	<p style="text-align: center;"><b>Scope of Work</b></p>	<p style="text-align: center;"><b>Kriel Power Station</b></p>
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Compiled by	Functional Responsibility	Authorised by
		
<p><b>W. Masemola</b></p>	<p><b>G. Mthombene</b></p>	<p><b>R. Nelwamondo</b></p>
<p><b>System Engineer</b></p>	<p><b>Electrical Engineering Manager</b></p>	<p><b>Engineering Manager</b></p>
<p>Date: <u>2024/07/02</u></p>	<p>Date: <u>2024/07/02</u></p>	<p>Date: <u>2024/07/03</u></p>

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## **1. Introduction**

Kriel Power Station plays a vital role in South Africa's energy infrastructure. The facility requires a major overhaul of its perimeter security measures. This proposal details the necessary steps to replace and enhance the existing boundary protection, including:

1. Installing a new electric fence
2. Replacing energizers
3. Upgrading the security software system
4. Replacing high-tension cables

The project's goal is to substantially enhance the power station's overall security, safeguarding personnel, protecting assets, and ensuring uninterrupted operations.

South African law mandates compliance with specific regulations for electric fence installations. The Electric Machinery Regulations, published in March 2011 under the Occupational Health and Safety Act of 1993, require all non-lethal electric fences to meet SANS 10222-3 standards. This specification outlines the minimum requirements for a Non-lethal Energised Perimeter Detection System (NLEPDS) that Eskom and its subsidiaries must follow to secure their facilities.

Due to the constant changes in the risk profiles of Eskom assets and installations, the review of physical security measures is necessary to ensure that current threats are appropriately mitigated, through the implementation of suitable site specific protection measures, systems and procedures. This document provides an overview of Eskom's requirements for the design, supply, installation and commissioning of a Non-Lethal Energised Perimeter Detection System (NLEPDS).

For the purposes of this document, the terms "Non-lethal Energised Perimeter Detection System (NLEPDS)" and "Non-lethal Electric Fence System (NLEFS)" are used interchangeably.

## **2. Supporting Clauses**

### **2.1 Scope**

This scope of work encompasses the complete overhaul of the Kriel Power Station's NLEPDS.

The proposed high-level scope of work entails:

- Installation of a new electric fence
- Replacement and upgrade of fence components including insulators, strainers, and poles
- Installation of new energizers
- Implementation of a security software system
- Replacement of high-tension cables
- Provision of all necessary labour, materials, equipment, and expertise to complete the project
- Compliance with all relevant safety standards and regulations
- Training of personnel on the new system
- Project management and quality assurance throughout the duration of the work

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### **2.1.1 Purpose**

This scope of work outlines the key requirements for implementing a high-quality NLEPDS at Kriel Power Station. It details the necessary functional, operational, and performance standards. In addition,

The main objective of this is to replace the existing NLEPDS. This upgrade aims to:

1. Discourage unauthorized entry attempts
2. Boost the ability to detect and respond to potential threats
3. Upgrade systems for monitoring and reporting security events
4. Meet current security regulations and standards
5. Improve the overall efficiency and dependability of the perimeter security infrastructure

The document serves as a technical guideline for the enquiry for a Non-Lethal Energised Perimeter Detection System (NLEPDS) Project and stipulates technical scope and deliverables for the project.

### **2.1.2 Applicability**

This scope of work applies to all aspects of the perimeter fence replacement project at Kriel Power Station.

It is applicable to:

- Engineering department
- Environment department
- All contractors involved in the project
- Kriel Power Station security personnel
- Relevant Kriel Power Station management and staff
- Any other parties directly involved in or affected by the perimeter security upgrade

### **2.1.3 Effective date**

The date from which the document is effective is not different from the authorisation date. The effective date means that from this date all training, artefacts and supporting systems required for compliance to the document requirements shall have been established and implemented.

## **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**

These documents are indispensable for the application of this document, i.e. documents to be used together with this document:

ISO 9001 Quality Management Systems

SANS 10222-3: Electrical security installations. Part 3: Electric security fences

SANS 10222-5: Electrical security installations. Part 5: Integrated security installations

240-78980848 Specification for Non-Lethal Energised Perimeter Detection System (NLEPDS) for protection of Eskom installations and its subsidiaries

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240-83684419, PTM&C technology development

240-60725641, Specification for Standard (19 Inch) Equipment Cabinets  
40-64100247, Standard for Earthing of Secondary plant Equipment in Substations

### **2.2.2 Informative**

Documents that are further sources of information referenced in the document, e.g., laws, standards, codes and procedures:

National Key Points Act 102 of 1980)

Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)

240-86738968, Specification for integrated security alarm system for protection of Eskom

Installations for protection of Eskom installation and its subsidiaries

### **2.3 Definitions**

Electric Fence: A barrier that uses electric shocks to deter intruders

Energizer: A device that sends electrical pulses through the fence

Stinger Insulator: A specialized insulator designed to support electric fence wires

Strainer: A device used to maintain tension in fence wires

Earth Spike: A metal rod driven into the ground to provide an electrical ground for the fence

High-Tension (HT) Cable: A Specialized cable designed to carry high-voltage pulses from the energizer to the fence

Tender: A tender refers to an open or closed competitive request for quotations / prices against a clearly defined scope / specification.

### **2.4 Abbreviations**

°C Degrees Celsius

AC Alternating Current

CCTV Close Circuit Television

CoC Certificate of Compliance

DC Direct Current

EMC Electro-magnetic Compatibility

FAT Factory Acceptance Test

GI Galvanized Iron

HT High Tension

HV High Voltage

Hz Hertz

IDF Intermediate Distribution Frame

IEC International Electro-technical Commission

IP Ingress protection

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Kg	Kilogram
kV	Kilovolt
m	Meter
mm	Millimetre
Mpa	Mega Pascal
ms	Millisecond
MTBF	Mean Time Between Failures
NC	Normally closed
NLEPDS	Non-Lethal Energised Perimeter Detection System
NO	Normally open
OHS	Occupational Health and Safety
PC	Personal Computer
PTZ	Pan-Tilt-Zoom
RSA	Rolled Steel Angle
SABS	South African Bureau of Standards
SANS	South African National Standards
SAT	Site Acceptance Test
SCADA	Supervisory Control and Data Acquisition
SCOT	Steering Committee of Technology
SMS	Short Messaging System
UV	Ultra Violet

## **2.5 Roles and Responsibilities**

Engineering department:

Provide technical expertise and oversight for the entire project.

Review and approve technical specifications for all components.

Ensure the design meets all relevant engineering standards and Eskom requirements.

Conduct technical risk assessments.

Review and approve any design changes during the project.

Collaborate with contractors on technical problem-solving.

Verify that the installed system meets all technical requirements.

Participate in the final acceptance testing of the system.

Environment department:

Conduct an environmental impact assessment for the project.

Ensure compliance with all environmental regulations and Eskom's environmental policies.

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Develop and oversee implementation of environmental management plans.

Monitor the project for potential environmental impacts (e.g., soil erosion, waste management).

Provide guidance on proper disposal of old fence materials and other waste.

Ensure that any protected flora or fauna in the project area are properly managed.

Conduct environmental audits throughout the project.

Liaise with relevant environmental authorities if required.

Provide environmental awareness training to project personnel.

**Maintenance department:**

Provide input on maintainability aspects of the new fence and security system.

Review maintenance requirements for all new equipment.

Ensure that the new system design allows for easy maintenance access.

Participate in the development of maintenance schedules and procedures.

Receive training on the maintenance of the new fence and security system.

Assist in the commissioning process to understand system operation.

Take over routine maintenance responsibilities after project completion.

Establish spare parts inventory for the new system.

Develop and implement a preventive maintenance program.

Coordinate with Security Department for any maintenance activities that may affect security operations.

**Security department:**

Provide input on security requirements and operational needs.

Review and approve the security system design from an operational perspective.

Coordinate with contractors to ensure minimal disruption to ongoing security operations.

Develop new security procedures to incorporate the enhanced fence and security system.

Participate in the testing and commissioning of the new security system.

Receive comprehensive training on the operation of the new system.

Update risk assessments and security plans based on the new infrastructure.

Ensure compliance with National Key Point security requirements.

Oversee the transition from the old to the new security system.

Conduct regular drills and exercises to test the new system's effectiveness.

**Project department:**

Overall responsibility for project execution.

Coordination between contractors, KPS management, and Eskom.

Ensure compliance with scope, budget, and timeline.

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Subject matter experts (SME):

Provide expert advice on security system design and implementation.

Provide advice during project execution.

Review and approve the scope of work and technical specifications.

Main Contractor:

Execute the scope of work as outlined in this document.

Manage subcontractors (if applicable).

Ensure quality of work (with an approved quality control plan (QCP)) and compliance with standards.

Provide all necessary training on the new installation.

Provide all required documentation at project completion

Procurement department:

The procurement team shall utilise this document for the enquiry process and during the product development phase.

## **2.6 Process for Monitoring**

- Regular site inspections by the Project Manager and Security Consultant.
- Weekly progress meetings with all key stakeholders.
- Monthly written reports detailing progress, issues, and upcoming work.
- Quality assurance checks at key project milestones.
- Final inspection and sign-off process involving all relevant parties.

## **2.7 Related/Supporting Documents**

Please refer to the normative and informative sections (i.e., section 2.2) for a list of all related and supporting documents.

## **3. Scope of work**

### **3.1 Overview of the scope of work**

The contractor is responsible for the complete lifecycle of the NLEPD), including:

Design

Manufacturing

Supply

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User documentation development

Factory testing

Delivery

Installation

Commissioning

All aspects must adhere to the provided technical specifications.

### **3.2 Pre-installation development scope**

The appointed contractor(s) shall be responsible for the following pre-installation development scope of work:

- a) System development including manufacturing of conductors. This includes any additional development work required to fully comply with the technical requirements.
- b) Compiling site specific detailed designs including the following:
  - i. All equipment required to comply with the specification and its configuration
  - ii. Cable layout and routing drawings
  - iii. Interfacing to the supervisory control and data acquisition (SCADA) system for security alarms to the security monitoring centre
  - iv. Interface drawings to the site security lighting
- c) Ensure that the design complies with all relevant standards in order for a Certification of Compliance (CoC) to be issued.
- d) Model system testing scheme for required functionality including energy, voltage tests and energizers synchronisation tests at the tenderer's workshop/premises.
- e) Factory testing of the complete system (FAT).
- f) Development of product training material and delivery of system related courses.
- g) Produce site acceptance testing procedure for Eskom's acceptance.
- h) Produce a functional design specification
- i) Produce a detailed design specification

### **3.3 Equipment for decommissioning and disposal**

The existing NLEPDS and associated equipment shall be completely decommissioned, removed and stored to a designated scrap area on site.

Note: Decommissioning shall be done in close consultation with the responsible Eskom representative for guidance on decommissioned equipment that will be reserved for spares.

### **3.4 Equipment for manufacturing, supplying, installing and commissioning**

The appointed contractor shall manufacture, supply, install and commission all the equipment in the following sections:

Entrance area:

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- a) Install an automatic sliding gate as per Eskom drawings (0.54/7470). The gate shall be installed together with all the associated equipment i.e. electric motors with suitable enclosure and mechanical disengage mechanism, status detector mechanisms, obstruction detector mechanisms, conductor wires and anti-theft brackets.
- b) Install a 25 Pair communication cable from the guard house to the sliding gate motors.
- c) Install infra-red (IR) units to prevent the gate from closing on vehicles. The IR units shall be installed together with the associated mounting posts with concrete foundations, blanking plates and cover plates.
- d) Install goose necks for mounting of biometric and card readers.

#### Access control building (ACB)/ Guard house:

Note: The equipment installed shall meet the functional requirements as specified in the technical specification, 240-78980848. The appointed contractor shall provide the specific system design, configuration, and equipment for the requirements of the site.

- a) Install the system configuration PC/Controller used to configure the electric fence system.
- b) Install the user interface/display unit to display the configured zones of the fence including alarms.
- c) Install relay cards to configure the system alarms as well as interfacing the Non-Lethal Electrified Fence with other security systems deployed at site. i.e.
  - i. Security lights
  - ii. CCTV cameras (PTZ cameras to zoom alarmed zones)
  - iii. Security alarm system
- d) Install the energizers including synchronisation mechanism.
- e) Install the equipment cabinets for all the electronic equipment in the ACB
- f) Ensure the system equipment in the security cabinet is earthed effectively as per Eskom's earthing principles outlined in the cabinet's specification (240-60725641).

#### Site Perimeter:

- a) Install HT cables, fence conductors (2.24 mm galvanised steel) and associated insulators.
- b) Install warning and zoning signs around the site perimeter.
- c) Install a 25 Pair communication cable from the guard house to the control room to interface the fence alarms to the SCADA system for routing of alarms to the remote monitoring centre. A trench has to be dug from the guard house to the closest trench in the HV yard.

Note: For coastal sites Eskom might decide to install aluminium fence conductors, clarity should be obtained from Eskom representative for the site for preferred fence conductor.

#### Testing and commissioning

- a) Site Acceptance testing shall be performed to ensure that the entire NLEPDS is fully functional and all alarms are commissioned to the monitoring centre.
- b) Issue the Certificate of Compliance (CoC) for the site.
  - i. Every user or lessor of an electric fence, as the case may be, shall have an original valid electric fence system certificate of compliance. Meaning that the original CoC shall be handed over to Eskom.
  - ii. The electric fence system certificate of compliance shall be accompanied by a test report.

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iii. An electric fence certificate of compliance shall be in accordance with the Electrical Machinery Regulations, 2011 as contained in the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).

iv. A map of the electric fence installation, clearly showing various aspects of the installation shall be attached to the test report.

v. The customer shall receive training in the operation of the NLEPDS.

vi. Official hand-over to the customer shall take place. The hand-over documentation shall consist of all marked-up drawings, test certificates / documents and the Certificate of Compliance.

### **3.5 Functional requirements**

#### **3.5.1 NLEPDS components and operation**

The NLEPDS serves three main purposes:

1. Deterrence: Discourage unauthorized individuals from entering protected areas
2. Detection: Identify and alert security to any unauthorized entry attempts
3. Delay: Slow down potential intruders trying to illegally access the site

An NLEPDS consists of electrified bare conductors that form a barrier. These wires carry pulses of electric current from an energizer, delivering non-lethal shocks to deter intruders. The energizer periodically sends controlled electrical pulses to the connected fence.

If someone tampers with the fence, it triggers an alarm recorded by the security electric fence energizer system. This can activate various security measures such as:

- Sirens
- Strobe lights
- CCTV cameras
- Public address systems
- Notifications to control rooms (local and remote)
- Alerts to authorized Eskom personnel via email, SMS, or phone

The system detects intrusion attempts when fence wires are cut or short-circuited. Essentially, security electric fences function as sensor arrays that:

- Create a physical barrier
- Act as a psychological deterrent
- Integrate with broader security and intrusion detection systems

The number of energizers used depends on the perimeter length. Multiple energizers require synchronization to pulse simultaneously. A display unit serves as the system's graphical interface, showing the status of different perimeter zones and sectors.

When a breach occurs in any zone:

1. It's displayed on the PC
2. An alarm is sent to the monitoring system, indicating the triggered zone
3. Security lights for that zone are activated via a relay card
4. CCTV cameras, including PTZs, begin recording in the affected area
5. A pre-recorded warning message plays through the PA system to warn potential intruders

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The NLEPDS generally comprise of the following components / sub-systems:

- a) Electric fence conductors
- b) Power supply
- c) Configuration PC / Controller
- d) User interface / Display unit
- e) Synchronising equipment/mechanism
- f) Relay cards
- g) Communication infrastructure
- h) Energizer(s)
- i) Posts (stain, intermediate & corner)
- j) Anti-tunnelling structure
- k) Vegetation control slab

Below is an overview of the requirement for the components/ sub-systems of the NLEPDS:

#### Electric fence conductors

- a) Perimeter installation of electric fence conductors
- b) Fence structure:
  - Vertical sectors: Areas covered by individual energizers
  - Horizontal zones: Divided sections of the perimeter
- c) Overlapping conductor installation for redundancy
- d) Maximum 100 mm spacing between conductors (SANS 10222-3 2016 compliant)

#### Configuration PC / Controller

- a) Zone and sector configuration via controller
- b) Alarm reset and acknowledgment capabilities
- c) Comprehensive system settings management

#### User interface / Display unit

- a) Visualization of fence zones and alarms
- b) Real-time alarmed zone display
- c) Alarm viewing and acknowledgment functions
- d) Possible integration of controller and display unit with strict access control

#### Relay cards

- a) Alarm relay and integration with other security systems
- b) Configurable for grouped and individual alarm

#### Communication infrastructure

- a) Robust cabling for harsh conditions and surge protection
- b) EMC-resistant communication medium (e.g., fibre optics)

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- c) Open standard protocols for interoperability
- d) Remote monitoring via Eskom Telecom or third-party infrastructure (compliant with cyber security standards)

Energizer(s)

- a) Safe operation under normal conditions
- b) Minimum of two energizers per installation for reliability
- c) 15-year minimum lifespan for energizers and associated equipment

Equipment placement:

- a) All electronic components of the NLEPDS must be installed within the protected site.
  - Primary location: Dedicated security equipment room and associated cabinets.
  - Alternative: If no dedicated room exists, suitable equipment housing must be provided that offers comparable operating conditions to a security equipment room.

Cabinet requirements:

- a) Only cabinets approved by Eskom may be used to house NLEPDS equipment.
- b) These cabinets must comply with Eskom's Specification for standard equipment cabinets (240-60725641).

### **3.5.2 Environmental requirements**

a) Environmental resilience:

The Non-lethal Energised Perimeter Detection System (NLEPDS) and all its components must function effectively across all South African climate conditions, including hot, cold, dusty, and humid environments.

The following specifications represent the minimum environmental tolerances required without compromising performance or reducing the system's lifespan:

b) Design criteria:

The system must be engineered for 'special' environmental conditions, as adapted from Table 2 of IEC 60255-1.

c) Temperature range:

- Control/equipment room installations: -25°C to +55°C
- Substation yard enclosure installations: -25°C to +70°C

d) Altitude tolerance:

Up to 2,500 meters above sea level

e) Pollution resistance:

Suitable for urban areas with industrial activities, without special precautions against sand or dust (compliant with classes 3C2 and 3S2 in IEC 60721-3-3)

f) Humidity tolerance:

98% relative humidity (24-hour average)

g) Installation environment:

Electronic equipment will primarily be installed in control/equipment rooms, with or without air conditioning. The equipment must maintain optimal performance and longevity under these conditions.

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h) Temperature resilience:

Energizers must be constructed to withstand extreme temperatures encountered during normal use.

Compliance verification: Test 18 of SANS 60335-2-76.

Performance requirement: Energizer output characteristics (as defined in 22.108 of SANS 60335-2-76) must not deviate by more than 10% under extreme temperature conditions.

i) Post-test integrity:

After undergoing the temperature endurance test:

The energizer must show no changes that impair its future use.

If sealing compound is used, it must not flow out to the extent that live parts become exposed.

The energizer must continue to meet the requirements of clause 8 of SANS 60335-2-76, which pertains to protection against access to live parts.

### **3.5.3 Electrical operating requirements**

a) Electrical environment resilience:

The system will be installed in areas near or under power lines, where inductive coupling could induce high voltages on the electrified fences. All Non-lethal Energised Perimeter Detection System (NLEPDS) components must operate reliably under these conditions without failure.

b) Electromagnetic interference immunity:

NLEPDS components must function without being affected by various device frequencies, including:

Cell phones

Portable radios

Telephones

Communication transmitters

DC relay operations

AC supply switching

Cable-borne interference

Other potential sources of electromagnetic disturbance

c) High voltage environment adaptation:

All NLEPDS components must operate effectively in environments with frequent high voltage switching, adapting to high levels of radiated electrical interference due to their physical placement or direct connection to electrical equipment.

d) Non-interference requirement:

NLEPDS components must not generate any interference that could impair their own performance or that of nearby equipment.

e) Energizer short circuit tolerance:

The energizer must be capable of withstanding a continuous short circuit on the electric fence structure without failure.

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### **3.5.4 Operational safety requirements**

a) Safety notification:

Before energizing electric fence conductors, all authorized individuals within or entering the secure area must be informed of the fence's location.

b) Additional safety measures:

In situations where there's a risk of secondary injury, appropriate extra safety precautions should be implemented.

c) Neighbouring fence safety protocol:

When two independently timed electric fences are in close proximity (less than 2.5 m apart), and both have wires no higher than 1,500 mm above ground or walking level, a barrier fence must be installed between them. This barrier fence must:

- Be at least 1,500 mm tall
- Have no openings larger than 50 mm in any direction
- Be positioned either:
  - \* Maximum 100 mm from either electric fence, or
  - \* Minimum 2,000 mm from either electric fence
- Be constructed to prevent access between the two electric fences

This protocol aims to prevent simultaneous contact with both electrified fences.

### **3.5.5 Alarming**

a) Relay contact configuration:

All status and alarm indication relays must use changeover contacts, allowing for either Normally Open (NO) or Normally Closed (NC) wiring to the Interface Distribution Frame (IDF) as needed.

b) Alarm output capabilities:

The alarm output must be able to activate the following security systems:

- Substation security lighting
- CCTV system equipment
- Public Address (PA) system recorded voice warnings
- Sirens
- Strobe lights

c) Interface documentation:

The tenderer must provide detailed drawings and manuals specifying how the system will interface with the aforementioned security systems.

d) Indication signal type:

All indications must be supplied as potential-free changeover contacts.

e) Remote alarm management:

Remote alarm resetting must be possible. This feature must comply with Eskom's information security standard for IT/OT and third-party remote access (32-373).

f) Energizer self-monitoring:

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The energizer must have self-monitoring capabilities, alerting to any out-of-bounds conditions or system failures.

g) NLEPDS triggering events:

The Non-lethal Energised Perimeter Detection System (NLEPDS) shall activate in response to any of the following potential intrusion indicators:

1. Detection of digging activity beneath the electric fence
2. Short-circuiting of electric fence conductors
3. Cutting of electric fence conductors (open circuit)

h) Alarm response sequence:

When the NLEPDS is triggered, the following sequence of events and interoperation of on-site security technologies shall be possible:

1. Immediate reporting of each violation to the security control centre and notification to the security controller
2. Ability for the security controller to address unauthorized individuals using the Public Address System
3. Activation of security perimeter lights in the affected fence zone(s)
4. Initiation of recording by CCTV cameras (including PTZs) in the affected fence zone(s), with camera analytics used for intruder tracking
5. Capability for the security controller to confirm the arrival of responders on-site following an alarm/intrusion event

i) Alert distribution:

The system shall be capable of sending security alerts and confirmations via email and SMS.

### **3.5.6 Monitoring**

a) Monitoring flexibility:

The system must support both local and remote monitoring of intrusion alarms.

b) Display unit functionality:

Client stations/display units must show the site configuration and configured fence zones.

c) Alarm detail requirements:

Generated intrusion alarms must include specific details about triggered fence zones to enable prompt response.

d) Event logging:

All security alarms and events must be accurately date-and-time stamped for traceability and investigative purposes.

e) Futureproofing and expandability:

In line with Eskom's long-term strategy to develop security regional centres, the NLEPDS system must be expandable and future-proof. It should allow for routing alarms to these regional centres without requiring extensive re-engineering.

f) Communication protocol:

Communication between the protected site and remote monitoring centre(s) must utilize open communication protocols.

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### **3.5.7 Electrical specification**

#### **3.5.7.1 Power supply**

a) Primary power source:

The system must utilize the standard AC power supply available at Eskom sites, which is typically a 230V ( $\pm$  10%), 47 – 51Hz single-phase AC supply.

b) Power fluctuation resilience:

The system must maintain proper functioning during power supply failures, restorations, under-voltage, or over-voltage conditions.

c) Backup power requirement:

A battery backup system capable of providing at least 12 hours of operation must be included.

d) DC power option:

Where available, Eskom will provide power using the site's DC system.

e) Energizer power input flexibility:

The energizer must be capable of operating with both AC and multiple DC voltage inputs (48V/110V/220V).

f) DC voltage tolerance:

When operating on DC power, the system must function as per specifications within a voltage range of 0.8 to 1.2 times the nominal voltage.

#### **3.5.7.2 Energizer requirements**

Energizer characteristics (as per SANS 60335-2-76), tested with a 500 $\Omega$  load at rated voltage:

a) Voltage output: Peak value above 7.5kV, not exceeding 10kV

b) Energy output: Between 5J and 8J for a 500 $\Omega$  load

c) Impulse frequency: Maximum 1 Hz

d) Impulse duration: Not exceeding 10 ms

Additional requirements:

e) Visible HV isolating switch with earth connection in off state

f) Clear ON/OFF positions on isolation switch, designed for high voltage handling

g) Safety mechanism (e.g., watchdog) to monitor and correct voltage/energy levels

h) Minimum 20km multi-wire fence powering capability

i) Type A energizer classification (battery-operated, mains-connectable)

j) External power supply connection terminals

k) Class II appliance compliance (SANS 60335-1), featuring enhanced insulation for safety without relying on protective earthing

#### **3.5.7.3 Conductors and high-tension (HT) cables**

Conductors:

a) Performance requirements:

Must provide rated current carrying capacity.

**CONTROLLED DISCLOSURE**

Must have low resistance.

b) Diameter specifications:

Sufficient to maintain high current-carrying capacity.

Adequate to maintain voltage meeting the electric fence design specifications.

Ensure recommended minimum electrical parameters are met

c) Primary function:

Provide deterrence along the electric fence perimeter by delivering an electric shock to potential intruders.

d) Material option for extended perimeters:

Aluminium wires may be used for longer perimeter distances.

e) Standard conductor specification:

Conductor/trace wires should be made from 2.24mm diameter solid fully galvanized steel wire.

f) Installation tension:

The 2.24mm solid fully galvanized steel wires should be installed with a maximum pulling strength of 50 kg.

g) Durability requirement:

Mechanical strength must be sufficient to withstand the operating conditions specified in this standard.

h) UV resistance and longevity:

Wire conductor materials must resist ultra-violet radiation and maintain integrity for a minimum of 15 years.

i) Entanglement prevention:

No objects that could cause entanglement (such as barbed wire or razor wire) should be attached to any conductors, whether live or earth.

j) Temperature and voltage tolerance:

Conductors must withstand the highest expected operating temperature and voltage.

High-Tension (HT) cables:

a) Application:

Used to connect the energizer to fence conductors

b) Material composition:

Inner core of HT cables must match the material of the electrified fence conductors/trace wires

c) Space fence insulators on brackets and poles so bare electric wires are no more than 100 mm apart on any face.

d) Place insulated high-tension cables as per SANS 10222-3, clause 4.3.1.1.

e) Position bare high-tension conductors according to SANS 10222-3, clause 4.3.1.2.

f) Secure insulated high-tension cables following SANS 10222-3, clause 4.3.2.1.

g) Attach bare high-tension conductors as specified in SANS 10222-3, clause 4.3.2.2.

h) Use aluminium cable ties to fasten all cables to NLEPD structures or poles.

i) For HT cables ending on NLEPD conductor/trace wires:

Secure at two points

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Terminate and seal with "Denzo" tape

- j) Apply "Lock-Tight" to all bolts.
- k) Shield conductors leaving ground level with U-shaped GI pipe sleeves, extending at least 300mm above ground.
- l) Install all HT cables in suitable conduit or GI pipe sleeves, ensuring moisture cannot enter.
- m) Fence high-tension cables and conductors other than HV cables shall only be buried if they are run in conduit, pipe, trunking or in similar protection.
- n) Excavate cable trenches where required, and lay HT cables.
- o) Trenches will be 300 mm wide and vary in depth between 500 mm and 1000 mm, depending on ground conditions.
- p) Danger tape will be laid in trenches 300 mm above conductors, before backfilling and compacting.
- q) Installation to be done in such a manner as to prevent moisture from entering GI pipe sleeves and conduits.
- r) The high-tension cable shall have the following properties:
  - be buried in pickable ground with a minimum cover of 300 mm;
  - be buried under roadways with a minimum cover of 500 mm and the backfill shall be properly compacted; and
  - have adequate cover when buried in rock or concrete or in a building element.

NOTE: Conductors and AC-circuits shall be identifiable in accordance with clause 4.2.3 of SANS 10222-3.

#### **3.5.7.4 Insulators**

All insulators must meet the following specifications:

a) Design criteria:

Insulators must be designed to prevent arcing under all conditions, including moisture and wet environments.

b) Sample submission:

At the time of tender submission, the following must be provided for Eskom's approval:

Three (3) marked samples of proposed insulators

5 meters of conductor / trace wire

c) Insulator testing:

Porcelain and non-metallic insulators must undergo the following test:

Minimum arcing voltage withstand: 20kV

Test configuration: Voltage applied between mounting screw and conductor / trace wire

Test conditions: Insulators soaked in 2% saline solution to simulate coastal or acid rain environments

Pass criteria: No arcing should occur during the test

d) Material requirement:

Non-metallic with guaranteed UV protection for a minimum of 15 years.

e) Strain insulator strength:

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Must withstand 300 kg pulling force at 45°C when attached to a 2.24 mm solid fully galvanized steel wire, using standard attachments.

f) Mechanical properties:

Must comply with Annex A.1 of SANS 10222-3 for general mechanical properties.

g) Length deviation for polymer and polyester-based insulators:

Maximum 5% deviation when tested according to Annex A.2 of SANS 10222-3.

h) Length deviation for ceramic insulators:

Maximum 5% deviation when tested according to Annex A.3 of SANS 10222-3.

i) Water absorption:

Maximum 3% deviation for all insulators when tested according to Annex A.4 of SANS 10222-3.

j) Distortion test:

Conditions: 250 g minimum weight suspended from any position on the insulator

Temperature: Minimum 45°C

Duration: Minimum 1 hour

Maximum allowable distortion: 20% from original form

#### **3.5.7.5 Synchroniser**

The synchronization mechanism shall be used to synchronize multiple energizers, allowing them to function as a single energizer with multiple outputs, all firing simultaneously with one single pulse.

#### **3.5.7.6 Lighting protection**

a) The system will be installed where it will be subject to voltage surges due to lightning, a variety of line faults, power interruptions and high voltage switching conditions. The system shall be able to operate without failure under all of the above-mentioned conditions. Therefore, it is imperative that the system be adequately earthed.

b) Protection against high voltage transients shall be provided on both the signal and power circuitry, without impairing the system's electrical parameters, sensitivity, or performance.

c) Lightning arrestors shall comply with the following additional requirements:

1) Comply with the requirements for fence insulators in Annex B of SANS 10222-3.;

2) Comply with corrosion protection requirements as stipulated in Annex F of SANS 10222-3.

3) Provide a resistance against ultra-violet radiation and shall not deteriorate within a minimum time period of 15 years; and

4) Have a maximum internal arc over voltage of 20 000V.

5) Lightning arrestors shall be capable of withstanding all the mechanical stresses that the wire conductor and its fixture to the electric fence will be subjected to, in terms of normal expected weather conditions.

#### **3.5.7.7 Earthing**

a) General compliance:

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Electrical fence earthing must follow the latest Eskom earthing standards.

b) Perimeter earthing:

Install a 35mm<sup>2</sup> copper earth rod ring around the entire perimeter, connected to the main earth mat.

c) Fence post earthing:

Connect all fence posts to the ring main using 35mm<sup>2</sup> earth rods. Light posts should be connected with 6mm<sup>2</sup> stranded copper.

d) Joint specifications:

All joints must be brazed/crimped to Eskom's approval, with minimum 75mm overlap.

e) Cabinet earthing:

Earth all electrical cabinets (e.g., energizer enclosures, doors) with 6mm<sup>2</sup> stranded copper to an earth rod or graded earth mat.

f) Earth peg placement:

Install earth pegs at the start/end of each zone, maximum 30m apart, connected to the main earth rod and NLEPD structure components.

g) ACB earthing:

Install three earth pegs in a triangular layout, 1.8m apart, on both sides of the ACB, connected to the main earth rod and first post of the NLEPD structure.

h) Earth peg specifications:

Use 1.5m long, copper-coated earth pegs.

i) ACB-adjacent earthing:

Connect all earth pegs, lightning diverters, and energizer ground connections with 16mm<sup>2</sup> copper earthing cables on both sides of the ACB.

j) Energizer earthing:

Lay 16mm<sup>2</sup> copper earth cables from the energizer to earth pegs on both sides of the ACB.

k) Periodic earthing:

Every 60m along the NLEPD structure, earth strain or corner posts to an earth rod, connecting to the next section's earth and back to the site earth mat.

l) Strain post earthing:

Loop all earth conductors/trace wires at each strain post, including the catenary/local earth reference wire. Connect to an earth spike and use Denzo tape to prevent chemical reactions between different materials.

m) Concrete slab earthing:

Install 6mm stranded copper underneath the concrete slab, bonded to all strain, in-line, corner, and intermediate posts.

### **3.5.7.8 Wire ways and conduits**

a) Install wire ways according to SANS 10222-3, clause 4.5.1.

b) Use conduit fittings and sizes that comply with SANS 10222-3, clause 4.5.2.

c) Protect all underground wiring by placing it inside:

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- Conduit
- Trunking
- Pipe

- Protective enclosure Note: Wire with an extruded polyethylene sheath designed for underground electric fencing qualifies as being in a protective enclosure.

d) Properly seal all conduits, ducts, and similar components to prevent water infiltration.

### **3.5.7.9 Electromagnetic compatibility requirements**

Installation clearance for electric fencing:

The electric fence must be installed with sufficient clearance from all potential obstructions, including vegetation. This clearance should account for both normal and wet conditions, ensuring that nothing can:

Come into direct contact with the electric fence.

Come into close proximity to the electric fence.

The purpose of this clearance is to prevent any interference with the communication system of the electric fence. This requirement helps maintain the fence's effectiveness and reliability in all weather conditions.

a) Compliance standard:

Installation of electric fences in proximity to overhead power lines must adhere to Annex BB of SANS 60335-2-76.

b) Support structure restriction:

Electric fence conductors must not be mounted on any support structure used for overhead power lines.

c) Crossing prohibition:

Connecting leads and electric security fence wires must not cross above overhead power lines.

d) Crossing guidelines:

- Avoid crossings with overhead power lines whenever possible.
- If unavoidable, crossings must be made underneath the power line.
- Crossings should be as close to a right angle as possible.

e) Height restriction:

When installed near an overhead power line, the height of connecting leads and electric security fence wires must not exceed 3 meters above the ground.

These guidelines aim to minimize potential interference and safety risks associated with the proximity of electric fences to overhead power lines.

f) General precaution:

When installing and operating electric fences near communication lines, measures must be taken to prevent harmful interference.

g) Compliance standard:

Installation of electric fences close to communication lines must adhere to Annex D of SANS 10222-3.

h) Crossing prohibition:

Connecting leads and electric security fence wires must not cross above overhead communication lines.

i) Wiring separation:

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Alternating current supply wiring must not be installed in the same conduit as signalling leads associated with the electric fence installation.

j) Crossing angle:

When an electric fence connection lead or wire crosses an overhead communications line, the crossing angle must be larger than 45°.

k) Parallel installation:

Avoid running electric fences parallel to communication lines when possible.

l) Short parallel distance separation:

For parallel installations less than 100 m in length, maintain a minimum separation of 1 m between the highest part of the electric fence and the communication line.

m) Long parallel distance separation:

n) For parallel installations exceeding 100 m in length, maintain a minimum separation of 2.5 m between the highest part of the electric fence and the communication line. These guidelines aim to minimize potential interference between electric fences and nearby communication lines.

### **3.5.7.10 Leakage current and electric strength**

a) Leakage current limits:

At operating temperature, system components must maintain leakage current within acceptable limits and demonstrate adequate electric strength.

b) Leakage current compliance:

Verification of leakage current requirements at operating temperature must be conducted in accordance with Section 13 of SANS 60335-1.

c) Transient overvoltage protection:

Energizer specifications:

Must withstand potential transient over voltages.

Compliance to be verified through tests 14.102 to 14.104 of SANS 60335-2-76.

During testing, no disruptive discharges should occur.

Surge protection devices are permitted to operate during tests, unless otherwise specified.

## **3.5.8 Mechanical requirements**

### **3.5.8.1 Energizer IP rating**

a) IP system compliance:

Energizers marked with the first numeral of the IP system must fulfil relevant requirements of SANS 60529.

b) Outdoor installation IP rating:

Energizers installed outdoors must have an IP rating of IP53.

c) Indoor installation IP rating:

Energizers installed indoors must have an IP rating of IP51.

d) Personal safety:

The enclosure must prevent or limit access to hazardous parts by human body parts or held objects.

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e) Equipment protection:

The enclosure must guard against ingress of solid foreign objects.

f) Dust protection:

Dust ingress prevention measures must be in place.

g) Water protection for outdoor units:

Outdoor energizers must be protected against jetting water.

h) High voltage protection:

Safeguards against high voltage apparatus must be provided.

i) Weather resistance:

Protection against adverse weather conditions is required.

j) Moisture protection:

The energizer enclosure must provide moisture protection according to its classification.

Compliance verification: Tests in Section 15 of SANS 60335-1.

### **3.5.8.2 Energizer mechanical strength**

a) Energizer robustness:

Must withstand rough handling expected in normal use.

Compliance test: Spring hammer test (Section 21.1 of SANS 60335-1).

Requirement: No damage impairing compliance with the test.

b) Insulation strength:

Accessible solid insulation parts must resist penetration by sharp implements

Compliance test: Tests in Section 21.2 of SANS 60335-1

Requirement: No breakdown during testing

c) Drop resistance:

Energizer must withstand dropping effects

Compliance test: Section 21.101 of SANS 60335-2-76

Requirement: No damage after the test

d) NLEPDS component resilience:

Mechanical shock and vibration must not affect:

Functioning of NLEPDS components

Life cycle of NLEPDS components

### **3.5.8.3 Energizer marking requirements**

Compliance with the following requirements must be verified through inspection:

a) General markings must comply with clause 7 of SANS 60335-1.

b) Required markings on the energizer:

Rated voltage or voltage range in volts

**CONTROLLED DISCLOSURE**

Supply nature symbol (unless rated frequency is marked)

Rated power input (watts) or rated current (amperes)

Manufacturer or responsible vendor identification

IP number for water ingress protection (if other than IPX0)

c) Warning label requirement:

This warning must be placed near the terminal cover: "Before obtaining access to terminals, all supply circuits must be disconnected"

d) Range marking:

For energizers with a range of rated values operable without adjustment, mark lower and upper limits separated by a hyphen.

e) Voltage setting visibility:

For adjustable voltage energizers, the set voltage must be clearly visible. For infrequent changes, a fixed wiring diagram is sufficient.

f) Multiple voltage markings:

For energizers with multiple rated voltages or ranges, mark the rated power input or current for each. If the voltage range difference is within 10% of the arithmetic mean, marking can relate to this mean value.

g) Input-voltage relationship:

Clearly mark upper and lower limits of rated power input or current to show the relationship with voltage.

h) Symbol compliance:

Any used symbols must comply with 7.6 of SANS 60335-1.

### **3.5.9 Environmental impact**

Temperature Endurance:

a) Energizers must withstand extreme temperatures encountered in normal use.

Compliance test: Test 18 of SANS 60335-2-76

Performance requirement: Output characteristics (as per 22.108 of SANS 60335-2-76) must not deviate by more than 10%

b) Post-test integrity:

No changes impairing further use.

Sealing compound (if any) must not expose live parts.

Must still meet requirements of clause 8 of SANS 60335-2-76 (protection against live parts access).

Corrosion Protection:

c) Metal-encased energizers:

Must be adequately protected against corrosion.

Compliance test: Salt mist test (IEC 60068-2-5) as specified in 31 of SANS 60335-2-76

Post-test requirements: No deterioration, coating intact and adhered to metal surface.

d) Corrosion protection performance must comply with Annex F of SANS 10222-3 standard

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e) Inland equipment requirements (beyond 6 km from high water mark):

500-hour minimum test period

Post-test visual inspection:

- i. Non-metallic coatings: No major corrosion signs
- ii. Metallic coatings: No major corrosion exceeding 25% of tested surface area.

f) Coastal area equipment requirements:

2,000-hour minimum test period

Post-test visual inspection:

- i. Non-metallic coatings: No major corrosion signs
- ii. Metallic coatings: No major corrosion exceeding 25% of tested surface area.

### **3.5.10 Safety requirements**

Fault condition safety:

Energizers must be constructed to minimize risks of fire, mechanical damage, and electric shock during abnormal or careless operation.

Compliance tests: Fault conditions tests (19.11, 19.12, and 19.14 of SANS 60335-1)

Test requirements:

- a) No emission of flames, molten metal, or hazardous amounts of poisonous/ignitable gas
- b) Temperature rises must not exceed values in Table 9 of SANS 60335-1

Temperature control:

Energizers and surroundings must not reach excessive temperatures.

Compliance test: Temperature rise determination under conditions in 11.2 to 11.7 of SANS 60335-1

Protection against live parts:

Adequate protection against accidental contact with live parts required.

Compliance test: Inspection and tests listed in 8 of SANS 60335-1

Output terminal placement:

Designed to prevent external conductors from contacting the enclosure.

Compliance check: Inspection

Insulation requirements (for mains-operated and mains-connectable battery-operated energizers):

No coincidental gaps between supplementary and basic insulation

No direct access to live parts through reinforced insulation gaps

Compliance check: Inspection

**CONTROLLED DISCLOSURE**

Battery compartment safety:

Terminals and accessible metal parts must have double or reinforced insulation from live parts.

Compliance check: Inspection, measurement, and relevant insulation tests

Battery connection safety (for battery-operated and mains-connectable battery-operated energizers):

Must include means to prevent electric shock from energizer output voltage during battery connection.

Compliance check: Inspection

Radiation and toxicity:

Energizers shall not emit harmful radiation or present a toxic or similar hazard due to their operation in normal use. The appliance is deemed to comply with this requirement without testing.

### **3.5.11 Construction requirements**

#### **3.5.11.1 Installation**

a) Install all Electric Fence parts as per SANS 10222-3, focusing on sections 10 and 11 for General and Specialised Electric Security Fences.

The fence can be:

Placed between two barrier fences.

Attached to an existing fence.

Mounted on a precast concrete wall or palisade fence.

Self-supporting.

c) For wall-top fences, follow SANS 10222-3, clause 10.4.1.

d) For piggy-back fences, adhere to SANS 10222-3, clause 10.4.2.

#### **3.5.11.2 Non-standalone NLEPDS structure requirements**

a) Construct brackets from materials strong enough to support their designated wire conductors.

b) Ensure brackets can withstand local temperature and environmental conditions.

d) Use fence insulator attachment devices that comply with SANS 10222-3, clause 10.2.2.5.

e) For steel brackets, follow dimensions/sizes specified in SANS 10222-3, clause 10.2.2.2.

f) Non-steel brackets or alternative designs must match the strength characteristics outlined in SANS 10222-3, clause 10.2.2.2 (a, b, c, or d).

g) For steel main supports, bracket dimensions/sizes must adhere to SANS 10222-3, clause 10.2.3.2.

h) Rolled steel brackets or those made from other materials must exhibit mechanical strength equivalent to brackets described in SANS 10222-3, clause 10.2.3.2 (a, b, c, or d).

### **3.5.12 Civil requirements**

a) Place a reinforced concrete anti-tunnelling T-shaped beam directly under the energized perimeter fence.

b) Dig a trench 100 mm wide and up to 600 mm deep beneath the fence line. Stop if hard rock is encountered. Spread excavated material in the barrier fence area.

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- c) Install 100x100x3 mm steel mesh, 500 mm wide, in the trench centre. Leave 100 mm above ground, bend 30 mm over ground level to attach slab reinforcement and cast with surface slab.
- d) Fill trenches with 20 MPa vibrated mass concrete.
- e) Cast a 20 MPa concrete slab, 800 mm wide, level with surrounding ground. Center the beam in the slab.
- f) Lay 100x100x3 mm steel mesh, 600 mm wide, 75 mm above ground, 300 mm on each side of the beam. Cast with vibrated concrete to form the slab.
- g) Pour slab on graded, compacted ground with a consistent slope between posts.
- h) Maintain maximum 100 mm distance between slab and bottom conductor/trace wire.
- i) Center conductors/trace wires in the slab.
- j) Finish slab sides and top with smooth wood shuttering.
- k) Cast panels 800 mm wide x 3000 mm long x 75 mm thick at sides, 150 mm at centre, in alternating sections.
- l) Butt all joints.
- m) Install 800x150x10 mm soft board expansion joints every 3000 mm maximum.

### **3.5.13 NLEPDS signage requirement**

- a) Construct warning signs from materials resistant to expected weather conditions and UV radiation throughout their lifespan.
- b) Install warning signs as per SANS 10222-3, clause 4.7.
- c) Clearly identify all electric fences with prominent warning signs.
- d) Securely attach signs to fence posts, the fence itself, fence elements, or building components within 200 mm of the electric fence.
- e) Use warning signs at least 200x100 mm in size.
- f) Place signs on access gates and within 500 mm of access areas with electric fences.
- g) Mount signs between 1.5 m and 2.0 m above ground level.
- h) Install signs within 2000 mm of each corner or bend in a straight fence section.
- i) In high-density areas, space signs no more than 10 m apart.
- j) In low-density areas, space signs no more than 100 m apart.
- k) Position signs for clear visibility.
- l) Include at least one warning sign on each side of the electric security fence.

Place warning signs at:

Each gate.

Every access point.

Intervals not exceeding 10 m (population density dependent).

Next to chemical hazard signs for emergency services.

- m) For fences along public roads or pathways, attach warning signs frequently to posts or clamp firmly to wires.
- n) Design signs with a yellow background on both sides and black text reading "CAUTION: Electric fence".

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### **3.5.14 Documentation**

a) Energizer instructions must include:

Electric fence installation guidelines.

Energizer-to-fence connection methods.

b) Provide installation instructions for NLEPDS components if not self-evident. Clearly state polarity sensitivity for relevant components.

c) Include advice on proper barrier use to prevent misuse and false alarms.

c) Provide a list of field-replaceable spare parts.

d) Ensure compliance with Eskom documents (contractor-submitted).

e) Include electrical and mechanical specifications for all equipment.

f) Provide equipment wiring diagrams.

g) Detail installation, commissioning, and maintenance procedures.

h) Include all module and circuit diagrams.

i) Provide schematic diagrams.

j) Include installation drawings.

k) Additional required information:

Power supply requirements

Performance characteristics (including MTBF)

Wiring and mounting instructions

Output ratings

Adjustment instructions (specifying any special tools)

Maintenance, testing, and servicing schedule

l) Issue a Certificate of Compliance (CoC) for all electric fence installations and extensions.

m) Ensure the electric fence system CoC complies with regulations 12(4) and 13(1) of the Electrical Machinery Regulations, 2011 of the Occupational Health and Safety Act, Act No.85 of 1993.

n) The CoC must comply with Annex G of SANS 10222-3.

### **3.5.15 Training**

Kriel Power Station personnel must receive product-specific training to:

Install

Test

Commission

Troubleshoot

Maintain

Configure the equipment

All system upgrades, including future firmware or software updates, shall be provided at no cost as part of ongoing product improvement and enhancement.

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### **3.6 Spares management**

- a) Supplier must provide a formal OEM support and agent agreement letter for local spares and repair services.
- b) Supplier to offer repair services for faulty units, subunits, and modules.
- c) Enable direct replacement spare procurement from manufacturers.  
Allow Eskom to contract external companies for equipment repairs.
- d) Suppliers must notify Eskom before discontinuing or modifying any system part to allow spare parts procurement for installed base.
- e) Repair and return service turnaround time: 7 days.
- f) Ensure NLEPDS component spares (including energizers) availability for 10 years post-model discontinuation.
- g) Provide a 5-year pro-rata warranty.
- h) Return faulty units, subunits, or modules to contractor for warranty repair or replacement.
- i) Warrant repaired items against same fault recurrence for 3 months from return date.
- j) Offer repair and return service for out-of-warranty equipment as needed.
- k) Energizer and associated NLEPDS components must have a minimum 2-year guarantee.
- l) The design of the NLEPDS shall comply with the standard technology development methodology as defined in PTM&C Technology Development standard (240-8364419).
- m) Suppliers shall ensure that system and its components comply to tests stipulated in Annex C. Compliance to some or all the tests listed will be confirmed through equipment demonstrations, factory acceptance test (FAT) as well as site acceptance test (SAT). The conducting of these tests by Eskom does not replace supplier's responsibility to ensure that the equipment offered complies with the stated test requirement.

### **3.7 Technical returnables**

The tenderer shall submit the following deliverables for technical evaluation:

- a) PSIRA registration certificate (mandatory).
- b) A completed technical Schedule A/B indicating compliance to NLEPDS requirements (mandatory) from Eskom standard (240-78980848).
- c) Supporting information including deviation schedules in response to AB Schedule for NLEPDS from Eskom standard (240-78980848) to be evaluated on technical basis.
- d) The tenderer's past experience in delivering projects of a similar nature and scale (provide references).
- e) A company overview detailing the company background, available local expertise and international technical support capabilities.
- f) CVs of company personnel
- g) OEM signed confirmation letter/s confirming that warranties to the end user shall be honoured by the OEM.
- h) Functional design specification and system design report).
- i) Detailed design specification.

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#### **4. Acceptance**

This document has been seen and accepted by:

<b>Name</b>	<b>Designation</b>
G. Mthombene	Electrical Engineering Manager
R. Nelwamondo	Engineering Manager
B. Green	Subject Matter Expert
R. Maahlo	Risk and Assurance Manager
K. Ntsheroa	Electrical Maintenance Manager
A. Nkadimeng	Senior Technician
E. Malofha	Senior Advisor

#### **5. Revisions**

<b>Date</b>	<b>Rev.</b>	<b>Compiler</b>	<b>Remarks</b>
June 2024	0	W. Masemola	The initial draft of the scope of work

#### **6. Development Team**

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

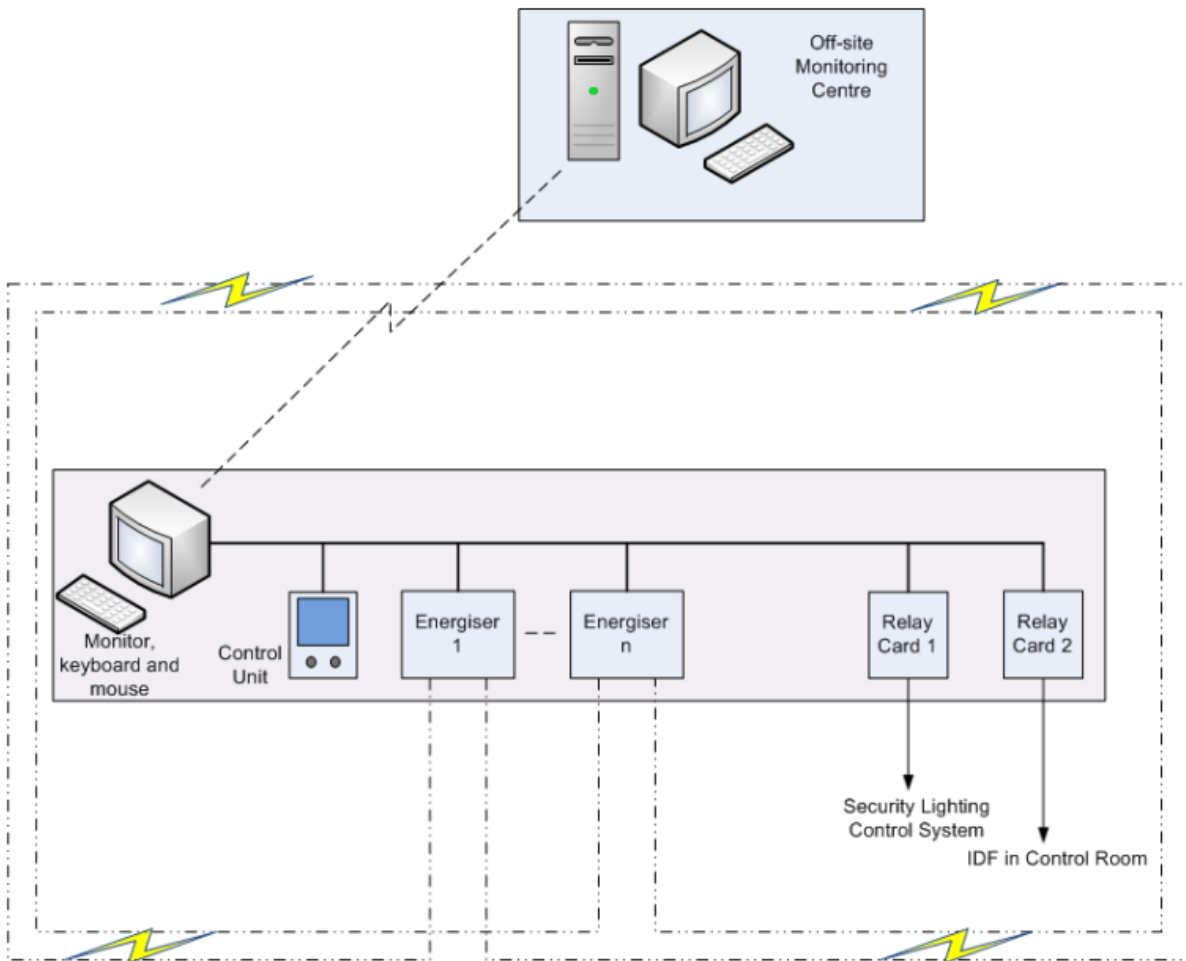
- W. Masemola
- G. Mthombene

#### **7. Acknowledgements**

Everyone that helped with the compilation of this document.

**CONTROLLED DISCLOSURE**

Annex A: Typical NLEPDS block diagram



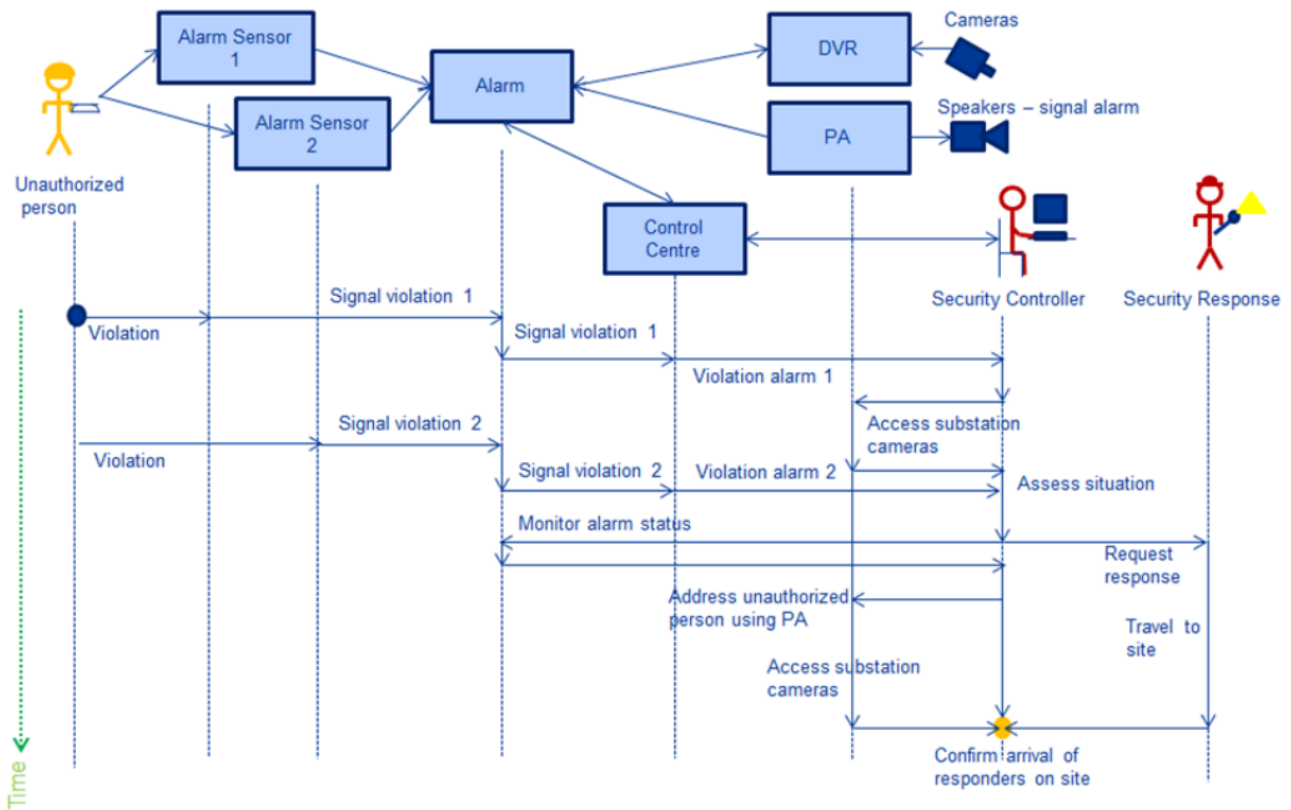
**CONTROLLED DISCLOSURE**

**Annex B: Energizer indications and alarms**

<b>Type</b>	<b>Duration</b>	<b>Description</b>	<b>Condition</b>
Status	Continuous	System-on (for each energizer)	Energizer powered
Status	Continuous	Energizer armed (for each energizer )	System is armed
Alarm	Momentary	Fence intrusion alarm (for each zone)	Alarm condition detected (Min. latching time of 1s)
Control	Minimum 50ms	System reset for each zone	System and alarm reset input
Alarm	Continuous	Battery low (for each energizer)	Battery voltage less than minimum voltage
Alarm	Continuous	Mains supply fail	AC power fail
Alarm	Continuous	Synchronisation problems	Energizers not pulsing simultaneously
Alarm	Continuous	Capacitor failure/equipment failure	Energizer parameters (Joules and kV) lower than minimum threshold
Alarm	Continuous	Watchdog	Energizer parameters (Joules and kV) beyond non-lethal energy and voltage legal requirements i.e. higher than 8 joules and higher than 10 kV

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**Annex C: Integrated alarm management**



**Annex D: Minimum clearance from power lines for NLEPDS**

Power line voltage (V)	Clearance (m)
≤ 1000	3
> 1000 and ≤ 33 000	4
>33 000	8

**Annex C: Functional and Detailed Design specifications requirements**

1. Functional design specification (basic design)

The tenderer is required to produce and submit a Functional Design specification and a System Design Report. The Functional Specification details Eskom's functional requirements in the context of the product that is offered by the Tenderer. The System Design Report documents the design that has been developed in order to meet the requirements as specified in the Functional Specification (240-78980848). At minimum the functional design specification and System design report shall cover the functional and interconnection details of system components listed below:

- a) Electric fence conductors
- b) Power supply

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- c) Configuration PC / Controller
- d) User interface / Display unit
- e) Synchronising equipment/mechanism
- f) Relay cards
- g) Communication infrastructure
- h) Energizer(s)

Note: The Functional Specification and the System Design Report can be combined as one document.

## 2. Detailed Design Specification

The tenderer is required to produce a Detailed Design Specification for both hardware and software components of the system and Acceptance Testing Procedures. At minimum the detailed design specification shall cover details listed in the following index.

- a) Overview of functional specification
- b) Scope of work
- c) High Level Integration
  - i. Local vs remote monitoring and control capabilities
  - ii. Software and network config files.
  - iii. Cause and effect matrices (e.g. if alarm on fence, lights are switched on)
- d) System Architecture (to include logical and physical design)
- e) Lifespan of System and product software versions (include 10 year life span support)
- f) Recommended Maintenance (Procedures, Spares and FMECA- Failure mode effects and criticality analysis, tools and test equipment, training requirements-engineering and field operations)
- g) System commission and acceptance testing procedure (commissioning results to be provided prior to system handover.
- h) Appendix A – Drawings
  - Site layout
  - Site Security Zoning
  - System Configuration
  - Security LAN and communication Reticulation
  - Cable and trench layout
  - Power reticulation
  - Control Panels
  - Electric fence and energiser
- i) Appendix B – Equipment Specification
  - Energisers
  - Electric fence conductors
  - Power supply
  - Configuration PC / Controller
  - User interface / Display unit

**CONTROLLED DISCLOSURE**

- Synchronising equipment/mechanism
- Relay cards
- Communication infrastructure

j) Appendix C – Datasheets

- Energisers
- Electric fence conductors
- Power supply
- Configuration PC / Controller
- User interface / Display unit
- Synchronising equipment/mechanism
- Relay cards
- Communication infrastructure

k) 10 Appendix D- Bill of Materials

**CONTROLLED DISCLOSURE**