domestic premises
- The hydrogen detection system architecture comprises of the following components:
 - An explosion proof controller that is positioned outside the battery room.
 - A 24V DC Power Supply with battery back-up of not less than 24 hours and the availability to operate for a further period of 1 hour in full alarm mode.
 - The power supply incorporates dry contacts for fault purposes to be interfaced to the Station Fire Alarm Panel.
 - Explosion proof fixed hydrogen detectors consisting of the detector and transmitter.
 - Explosion proof Audible & Visual Alarm Initiating Devices that are installed both internal and external to the battery room.
 - PH 120 Cabling
 - Bosal Conduit
 - Interface Modules enabling future interfacing with the Station Fire Alarm System
 - Fire Retardant Power Supply Cabling
 - Comms Module & Cabling
 - Panel Enclosure (Hub Enclosure) for housing 24V DC Power Supply and I/O Modules
 - Isolator or Zener Barrier

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- The hydrogen detection systems comprise of single fixed-point type detectors connected to a display control unit located outside of the protected area, designed to provide.
 - Indication of gas concentration
 - Audible and visual alarms
 - Outputs for alarming and monitoring
- The hydrogen detectors can detect hydrogen in the 0% to 4% by volume (0% to 100% LEL) in air.
- Given that the Lower Explosive Limit (LEL) for hydrogen is 4% by volume in air, the detection and alarming is set at 1% by volume hydrogen concentration in air, equivalent to 25% of the low explosive limit (LEL).
- The selection and quantity of detectors for the area and spacing is based on the coverage provided per detector in relation to the room area, construction and layout of the room and equipment and the environmental conditions in the room.
- Detectors are located at the highest point where hydrogen build-up can most likely occur.
- Hydrogen detectors, transmitter and controllers are explosion proof and are FM, Ex and ATEX Certified.
- The *Contractor* provides a Declaration of Conformity to demonstrate that the equipment installed in the hazardous location is FM, Ex & ATEX Certified and in conformance with SANS 10086-2:2013, SANS 60079-25:2020, SANS 60079-29-1, SANS 60079-29-2, SANS 60079-29-3, SANS 60079-29-4 and SANS 60079-14:2014.
- Provision is made for protection against loss of main power supply to ensure unrestricted operation of gas detection equipment and alarm functions are guaranteed.
- The hydrogen detection controller must support Modbus TCP/IP protocol to enable integration with the SCADA. The preference for the use of comms cabling is to use CAT6 STP cabling for runs up to 100m and fiber optic cable for runs exceeding 100m. The *Contractor* make provision for interfacing with the *Employer's* SCADA.
- The *Contractor* issues a Certificate of Compliance (CoC) for the hydrogen detection system performed by a registered person as Master Installation Electrician in terms of regulation 11(2) of Electrical Installation Regulations in the OHS Act.

5.2.1.1 Hydrogen Detector

- The Hydrogen detector is explosion proof and of the single fixed-point type.
- For purposes of standardisation and spares interchangeability, consideration must be given to similar devices used elsewhere in Eskom at Arnot Power Station, which use the Catalytic Sensor Model CGS that is compatible with FlexVu Model UD10 and Transmitter Model 505.

5.2.1.2 Hydrogen Transmitter

- The Hydrogen detection transmitter is explosion proof.
- For purposes of standardisation and spare interchangeability, consideration must be given to similar devices used elsewhere in Eskom at Arnot Power Station, which use the Transmitter Model 505 that is compatible with Controller FlexVu Model UD10.

5.2.1.3 Hydrogen Detection Controller

- The Hydrogen detection controller is explosion proof.

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- For purposes of standardisation and spare interchangeability, consideration must be given to similar devices used elsewhere in Eskom at Arnot Power Station, which use the Controller FlexVu Model UD10.
- The controller is visually unobstructed, mounted externally to the battery room at the entrance and is integrated with other associated equipment that are in a panel enclosure (hub enclosure) and the detectors and alarm initiated devices.
- An isolation barrier or Zener barrier is installed externally to the battery room to ensure that all detection and alarm entering the battery room conforms to requirements of **SANS 60079-25:2020 Explosive Atmosphere Part 25: Intrinsically safe electrical systems** and **SANS 60079-14:2014 Explosive atmospheres Part 14: Electrical installations design, selection and erection**.

5.2.1.4 Power Supply

- For purposes of standardisation and spare interchangeability, consideration must be given to similar devices used at Drakensberg, which use the 24V EN54-44 Switch Mode Power Supply Unit Part No.: BF562-5 on the fire protection systems.
- The power supply is sized according to the design of the system.

5.2.1.5 Alarm Initiating Devices

- Visual and audible alarm initiating devices are installed both internal and external to the battery room.
- An isolation barrier or Zener barrier is installed to prevent devices from generating a spark.

5.2.1.6 Cabling

- Fire alarm cabling is of the enhanced fire resistance (PH120 rating) type.
- Fire alarm cabling is sized according to the design of the system.
- Power supply cabling is sized according to the design of the system.
- Power supply cabling is of the flame-retardant type comprising of the blue cable trace colour (Low halogen emission PVC bedding and sheath).
- All cabling is fitted with approved cable and core numbers.
- All cable screens are terminated on standard terminals at one end of the cable, or both ends depending on the design. Cable screens are earthed throughout the loop.

5.2.1.7 Conduit

- Conduits shall comply with SANS 1065 part 1 and 2
 - Screwed metallic conduit and accessories
 - Plain-end metallic conduit and accessories
- Cabling is run in close-ended galvanised mild steel conduit that is in accordance with SANS 32 & 121.

5.2.1.8 Integration

- The *Contractor* is responsible for the integration of hydrogen detection system onto the SCADA. Standard communication protocols are to be used to communicate with the Employer's SCADA system in the following order of preference: (1) IEC 60870-5-104, (2) IEC 61850, (3) Modbus TCP, (4) Modbus RTU.

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- The *Contractor* is responsible for the + integration between the inverter/essential supply and the new hydrogen detection system.
- The *Contractor* is responsible for the supply, installation, terminating and testing of the wiring between the inverter/essential supply and the new hydrogen detection system.
- The *Contractor* is responsible for the supply, installation, terminating and testing of the wiring between the new fire zones and the existing Station Fire Alarm system.
- The *Contractor* is responsible for the integration of hydrogen detection system with the I/O Units that would allow for future integration with the Station Fire Alarm System.
- The *Contractor* is responsible for the integration of 24V DC Power Supply with the I/O Units that would allow for future integration with the Station Fire Alarm System.

5.3 PROCEDURE FOR SUBMISSION AND ACCEPTANCE OF *CONTRACTOR'S* DESIGN

The *Contractor* is made aware that all documents or designs submitted for review to the *Employer* for acceptance requires a process of review as stipulated in the Engineering Change Management Procedure (240-53114002). This process consists of:

- Submission of the tender returnable
- Technical Evaluation
- Contract Award
- Submission of Detail Design by *Contractor*
- *Employer's* Project team reviews
- Updates Detail Design review by *Contractor*
- Detail Design Scope Freeze review
- Procurement of material
- Manufacturing of associated components
- Factory acceptance tests
- Delivery of equipment and associated components to the Power Station
- Implementation.
- Commissioning
- Handover and Final acceptance by the *Employer*

5.4 OTHER REQUIREMENTS OF THE *CONTRACTOR'S* DESIGN

5.4.1 Plant coding and labelling

- Labelling is the responsibility of the *Contractor* and is done by the *Contractor* in accordance with the *Employer's* standard Eskom Standard 240-71432150 [Plant Labelling and Equipment Description Standard].
 - a) Plant codification is done in accordance with the KKS-system as used at Drakensberg Power Station. The *Employer* in conjunction with the *Contractor* does the codification.

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- b) The *Employer* only supplies codification numbers to the *Contractor* where-after the *Contractor* ensures that the labelling is done.
- c) The *Contractor* ensures that the KKS codes are applied in a uniform and consistent way and that all codes allocated are unique.
- d) The *Contractor* is responsible to supply identification labels to provide the *works*.
- e) The *Contractor* ensures that all plant, materials, component and documentation to supply the *works* is codified correctly.
- f) The *Contractor* uses all levels of the coding system to ensure clear identity of signals on the control and indicating equipment. As a minimum, 17 characters are used in the KKS code to uniquely identify each detector signal.

5.4.1.1 General

- The *Contractor* ensures that he is fully familiar with the standards and concepts of the KKS system as applied by the *Employer*.
- The specific KKS codes for each item of the *works*, equipment, components, measuring points, junction boxes, cables etc., appears on all documents, instruction manuals, schedules, drawings, (i.e. zone diagrams, general arrangements, schematic diagrams, cable diagrams etc.), and labels, name plates and instruction plates for the *works*, equipment and components.

5.4.1.2 Labels and cable numbering

- For control and indicating equipment panels, cubicles, and equipment, labels are made according to the *Employer's* Eskom Standard 240-71432150 [Plant Labelling and Equipment Description Standard].
- All control and indicating equipment, and all associated equipment that is located, manipulated or identified is appropriately and clearly labelled.
- Where new cables are installed, a range of cable numbers is issued by the *Employer*. The *Contractor* completes the schedules included in the cable numbering information manual. All existing cable numbers connected to the new equipment are to be included in the new drawings.

5.5 USE OF CONTRACTOR'S DESIGN

All Designs, drawings, specifications, instructions, manuals and other documents created, produced by or on behalf of the *Contractor* for the purposes of Providing the *Works* (collectively, the "*Contractor's* Copyright Documents") and copyright therein and all intellectual property rights relating thereto, are, will be, and will remain the property of the *Contractor*.

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The *Contractor* hereby grants to the *Employer*, with effect from the Contract Date or in the case of documents or other matter not yet in existence, with the effect from the creation thereof (and notwithstanding the Completion or abandonment of the *Works* or termination of this Agreement) an irrevocable, royalty-free, non-exclusive and perpetual licence to use those of the *Contractor's* documents and other matter supplied to the *Employer* under this contract, for any purpose whatsoever connected with the works, including for the purpose of maintenance, operation, construction, retrofit, refurbishment, upgrade, repair or demolition of the works or any parts thereof.

The *Employer* uses the *Contractor's* Copyright Documents and all intellectual property rights relating thereto for the sole purpose of all its needs at Drakensberg Power Station, which includes any *Employer* processes and procedures pertaining to use, maintenance, operation, construction, retrofit, refurbishment, upgrade, repair or demolition of the *Works*.

The *Employer* may copy and submit, without restriction, all documentation to others employed or contracted by the *Employer* who has duly signed a confidentiality agreement with the *Employer*.

The *Contractor* may not use any Copyright Documents (and the copyright therein and all intellectual property rights relating thereto), which are owned by the *Employer* and/or Others and provided to the *Contractor*, for any other purpose than to Provide the *Works*. The *Contractor* may not copy and therefore not retain copies of any such Copyright Documents. At Completion of the whole of the *Works*, or earlier termination, the *Contractor* returns to the *Employer* all such documentation provided to him by the *Employer* and/or Others.

5.6 DESIGN OF EQUIPMENT

Not Applicable.

5.7 EQUIPMENT REQUIRED TO BE INCLUDED IN THE WORKS

- The *Contractor* supplies and delivers all Equipment, Plant and Materials, design drawings, labour, tools, scaffolding, consumables, storage facilities and accommodation and anything deemed necessary to provide the *Works*.
 - a) All measuring and calibration equipment used by the *Contractor* to Provide the *Works* are provided with a SANAS (South African National Accreditation System) Calibration Laboratory test certificate.
 - b) The *Contractor* supplies all special or dedicated test Equipment for testing, commissioning, fault finding and maintenance of the systems as part of the requisite criteria for Completion of the section of the *Works*.
 - c) The *Contractor* furthermore, describes the operation and use of the equipment in the relevant operating, maintenance and training manuals.
 - d) The *Contractor* supplies all special or dedicated test equipment to the *Employer* new, as part of the requisite criteria for Completion of the section of the *Works*.
 - e) The *Contractor* supplies all special tools and Equipment required for the engineering and to Provide the *Works*. All Equipment other than normal hand tools, measuring and test Equipment are considered special tools.

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5.8 AS-BUILT DRAWINGS, OPERATING MANUALS AND MAINTENANCE SCHEDULES

1. All documentation and drawings to comply with the latest Eskom's Classification and Designation of Technical Documentation Standard, 240-54179170; Eskom's Documentation Management Standard, 32-44 Revision 1 and Eskom's Engineering Drawing Standard – Common Requirements, 240-86973501 Revision 3, respectively.
2. All drawings issued to Eskom are in an electronic format, MicroStation (DGN), pdf format and a hardcopy of the original size drawing.
3. The *Contractor* updates all relevant mark-ups or changes to drawings for all defects during the defects period after Completion of the *Works*.
4. All documentation submitted are indicated 'approved' by the *Contractor* and sent to the *Employer* for review and acceptance.
5. The *Employer* reviews all documentation.
6. The *Contractor* uses one relational database drawing system.
7. In conjunction with the electronic DGN copies the *Contractor* also provides a merged set of *.pdf electronic copies upon first issue and each time drawing updates are required. All drawings are signed, and the revisions noted as per *Employer's* specifications.
8. All detail design drawings have the pre-approved title blocks and borders as provided by the *Employer*. The *Employer* provides samples of the pre-approved title blocks to be used by the *Contractor*. The *Contractor* completes the title block information as per drawing standard listed.
9. Graphical symbols are used in accordance with the NRS002 standard.
10. All drawings are submitted to the *Project Manager* for his acceptance.
11. When drawings are submitted to the *Employer* for review, a registered Engineer will approve the drawings and designs. This information by the engineer is included on the drawings (CAD file) by the *Contractor* when the final drawings are submitted.
12. The *Contractor* produces as build drawings within 4 weeks of each site acceptance tests and submits to the *Project Manager* for his acceptance.
13. The *Contractor* produces the following types of drawings:
 - a) General layout drawing of the proposed devices and panels
 - b) General assembly drawing for the hydrogen detection system
 - c) Conduit arrangement drawing

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- d) Layout drawings indicating the position of all components.
 - e) Single line diagram
 - f) Block diagram of the system
 - g) Circuit/Loop Diagram
 - h) Panel internal wiring drawings, including cross referencing and wire numbers
 - i) Cable block diagrams with termination points
 - j) Termination Schedule/Diagram
14. The *Contractor* updates drawings until after the final commissioning of the last unit when the *Employer* has signed off and approved the final “As Built” state of the drawings. After commissioning of each unit, the *Contractor* supplies two sets of drawing hardcopies within two separate files and in A3 format as well as DGN and PDF formats (as indicated above).

6. PROCUREMENT

6.1 PLANT AND MATERIALS

6.1.1 Quality

The *Contractor* procures, fabricates, and delivers all the material necessary to complete the *Works*. All structural and constructional material is new and of the best quality, of the class most suitable for the purpose specified and governed by the following internationally recognised standards: ASME, DIN, BS, IEC, and SANS. Other standards are submitted to the Project Manager for approval. Furthermore, all such materials can withstand the variations of temperature and pressure, arising under working conditions without distortion or deterioration or the setting up of undue strains in any part, such as to affect the efficiency and reliability of the hydrogen gas detection system assembly and its control system.

- The *Contractor* to comply with the requirements of Supplier Quality Management Specification 240-105658000: Category 1.
- The *Contractor* notifies the *Employer* of any proposed changes to the quality management system that will affect the contract quality requirements, prior to implementing such changes.
- The *Contractor* provides a complete solution in the event of specialized work based on the *Contractors* own design and their standard manufacturing product in the *Works* being defective or any components used found to be defective due to manufacturing defects and thus forcing any improvement to be implemented to rectify such inherent defects.
- In case of specialized work based on the *Contractors* own design and their standard manufacturing product in the *Works* being defective or any components used found to be defective due to manufacturing Defects and thus forcing, any improvement to be implemented to rectify such inherent Defects, the cost of such an undertaking would be the responsibility of the *Contractor*.
- Quality control plans (QCP's) to be presented by the *Contractor* for Eskom's acceptance.

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6.1.2 Guarantee Inspection

Not Applicable.

6.1.3 Product Support

Not Applicable.

6.1.4 Defects correction

The defects correction period is 12 months.

6.1.5 Plant & Materials provided “free issue” by the *Employer*

No new Plant and Materials will be free issued by the *Employer*.

6.1.6 *Contractor's* procurement of Plant and Materials

Contractor is responsible to procure all plant and materials that is required for them to complete the *Works*.

The *Contractor* shall ensure that the Hydrogen gas detection system and its associated equipment is adequately packaged and crated for transportation and delivered to the Power Stations, undamaged.

6.1.7 Spares and consumables

A complete recommended spares list includes the following details:

- Detailed description, including dimensions and material specification
- Part number
- Special storage requirements
- Replacement part or routine maintenance part
- Quantity
- Cost
- Lead time
- Supplier full contact details and address
- Applicable test/calibration/material certificates.

6.2 TESTS AND INSPECTIONS BEFORE DELIVERY

Copies of all type test certificates, indicating the result of all type tests performed, are submitted for acceptance by the *Employer*. These tests are required to verify that the design of the equipment to be supplied meets with the *Employer's* requirements.

6.3 MARKING PLANT AND MATERIALS OUTSIDE THE WORKING AREAS

- All Plant and Material paid for by the *Employer* must be clearly labelled as being the *Employer's* property.
- The *Contractor* marks all identified items of Plant and Material with the Contract and Order numbers.
- Plant and Material is delivered to either the Site or the *Contractor's Works*.

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6.4 **CONTRACTOR'S EQUIPMENT (INCLUDING TEMPORARY WORKS).**

The *Contractor* to provide all necessary equipment to complete the *works*.

6.5 CATALOGUING REQUIREMENTS BY THE **CONTRACTOR**

N/A.

7. CONSTRUCTION

7.1 TEMPORARY WORKS, SITE SERVICES & CONSTRUCTION CONSTRAINTS

7.1.1 **Contractor's equipment**

- The *Contractor* provides the *Employer* with a complete list of materials, tools, Equipment and or machinery before bringing it onto Site.
- Records are to be kept of Equipment on Site including whether it is owned or hired. The *Contractor* is responsible to provide his own scaffolding, lifting equipment, mobile cranes and fork lifts where required.
- The *Contractor* provides and maintains all test and measuring Equipment required for all tests to the required accuracy. The accuracy of test Equipment is required to be better than ± 0.1 %.
- The type and class of Equipment used is subject to the Acceptance by the *Employer*.
- The *Contractor's* measuring Equipment is accompanied by valid calibration certificates from an approved authority.
- The Project Manager may at any stage during the Contract require such Equipment to be checked by an approved laboratory or the South African Bureau of Standards.

7.1.2 Equipment provided by the **Employer**

No equipment will be provided by the *Employer*.

7.1.3 Site services and facilities

The services available is confirmed by the *Employer* on site and are not necessarily available at point of *Works*.

7.1.4 Facilities provided by the **Contractor**

The *Contractor* makes provision for their own accommodation, vehicles, kitchen - and office space (mobile container) and Equipment etc.

The *Contractor* removes all equipment and waste which was generated during the installation process, within 24 hours after completion.

7.1.5 Existing premises, inspection of adjoining properties and checking work of Others

N/A.

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7.1.6 Survey control and setting out of the works

Full survey of the battery rooms plant area and dimension verification to be performed by the *Contractor* prior to start of the works.

7.1.7 Excavations and associated water control

N/A.

7.1.8 Underground services, other existing services, cable and pipe trenches and covers

N/A.

7.1.9 Sequences of construction or installation

All activities are performed according to the Programme accepted by the *Employer*.

7.1.10 Hook ups to existing works

Contractor notifies *Employer* before interfacing with existing *Works*.

7.2 COMPLETION, TESTING, COMMISSIONING AND CORRECTION OF DEFECTS

7.2.1 Work to be done by the Completion Date

Insert text here.

	Item of work	To be completed by
	As built drawings of Hydrogen Gas Detection System in the Battery Room Floor Plan	Within 60 days after Completion
	Performance testing of the <i>works</i> in use as specified in paragraph 7.2.8 of this Technical Specification.	See performance testing requirements.
	Commissioning of the <i>Works</i>	See section 7.2.4

7.2.2 Use of the works before Completion has been certified

The *Employer* may use any part of the *Works* before completion has been certified but in doing so the *Employer* takes over the part of the *Works* except if the use is for a reason stated in the Technical Specification.

7.2.3 Materials, facilities and samples for tests and inspections

Samples of components may be requested by the *Employer* for pre-acceptance, where deemed necessary.

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7.2.4 Commissioning

Commissioning will not start until the following documents, required for the commissioning of the equipment, to be accepted by the *Employer*:

- (a) All relevant drawings
- (b) All relevant site acceptance test reports completed and signed
- (c) All installation related defects are cleared.
- (d) All QCP's signed at the relevant steps.
- (e) All safety clearance certificates signed.

7.2.5 Start-up procedures required to put the works into operation

The *Contractor* is on site when the first live operation of the plant commences. All operating will be done by the *Employer* under the supervision of the *Contractor* as per the agreed commissioning program.

7.2.6 Take over procedures

Take-over is when all testing, inspections and commissioning as specified in Section 7.2.1, 7.2.4, 7.2.5 are successfully completed.

The *Contractor* shall aid the *Employer* on a temporary basis on Completion.

7.2.7 Access given by the *Employer* for correction of Defects

For the correction of defects after completion, the *Contractor* is to request an opportunity for correction a minimum of 4 weeks in advance and provide full details on the work to be executed.

7.2.8 Performance tests after Completion

The *Contractor* tests the *Works* in accordance with the accepted testing procedures.

7.2.9 Training and technology transfer

All pre-FAT training is conducted at the *Contractor's* local test facility and all operating and maintenance training is conducted at Drakensberg & Ingula Pumped Storage Schemes.

7.2.10 Operational maintenance after Completion

N/A.

8. PLANT AND MATERIALS STANDARDS AND WORKMANSHIP

8.1 INVESTIGATION, SURVEY AND SITE CLEARANCE

N/A.

8.2 BUILDING WORKS

N/A.

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8.3 CIVIL ENGINEERING AND STRUCTURAL WORKS

N/A.

8.4 ELECTRICAL & MECHANICAL ENGINEERING WORKS

The *Contractor* adheres to the following specifications and standards as a minimum, in providing the *Works* as per Section 2.2.2 & Section 5. The *Contractor* ensures the latest revisions and amendments of these documents are to be used for the *Works*.

8.5 PROCESS CONTROL AND IT WORKS

The *Contractor* adheres to the following specifications and standards as a minimum, in providing the *Works* as per section 2.2.2.

8.6 OTHER

N/A.

9. LIST OF DRAWINGS

9.1 DRAWINGS ISSUED BY THE *EMPLOYER*

This is the list of drawings issued by the *Employer* at or before the Contract Date and which apply to this contract.

Note: Some drawings may contain both Works Information and Site Information.

Drawing number	Revision	Title
0.83/24 102	Latest Rev.	Sheet 4 Ingula Battery Room Layout Drawing
0.48/3216	Latest Rev.	Drakensberg Battery Room Layout Drawing

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10. DEVELOPMENT TEAM

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

- Not Applicable

11. ACKNOWLEDGEMENTS

None.

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APPENDIX 1: SCHEDULE A/B

TECHNICAL REQUIREMENTS

1.1 GENERAL

The technical requirements of this section specified under 'Schedules A and B' shall form part of the *Employer's* enquiry documentation. Schedule B shall be completed by the *Contractor* and submitted with his tender.

1.2 SCHEDULES A AND B

Schedule A: Particular of *Employer's* Requirements

Schedule B: Guarantees and technical particulars of equipment offered by the *Contractor*.

1.3 FILLING IN INSTRUCTIONS

- 1.3.1 Where the *Contractor* does not fully comply with the *Employer's* requirement, any deviations must be clearly indicated in Schedule B and listed in the Deviation Schedule (Annexure A).
- 1.3.2 Where there is a need to substantiate or further describe an item in Schedule B, especially in instances of non-compliance with Schedule A, particulars are furnished on a separate sheet clearly marked with the notation of the Schedule A item referred to.
- 1.3.4 Some areas in Schedule A are intentionally left blank as shown by legend xxxxxxxx . Tenderer to provide the relevant information in Schedule
- 1.3.5 If a blank space is left in Schedule B next to *Employer's* requirements listed in Schedule A it is assumed that the Tenderer does not comply with this requirement.

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Schedule A: Particulars of Eskom's requirements

Schedule B: Guarantees and technical particulars of equipment offered

2	REQUIREMENTS	100.00%		
2.1	High Level Layouts	15.00%	Schedule A	Schedule B
2.1.1	Tenderer submits preliminary high-level layout drawing indicating the hydrogen detectors, cabling, controller, power supply and interface modules	50.00%	Yes	
2.1.2	Tenderer submits preliminary high-level wiring and termination diagrams detailing connection of detectors, controller, power supply and interface modules	50.00%	Yes	
2.2	Hydrogen Detector	15.00%	Schedule A	Schedule B
2.2.1	Detector is compatible with the corrosive environment.	7%	Yes	
2.2.2	Detector material type.	7%	Stainless Steel	
2.2.3	Forced air movement have no impact on the type of detector.	7%	Yes	
2.2.4	Type of detector.	7%	Point Type	
2.2.5	Technology type.	8%	xxxxxxx	
2.2.6	Brand	7%	xxxxxxx	
2.2.7	Model	7%	xxxxxxx	
2.2.8	Supply voltage	7%	10V - 30V DC	
2.2.9	Measuring range	7%	0-100% LEL	
2.2.10	Temperature range	7%	xxxxxxx	
2.2.11	Humidity range	7%	0 to 99% RH, non-condensing	
2.2.12	Detection coverage (square meters)	7%	xxxxxxx	
2.2.13	Explosion proof	7%	Yes	
2.2.14	ATEX, Ex & FM Certified	7%	Yes	
2.3	Hydrogen Detection Transmitter	15.00%	Schedule A	Schedule B
2.3.1	Transmitter is compatible with the corrosive environment.	11%	Yes	
2.3.2	Transmitter material type.	11%	Stainless Steel	
2.3.3	Brand	11%	xxxxxxx	
2.3.4	Model	11%	xxxxxxx	
2.3.5	Supply voltage	11%	10V - 30V DC	
2.3.6	Brand	11%	xxxxxxx	
2.3.7	Model	11%	xxxxxxx	
2.3.8	Explosion proof	11%	Yes	
2.3.9	ATEX, FM Certified	12%	Yes	
2.4	Hydrogen Detection Controller	15.00%	Schedule A	Schedule B
2.4.1	Operating voltage.	10.00%	24V DC	
2.4.2	Operating temperature	10.00%	xxxxxxx	
2.4.3	Humidity range	10.00%	0 to 99% RH, non-condensing	

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2.4.4	LCD Display	10.00%	Yes	
2.4.5	Technology used.	10.00%	xxxxxxx	
2.4.6	Brand	10.00%	xxxxxxx	
2.4.7	Model	10.00%	xxxxxxx	
2.4.8	Communications Protocol	10.00%	Standard communication protocols are to be used to communicate with the Employer's SCADA system in the following order of preference: (1) IEC 60870-5-104, (2) IEC 61850, (3) Modbus TCP, (4) Modbus RTU.	
2.4.9	Explosion proof	10.00%	Yes	
2.4.10	ATEX, FM Certification	10.00%	Yes	
2.5	Visual & Audible Alarm Initiating Devices	15.00%	Schedule A	Schedule B
2.5.1	Operating voltage.	20.00%	24V DC	
2.5.2	Operating temperature	20.00%	xxxxxxx	
2.5.3	Humidity range	20.00%	0 to 99% RH, non-condensing	
2.5.4	Brand	20.00%	xxxxxxx	
2.5.5	Model	20.00%	xxxxxxx	
2.6	24V DC Power Supply	15.00%	Schedule A	Schedule B
2.6.1	Input voltage	15.00%	230V	
2.6.2	Output voltage	15.00%	24V DC	
2.6.3	Brand	15.00%	xxxxxxx	
2.6.4	Part number	15.00%	xxxxxxx	
2.6.5	Status LED Indication	15.00%	Yes	
2.6.6	Power supply fault monitoring	15.00%	Yes	
2.6.7	Battery fault monitoring	10.00%	Yes	

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2.7	Cabling	10.00%	Schedule A	Schedule B
2.7.1	Detector cabling is of the enhanced fire resistant (PH120 rating) type	25.00%	Yes	
2.7.2	Power supply cabling is of the flame-retardant type comprising of the blue cable trace colour (Low halogen emission PVC bedding and sheath)	25.00%	Yes	
2.7.3	Cabling is run in close-ended galvanized mild steel conduit	25.00%	Yes	
2.7.4	Provide datasheets and certification for all cabling	25.00%	Yes	

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ANNEXURE A: DEVIATION SCHEDULE

Any deviations/modifications/alternatives offered shall be listed below with reasons for the departures.

No deviations/modifications/alternative offered will be recognized unless listed on this schedule

If no deviations/modifications/alternatives are offered, this schedule must be marked "**None**"

Page Ref.	Specification / Schedule / or clause number	Proposed deviation/ modification/ alternative	Cost of deviation or alternative

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APPENDIX 2: EVALUATION CRITERIA

INTEREST CATEGORIES	TENDER RETURNABLE	SCORING CRITERIA	WEIGHT	RATING (0-5)
EXPERIENCE			25.00%	
Tenderer submits evidence of completed works that are equivalent to the works required in this Specification. Tenderer produces a track record of completed works consisting as a minimum either of maintenance, design, installation, testing or commissioning of gas detection systems. In case the Tenderer intends to subcontract or form a joint venture, a letter of agreement, together with a track record must be produced.	Tenderer submit project references. As a minimum the reference list must contain: o Contact Person(s) o Contact Number(s) o Project Description o Construction Period o Contract Value	1-2 Projects - 5 0 Projects - 0	100.00%	
TECHNICAL SCHEDULE A&B COMPLIANCE			25.00%	
Compliance to scope of work, intent to undertake full scope of work.	Completion of the Technical Schedule A&B.	Schedule A&B score: 80%-100% [5] Schedule A&B score: 70%-79% [4] Schedule A&B score: 40%-69% [2] Schedule A&B score: 0%-39% [0]	100.00%	
EXECUTION DOCUMENTATION			25.00%	
The execution plan to include the following: 1. Method Statement - includes, but is not limited to; detail on how the works will be executed, design, installation, testing & commissioning of the hydrogen detection system, standards that will be complied with, integration detail, mechanical, electrical & C&I. CoC requirements & Certification Approvals. 2. Installation Plans 3. Quality Control Plans	Tenderer supplies approved execution documentation.	All 3 items supplied - 5 Number of items supplied: (equal to 2) - 4 Number of items supplied: (equal to 1) - 2 Number of items supplied: (no items supplied) - 0	100.00%	
DATA SHEETS			25.00%	
Tenderer provides technical detail or data sheets of the following equipment: 1. Explosion-Proof Fixed Point Type Hydrogen Detector 2. Explosion-Proof Transmitter	Tenderer supplies technical documentation or data sheets.	Datasheets of all 9 items supplied = 5 Number of datasheets supplied: (Less than 9 but more or equal to 8) = 4	100.00%	

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3. Hydrogen Detection Controller 4. Audible and Visual Alarm Notification Devices 5. 24V Power Supply with Battery Back-up 6. PH 120 Fire Alarm Cabling 7. Fire Retardant (Blue Strip) Power Supply Cabling 8. Comms Interface Cabling 9. Zitron & Aritech I/O Modules		Number of datasheets supplied: (Less than 8 but more or equal to 4) = 2 Number of datasheets supplied: (Less than 4 datasheets supplied) = 0		
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APPENDIX 3: TECHNICAL EVALUATION STRATEGY

TECHNICAL EVALUATION THRESHOLD

The minimum weighted final score (threshold) required for a tender to be considered from a technical perspective is 80%. This is due to the *Employer* requiring all section of the evaluation being completed to ensure a comprehensive tender. The *Employer* reserves the right to reduce the threshold to 70%.

The scoring table is as follows:

Score	(%)
5	100
4	80
2	40
0	0

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APPENDIX 4: PRICING DATA

C1 PRICING ASSUMPTIONS

Entries in the four columns Unit, Quantity, Rate and Price are made by the tendering *Contractor*.

All Prices are to be shown excluding VAT unless instructed otherwise by the *Employer* in Tender Data or in an instruction the *Employer* has given before the tenderer enters his Prices.

If there is insufficient space in the Price List which follows, state in which document the Price List is contained.

C2 PRICE LIST

The Price List is as follows / contained in _____ (delete the text which does not apply and this note)

1	Drakensberg Hydrogen Detection System				
Item no.	Description	Unit	Quantity	Rate	Price
1.1	Hydrogen Detectors	ea	5		
1.2	Transmitters	ea	5		
1.3	Audible& Visual Alarm Notification Devices	ea	2		
1.4	Hydrogen Detection Controller	ea	1		
1.5	24V DC Power Supply	ea	1		
1.6	PH 120 Cable	m	500		
1.7	Bosal Conduit (6m lengths)	ea	10		
1.8	Fire Retardant Cable (Blue Stripe)	m	50		
1.9	I/O Unit	ea	5		
1.10	Panel Enclosure	ea	1		
1.11	Tester	ea	1		
1.12	Sundries	ea	1		
1.13	Comms Module	ea	1		
1.14	Comms Cable	m	50		
1.15	Delivery Costs	ea	1		
	[1] The total of the Prices (excluding VAT):				

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2	Resources				
Item no.	Description	Unit	Quantity	Rate	Price
2.1	Supervisor x 1	hours	40		
2.2	Technician x 2	hours	40		
2.3	Semi-Skilled Assistant x 2	hours	40		
2.4	Safety Officer x 1	hours	40		
2.5	Living Out Allowance x 6	days	5		
2.6	Accommodation Cost x 6	days	5		
2.7	Travelling Cost	km	1000		
	[2] The total of the Prices (excluding VAT):				
3	Safety File				
Item no.	Description	Unit	Quantity	Rate	Price
3.1	Cost for Safety File	ea	1		
	[3] The total of the Prices (excluding VAT):				
4	Design				
Item no.	Description	Unit	Quantity	Rate	Price
4.1	Cost for Design	ea	1		
	[4] The total of the Prices (excluding VAT):				
5	Certification				
Item no.	Description	Unit	Quantity	Rate	Price
5.1	Cost for Certification	ea	1		
	[5] The total of the Prices (excluding VAT):				
6	Manuals & Drawings				
Item no.	Description	Unit	Quantity	Rate	Price
6.1	Cost for Manuals	ea	1		
6.2	Cost for Drawings	ea	1		

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	[6] The total of the Prices (excluding VAT):					
7	Training					
Item no.	Description	Unit	Quantity	Rate	Price	
7.1	Training Material	ea	1			
7.2	Trainer x 1	hours	32			
7.3	Accommodation x 1	days	4			
7.4	Travelling Cost	km	1000			
7.5	Living Out Allowance x 1	days	4			
	[7] The total of the Prices (excluding VAT):					
8	Issuing of COC					
Item no.	Description	Unit	Quantity	Rate	Price	
8.1	Master Electrician x 1	hours	16			
8.2	Accommodation x 1	days	2			
8.3	Travelling Cost	km	1000			
8.4	Living Out Allowance x 1	days	2			
	[8] The total of the Prices (excluding VAT):					
	[1] + [2] + [3] + [4] + [5] + [6] + [7] + [8] The total of the Prices (excluding VAT):					

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1	Ingula Hydrogen Detection System				
Item no.	Description	Unit	Quantity	Rate	Price
1.1	Hydrogen Detectors	ea	5		
1.2	Transmitters	ea	5		
1.3	Audible& Visual Alarm Notification Devices	ea	2		
1.4	Hydrogen Detection Controller	ea	1		
1.5	24V DC Power Supply	ea	1		
1.6	PH 120 Cable	m	500		
1.7	Bosal Conduit	ea	10		
1.8	Fire Retardant Cable (Blue Stripe)	m	50		
1.9	I/O Unit	ea	5		
1.10	Panel Enclosure	ea	1		
1.11	Tester	ea	1		
1.12	Sundries	ea	1		
1.13	Comms Module	ea	1		
1.14	Comms Cable	m	50		
1.15	Delivery Costs	ea	1		
	[1] The total of the Prices (excluding VAT):				
2	Resources				
Item no.	Description	Unit	Quantity	Rate	Price
2.1	Supervisor x 1	hours	40		
2.2	Technician x 2	hours	40		
2.3	Semi-Skilled Assistant x 2	hours	40		
2.4	Safety Officer x 1	hours	40		
2.5	Living Out Allowance x 6	days	5		
2.6	Accommodation Cost x 6	days	5		

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2.7	Travelling Cost	km	1000		
	[2] The total of the Prices (excluding VAT):				
3	Safety File				
Item no.	Description	Unit	Quantity	Rate	Price
3.1	Cost for Safety File	ea	1		
	[3] The total of the Prices (excluding VAT):				
4	Design				
Item no.	Description	Unit	Quantity	Rate	Price
4.1	Cost for Design	ea	1		
	[4] The total of the Prices (excluding VAT):				
5	Certification				
Item no.	Description	Unit	Quantity	Rate	Price
5.1	Cost for Certification	ea	1		
	[5] The total of the Prices (excluding VAT):				
6	Manuals & Drawings				
Item no.	Description	Unit	Quantity	Rate	Price
6.1	Cost for Manuals	ea	1		
6.2	Cost for Drawings	ea	1		
	[6] The total of the Prices (excluding VAT):				
7	Training				
Item no.	Description	Unit	Quantity	Rate	Price
7.1	Training Material	ea	1		
7.2	Trainer x 1	hours	32		
7.3	Accommodation x 1	days	4		
7.4	Travelling Cost	km	1000		
7.5	Living Out Allowance x 1	days	4		

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	[7] The total of the Prices (excluding VAT):					
8	Issuing of COC					
Item no.	Description	Unit	Quantity	Rate	Price	
8.1	Master Electrician x 1	hours	16			
8.2	Accommodation x 1	days	2			
8.3	Travelling Cost	km	1000			
8.4	Living Out Allowance x 1	days	2			
	[8] The total of the Prices (excluding VAT):					
	[1] + [2] + [3] + [4] + [5] + [6] + [7] + [8] The total of the Prices (excluding VAT):					

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