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Compiled by



Andrew Koenane
Senior Engineer Electrical
Eskom Real Estate

Date: 2023/08/30

Functional Responsibility



Andrew Koenane
Senior Engineer Electrical
Eskom Real Estate

Date: 2023/08/30

Authorised by



Tshepo Phiri
Programme Manager Acting
Eskom Real Estate

Date: 2023/08/30

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1. INTRODUCTION

This document stipulates the functional specifications for the upgrade and safety-compliant of the Eskom Academy of Learning Electrical Kiosks, Distribution Boards and Sub-Distribution Boards. The requirements include upgrading all EAL Distribution Boards, Sub-Distribution Boards, Kiosks and ensuring work performed safely complies to SANS 10142-1 (The Wiring of Premises - Part 1: Low-voltage Installations) and the Electrical Installation Regulation of the OHS Act, (Occupational Health and Safety Act, 1993 (Act 85 of 1993)).

The Eskom Academy of Learning (EAL) site comprises of 39 buildings, which require safe and efficient electrical supplies. EAL Main building, Leadership Development Centre (LDC), Finesse building, Workshops, Simulator Building, Administrative center buildings, Accommodation buildings, Fire Protection Pump Station, and Water Treatment Plant. The Electrical Installation regulations have changed considerably since the time that the EAL site was constructed. As a result, the site does not comply with the SANS and OHS act. The vast majority of the EAL Kiosks require full replacement this is due to their hazardous conditions. The Eskom Academy of Learning Assessment reports which is referenced in this specification covers in detail the current condition of the Electrical Network at EAL. The EAL Electrical installation has many outdated, defective, and irregular-sized components that pose a risk of failure to protect human life in case of emergency and/or to respond slowly to prevent damage to property/Equipment in case of malfunctions/overcurrent.

2. SUPPORTING CLAUSES

2.1 SCOPE

The scope of work is as follows:

- Replacement all distribution boards, sub-distribution boards and kiosks at EAL to comply with the SANS 10142-1 (The Wiring of Premises - Part 1: Low-voltage Installations). The design base of the works shall be the EAL conditional assessment reports. The installation shall be tested, and a certificate of compliance shall be issued per distribution, sub board and kiosk.
- Production of full detailed design work report. The Eskom assessment reports referenced in this document shall form the basis of the detailed design.
- Provision of the electricity metering. Currently there are no meters installed in the distribution boards (DBs). Sub energy metering shall be allowed for on the main incomers DB/Kiosk per building. The kWh sub metering will monitor the electrical consumption per building. Install separate meters for lighting, general power and equipment be installed to facilitate and record better energy usage. Separate meters to be included on single line diagrams. Provide board load metering per phase for on the single line diagrams to aid energy management. Every meter is supplied with a Building Management System (BMS) interface module capable of communication on a BACNet TCP-IP protocol.
- Provide General arrangement drawings (GA) for each Kiosks, Distribution boards and Sub-Distribution boards connections.
- Conduct the tests and issue electrical Certificate of Compliance (CoC) by a qualified, registered electrician. The purpose of this certificate is to prove that all the electrical work and installations are in safe, good working order, and up to standard. The SANS10142-1 electrical installation regulations comprise of an entire book of regulations and the Occupational Health and Safety Regulations.
- Develop the layout drawings indicating the positioning of the Lights, Isolators, plugs. The positions of the distribution, sub boards and kiosks shall be indicated on the layout drawings.
- Production of Electrical single line diagrams (from each mini-substation, kiosk up to distribution, and sub-distribution boards level).

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- Conduct the full design base verification of the entire EAL reticulation network diagram and produce a single line network reticulation diagram.
- Provide the accurate ratings of all the DB's and Kiosks including their components. The technical data must include all "As Is" electrical drawings and on completion of the works, produce the "As built" electrical circuit wiring diagrams with detailed component, circuit breaker types, ratings, and sizes.
- Work should always be subject to full time supervision by a qualified and experienced site Eskom electrical technician.
- Re-generate and reproduce the Legends for each individual DB's, Sub DB's and Kiosks for the entire EAL site. Comprehensive, neatly legends card identifying all circuits.
- Compile the data sheet for all LV cables feeding from mini-substation, kiosks to distribution boards and sub-distribution boards.
- Produce a detailed design report for EAL DB's, Sub-DB's and Kiosks indicating the "As Is" and "As built" accurate components list.
- Distribution boards and Kiosks requirements, such as kA ratings, space limitations and colour requirements, to be made available on the "As Built" single line and wiring diagrams.
- Produce list and cost of all components that require urgent replacement to prevent business operations disruptions.
- Build new concrete and metal plinths of the Kiosks to meet the relevant standards and regulations.
- Assess and produce detailed report of the re-positioning of all the Kiosks located where there is soil erosion or non-compliant in accordance with SANS 10142-1 (The Wiring of Premises - Part 1: Low-voltage Installations) and give recommendations with cost for repositioning.
- Label all EAL DB's, Sub-DB's and Kiosks. Clearly engraved labels are to be provided below the relevant isolators, sockets, and circuit breakers. An engraved label is to be provided on the outside of the doors indicating the name of the distribution board and Kiosk. Distribution board signage such as danger signs shall be included in accordance with relevant regulations.
- The existing earthing and lightning protection system for the buildings shall be inspected, repaired, tested, and certified. Earthing for the electrical system shall be provided in accordance with SANS 10292.
- Earthing, bonding, and lightning protection. The *Contractor* shall ensure that all earth continuity conductors and earth busbars on all distribution, sub-distribution boards and kiosks are connected to the main earth system via the earthing of each supply cable. The building shall be properly earthed according to SANS 10313 and SANS 62305.
- The front face of the distribution boards, sub-distribution boards and kiosks shall be secured by means of appropriate slot or square key catches.
- Provide the scan to identify the underground power cables and underground services
- Provide a list of strategic spares with costs.

2.1.1 Purpose

The purpose of this document is to describe the functional requirements that must be met by the *Contractor* to upgrade, test and issue CoC's and detailed Electrical network diagrams of the EAL Kiosks, Distribution Boards and Sub-Distribution Boards including associated cables. The test report shall be in the format approved by the chief inspector, in respect of every electrical installation. The test results report and "As built" technical data, including the layout and wiring diagrams will be reviewed by the Employer for acceptance. The detailed designs will be used on a day-to-day basis for plant operation and maintenance purposes. The scope of this document applies to Electrical distribution boards, Sub-Distribution boards and kiosks EAL site environment.

- Fulfil the legal obligation to ensure that all electrical Installation is of a good quality standard.
- Safe for use by humans and it may not cause a negative environmental impact.

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- Conduct design base verification and provide detailed design report per distribution, sub distribution boards and kiosks.
- All works shall comply with SANS 10142-1 (The Wiring of Premises - Part 1: Low-voltage Installations) and Electrical Installation Regulation of the OHS Act, (Occupational Health and Safety Act, 1993 (Act 85 of 1993).
- Production of “As is” and “As built” drawings
- The design data is identified and is based on the following criteria:
 - ✓ What is the equipment?
 - ✓ What is the equipment connected to?
 - ✓ How is the equipment identified?
 - ✓ What is the respective size of the Kiosks, Distribution Boards and Sub-Distribution Boards.

The electrical certificate shall cover:

- Everything in the main kiosks, distribution boards, and any sub distribution boards, circuit breakers, earth leakage etc.
- The earthing system and connectivity throughout the installation.
- Bonding of all metal components.
- The socket outlets and light switches.
- All isolators for fixed appliances.
- All the cables from the mains incoming points, Switchgear, Kiosks to the main distribution board, sub boards and kiosks.
- All the cabling from the distribution boards to switches and plugs (including the wall plugs and light switches, through to the connection at the lights).
- All circuits and wiring to any fixed appliances, even if they are plugged into a wall socket (excluding the actual appliance itself).
- Positioning of electrical equipment (e.g., light switches and plugs that may not be within a certain distance of taps, shower, baths etc.).
- Mains switch and their accessibility within a certain height from the floor in case of emergencies.
- Ensuring that all electrical equipment in the installation is approved by SABS or other relevant approvals and be of the correct type and rating for the application.
- Ensuring that all electrical equipment must be installed in an approved manner.
- Ensuring that all electrical equipment is securely attached in place and suitably protected from little fingers gaining access.
- Ensuring that all parts of the permanent electrical installation is in good working order (including safety features); and lastly,
- An electrician will also take various readings to ensure that voltages, insulation, earthing, and other values adhere to regulatory requirements.
- Calibration certificates for energy meters supplied and installed.

2.1.2 Applicability

This document shall apply to the EAL Electrical Reticulation System Upgrade Project.

2.2 NORMATIVE AND INFORMATIVE REFERENCES

2.2.1 Normative

- [1] 240-143266511: Eskom Real Estate: MWP Electrical Plant Conditional Assessments Report
- [2] User Requirements Specification (URS): 240-142922253

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- [3] Required Operational Capability Report (ROC): 240-143295868
- [4] Engineering Work Request (EWR): 240-143328529
- [5] EAL Assessment Reports (All reports are compiled by *Others*)
- [6] Electrical Installation Regulation GNR.242 of 6 March 2009
- [7] Wiring Code: South African National Standards SANS10142-1
- [8] Electrical Installation Regulation Annexure 1 Section 4

2.2.2 Informative

- [1] 240-53114002: Engineering Change Management Procedure
- [2] 240-53114026: Project Engineering Change Management Procedure
- [3] 240-53665024: Engineering Quality Manual
- [4] 240-53114186: Document and record Management Procedure
- [5] ISO 9001 Quality Management Systems.

2.3 DEFINITIONS

Table 1 – Definition of Terms

Definition	Description
Acceptance	The <i>Employer</i> accept the condition or design but does not take responsibility from the Contractor
Architect Engineer	Architect Engineer - When <i>Eskom</i> acts as the Architect Engineer on a project/package/plant/system/asset, the reviewer(s) shall review the design documentation issued by the Design Authority to ensure that: the design satisfies the stakeholder requirements (i.e. validation of design deliverables against stakeholder requirements); the design is integrated by identifying all interfaces with other packages/plant systems/assets and ensuring that these interfaces are catered for; foreseen technical risks are identified and addressed/challenged with the Design Authority; general technical oversight is provided over the design.
Approval	Written agreement or authorization by <i>Employer</i> . All requests for approval must be submitted in writing and any proposed deviation from specified requirements must be fully justified and agreed by Employer.
Client	The end user will be Eskom who will be represented by Eskom Real Estate throughout the duration of the Project.
<i>Contractor</i>	Refers to the corporation appointed to perform the detailed design, plant and material selection, shop/construction drawings, procurement, and construction works required for Eskom Academy of Learning Refurbishment Project.
Design Authority	Design Authority - When Eskom acts as the Design Authority on a project/package/plant/system/asset, the reviewer(s) shall review the design documentation to ensure that: the design satisfies the design requirements; all relevant Eskom design standards, procedures and guidelines have been adhered to; the design is suitable and correct (calculations, philosophy, functionality, etc.); best Engineering practices were applied; the design is integrated by identifying all interfaces with other packages/plant systems/assets and ensuring that these interfaces are catered for.
Design freeze	Is a binding decision that defines the whole product, its parts or parameters and allows the continuation of the design based on that decision (no further changes can be made to the design, it is cut-off for the engineers)

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Definition	Description
Design Base	The Design Base is defined as the set of information that the engineering function deems material to describe the system design and the evolving design of an asset to ensure that the asset fulfils its intended purpose.
Employer	Refers to Eskom Holdings State Owned Company
Eskom Plant Engineering	Refers to the Eskom Engineering team who will perform the reviews and provide technical assistance for the work performed by the appointed Contractor/
Interface	Interface in these document means either to hard wired or software interaction between the <i>Contractor</i> and/or other Works
Owners Engineer	Owners Engineer - When Eskom acts as the Owners Engineer on a project/package/plant/system/asset, the reviewer(s) shall review the design documentation issued by the Design Authority to ensure that: the design satisfies the stakeholder requirements (i.e. validation of design deliverables against stakeholder requirements). General technical oversight is provided over the design.
Plant Equipment	An item performing a particular purpose as part of a system (Site Infrastructure).
Site Infrastructure	Refers to Eskom Academy of Learning All Electrical Kiosks, Distribution Boards, and Sub-Distribution Boards installed in all EAL buildings, sewage plant, Fire Protection pump station, and other pump stations around the EAL site. This includes the Civil and Structural, Electronics, Electrical System required to support the works.
Specification	The document/s forming part of the contract in which the methods of executing the various items of work to be done is described, as well as the nature and quality of the materials to be supplied and it includes technical schedules and drawings attached thereto as well as all samples and patterns
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.

2.3.1 Disclosure Classification

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

2.4 ABBREVIATIONS

Abbreviation	Description
AC	Alternating Current
DC	Direct current
BMS	Building Management System
CAPEX	Capital Expenditure
C&I	Control and Instrumentation
EMaP	Engineering Management Plan
LPS	Low Pressure Services
OEM	Original Equipment Manufacturer

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Abbreviation	Description
Qty	Quantity
SANS	South African National Standard

2.5 ROLES AND RESPONSIBILITIES

- *Eskom* ERE Engineering will act as the *Owners Engineer* throughout the life cycle of this project.
- *Eskom* ERE Engineering is responsible for reviewing all the *Contractor* works and ensuring that the works comply with the functional specification requirements as well as with Eskom Standards and other international applicable standards.

2.6 PROCESS FOR MONITORING

The primary process for monitoring will be governed by the Design Review Procedure (240-53113685), this entails assuring that the design achieves the requirements set out in this document. Any changes to this document will be performed as per Project Engineering Change Management Procedure (240-53114026).

2.7 RELATED/SUPPORTING DOCUMENTS

Refer to Section 2.2.1 and 2.2.2.

3. SYSTEM REQUIREMENTS

3.1 PROJECT OBJECTIVE

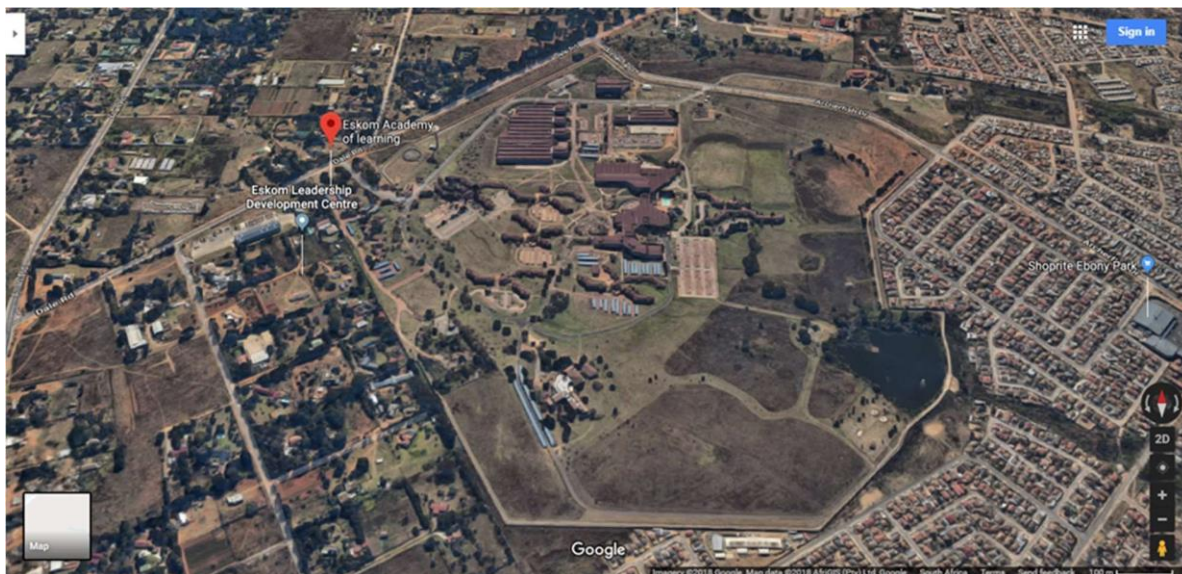
The project objective is to ensure compliance to SANS, OHSA and Eskom standards.

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3.2 SYSTEM DEFINITION

3.2.1 Background



The Eskom Academy of Learning (EAL) is built on 105 hectares of land and surrounded by a 3.9km radius High Security Mesh Fence perimeter. There are 39 buildings on site, which cater for diverse business operations specializing in among others, training and development, conferencing, hospitality, Information and Communication Technology, accommodation, and business office environment. All this business operations are supplied by a network of the Electrical Reticulation which comprises of the (11/0.4 kV) substations, 400V mini- substations, Kiosks, Distribution Boards and Sub-Distribution Boards.

Distribution boards contain the heart of the electrical installation. The mains' incoming supply is split to the various circuits, mainly plugs, lights, geysers, contactors, water heaters, isolators, Air-conditioning, earth leakage (E/L) and various other circuits. The circuit breakers protect against overload and short circuit faults, which could cause fires. The circuit breakers and wire size need to be correctly rated according to the maximum amount of electricity that the connected circuit may be expected to carry. The earth leakage guards against potential electrocution conditions. At least the main switch must be easily accessible in case of emergencies; preferably the entire board should be accessible.

Due to the state of disrepair of the EAL Electrical Kiosks and Distribution boards (DB's), including sub-distribution boards, they pose a safety risk. The Electrical Kiosks, Distribution boards (DB's), including sub-boards at EAL have been installed for more than 35 years and they do not possess Certificates of Compliance (CoC's). They have since deteriorated and some are dilapidated, but they are kept operational and are being used to provide electrical supply to all EAL buildings essential and non-essential loads. This deems the site buildings non-compliant in accordance with SANS 10142-1 (The Wiring of Premises - Part 1: Low-voltage Installations) and The Electrical Installation Regulation of the OHS Act, (Occupational Health and Safety Act, 1993 (Act 85 of 1993)). Only the Leadership Development Centre (LDC) building DB's (including sub-distribution boards) defects were identified, repaired and CoC's have been issued in accordance with the SANS 0142 (The Wiring of Premises - Part 1: Low-voltage Installations).

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The vast majority of the EAL Kiosks require full replacement this is due to their hazardous conditions. They are widely made of Fibreglass (over the years became brittle), reached their life span, worn out, weatherproof has been severely compromised (Ingress Protection compromised), foreign objects (dirt, dust, and termites) build inside the Kiosks. Some Kiosks have weed and vegetation growing on the inside of the shell. They are dilapidated, some are literally exposed (with visible loose & bare wires) and there is high possibility of electrical contact. They are dangerous, do not have CoC's, non-compliant and require urgent replacement/renewal. They have compromised the electrical integrity of the components and overall safety is significantly compromised.

Electricity is potentially dangerous, and a faulty or non-compliant installation can cause damage to property or harm to people through fire or electrocution. Overall safety of personnel and buildings has been severely compromised.

Visually inspecting each one of the Kiosk, DB's and sub-boards, several of them have been modified/alterd throughout the years and no Certificate of Compliance (CoC's) reissued. They do not meet statutory requirements of Certificate of Compliance (CoC). They need to be either replaced or repaired/renewed (re-wiring, re-arrange the wiring, change of components; covers need to be rehabilitated, re-labelled with new emblems). Refer to the EAL Conditional Assessment reports which are compiled by *Others*. They urgently need to be renewed/repared or replaced and then CoC's issued to ensure security of electrical supply and safety of the Eskom personnel and public in general.

3.3 SCOPE OF WORK

The scope of works includes the design base verification, detail design replacement report, production of layout drawings, single line diagrams, of the EAL Electrical Switchgear, Kiosks and Distribution boards (DB's), including sub-distribution boards, at Eskom Academy of Learning complex.

The purpose of the project is to provide an assurance that the electrical wiring and installations of the site are safe and in order. The Electrical Installation Regulations ("the Regulations"), promulgated under section 43 of the Occupational Health and Safety Act 85 of 1993, obliges every user or lessor of an electrical installation to have a valid certificate of compliance under regulation 7(1):

"Subject to the provisions of sub regulation (3), every user or lessor of an electrical installation, as the case may be, shall have a valid certificate of compliance for that installation in the form of Annexure 1, which shall be accompanied by a test report in the format approved by the chief inspector, in respect of every such electrical installation."

Under section 1 of the Regulations a "certificate of compliance" means:

"(a) a certificate with a unique number obtainable from the chief inspector, or a person appointed by the chief inspector, in the form of Annexure 1, and issued by a registered person in respect of an electrical installation or part of an electrical installation; or

(b) a certificate of compliance issued under the Electrical Installation Regulations, 1992"

- All work shall be executed and supervised by suitably qualified staff. Only "ACCREDITED PERSONS" shall be permitted to carry out and supervise work.
- The *Contractor* shall always have an adequate number of employees available during the works period to ensure that the work does not delay the construction programme.

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- The works shall be supervised by a full time registered “MASTER ELECTRICIAN”. A valid electrical certificate of compliance (CoC) issued by a registered person as prescribed by Clause 9 of the Electrical Installation Regulations of 2009 is proof that your electrical installation complies with the minimum safety standard.

3.4 SYSTEM FUNCTION AND PERFORMANCE REQUIREMENTS

- N/A

4. DESIGN REQUIREMENTS

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

The *Contractor* is responsible for the detailed upgrade of the complete *Works* based on the *Employer's* functional specification with all EAL assessment reports forming the basis of complete works.

The *Contractor's* works is to comprise of detailed reports packages which will be reviewed and approved by Eskom.

The *Contractor* is required to carry out detailed site investigation and take the actual measurements onsite. All survey data must be submitted to *Eskom* for record purposes and to assist as input during the review process. The *Contractor* shall make use of all the EAL assessments reports for the works and pricing. The EAL assessments reports are the basis of the final works.

The *Contractor* shall be responsible for accurate and complete works, i.e., safety, effectiveness, and adequacy of the EAL electrical system, propose the new areas which require alterations. The *Contractor* shall assume that the electrical services to site are operational. Finishing and tidying shall therefore not be left to the end of the contract but shall be a continuous operation.

- a) The *Contractor* is responsible for obtaining information regarding services for the existing works which may be affected by the new works. Before the *Contractor* commences operations, he must discuss with and have the acceptance of the engineer concerned regarding the method he/she proposes to use for the safeguarding of any services and existing works he may encounter during construction. The cost of all precautionary measures, which may be necessary to ensure the safety of such services and existing works, as well as the protection of all persons, shall be borne by the *Contractor*. Any alteration to services, which may be required, shall be carried out by the Authority concerned at the expense of the *Contractor*. The *Contractor* shall be held responsible for any damage, injury or accident caused because of his failure to take the necessary precautionary measures.
- b) The *Contractor* shall ensure that all safety regulations and measures are applied and enforced during the works.
- c) The *Contractor* shall take all the necessary precautions to protect existing services, finishes and structures during the execution of the contract, and shall be fully responsible for all repairs and damages thereto. The costs for any repairs of damages shall be recovered from the *Contractor*.

4.1.1.1 Electrical System Design

- N/A

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4.1.1.2 Outdoor Design Conditions

- N/A

4.1.1.3 Indoor Design Conditions

- N/A

4.1.1.4 Objectives and purpose of the works

The objectives and purpose of the *Works* is to upgrade, test, and issue CoC's at EAL site Distribution, Sub-Distribution Boards and Kiosks system, produce detailed upgrade report and produce the "As built" electrical layout, and wiring diagrams, Compliance with electrical wiring code (SANS 10142-1) for protection of people, animals, and property when it comes to electrical installations. Ensure installation as well as materials to be repaired/replaced to comply with Electrical Installation Safety Standards as outlined in Electrical Installation Regulation GNR.242 of 6 March 2009 and as stipulated in SANS10142-1.

- Fulfil the legal obligation to ensure that all electrical Installation is of a good quality standard.
- Safe for use by humans and it may not cause a negative environmental impact.

4.1.2 Electrical Services

The *Contractor* provides a detailed report of the Distribution Boards (DB's) and Kiosks including the reticulation diagrams and the layout arrangements. This includes:

- Upgrade each Distribution Boards (DB's), sub-distribution boards & Kiosks and provides the detailed design.
- *Contractor* verifies the Eskom condition assessment reports referenced in this document, evaluates, and provides design commendations of the required alterations to comply with the SANS 10142-1 (The Wiring of Premises - Part 1: Low-voltage Installations). The employer to review the designs before work starts.
- All works to comply with relevant electrical standards. Electrical Installation Regulation GNR.242 of 6 March 2009 and as stipulated in SANS10142-1.
- Provide electrical system "As is" and "As built" layout drawings.
- The works shall also comply with the requirements as laid down by the latest editions of:
 - Applicable SANS-codes
 - OHS Act
 - ESKOM regulations for building installations
- The *Contractor* adheres to National Building regulations and uses 240-54937450 – Fire Protection and Life Safety Design Standard and 240-54937448 Fire Detection and Life Safety Design Standard a guidance for Eskom specific requirements.
- The *Contractor* must supply the following documentation as a minimum for Employer Acceptance:
 - i. Scaled site electrical layout drawings indicating the following:
 - Accurate Legends in each Kiosk and Distribution Boards, including Sub-Distribution boards.
 - ii. System fault monitoring capabilities
 - iii. Detailed description of each interface including protocol used for interface
 - iv. Power Supply methodology

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- v. Method statements of the work prior to proceeding with the work

4.1.2.1.1 Component Requirements and Compliance

- N/A

4.1.2.1.2 Installation Requirements

- N/A

4.1.2.1.3 Interface Requirements

- a) Interfaces between the other systems must be identified and managed by the *Contractor Project Manager* and the *Eskom Project Manager*.

4.1.3 Civil and Structural Services

- Upgrade all the plinths and steel supports (where required) for all the Kiosks as per relevant SANS standards

4.1.4 Interfaces

The following interfaces are part of the project:

- Earthing surge, and lightning protection
- Civils and Structural requirements (Kiosks plinths and stands)

4.2 DESIGN OF PLANT EQUIPMENT

N/A

4.3 USE OF *CONTRACTOR'S* WORKS

The *Contractor* grants to the *Employer*, with effect from the starting date, an irrevocable royalty-free non-exclusive licence to use all the documents provided to provide the Works (including, but not limited to calculations, drawings, manuals, models, and other documents of a technical nature), for any purpose whatsoever, including for the purpose of operating, repairing, maintaining, dismantling, re-assembling, and adjusting all parts of the *Works*.

4.4 PROCEDURE FOR SUBMISSION AND ACCEPTANCE OF CONTRACTOR'S WORKS AND DOCUMENTATION

The following process will be followed during submission of documents:

- a) The *Contractor* submits the documents/drawings to the *Employer*
- b) The *Employer's* Document Controller registers the documents.
- c) The *Employer's* Document Controller will supply the documents/drawings to all relevant parties within the *Employer's* project team.
- d) The *Employer's* project team reviews the documents/drawings and will submit all comments or inputs to the *Contractor* for consideration.

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- e) If the *Employer* finds major deficiencies in the submitted documents/drawings, the *Contractor* revises the documents/drawings and resubmits to the *Employer*.
- f) The *Employer* reviews the documents/drawings and if no major deficiencies are found, the *Contractor* organises a Review session.
- g) The *Employer* and the *Contractor* conduct a Review.
- h) If any fundamental errors were found in the works or further actions are required, the *Contractor* record all concerns raised and revises the designs.
- i) The *Contractor* organises a Review session once all works were revised according to the concerns raised by the *Employer*.
- j) If no fundamental errors were found in the designs during the Design Review session, the *Contractor* compiles the Review minutes or report and submits it to the *Employer*
- k) The *Employer's* Document Controller registers the report.
- l) The *Employer's* project team reviews the *Contractor* report/minutes. If the report/minutes are not acceptable, the *Contractor* revises the report/minutes and resubmits to the *Employer's* Agent.
- m) The *Employer's* Agent will accept the *Contractor* works once the report/minutes are accepted by the *Employer's* project team.
- n) *Work* shall always be subject to full time supervision by a qualified and experienced site agent. This representative must be authorised and competent to receive instructions on behalf of the *Contractor*.

The following documents are supplied to the *Employer* by the *Contractor* as a minimum:

4.4.1 Detail Design

- As per the SANS 10142-1 (The Wiring of Premises - Part 1: Low-voltage Installations).

4.4.1.1 Process Design

- Component lists/schedules

4.4.1.2 Arrangement Drawings

- Plant Layout Drawings
- Arrangement drawings

4.4.1.3 Mechanical Detail Design

- N/A

4.4.2 Technical Specification

- Technical Specification document (Works Information/Tender document) and Enquiry drawings
- Technical tender evaluation strategy

4.4.3 Construction administration and Quality Assurance and Close out

- Construction Completion Review
- Acceptance Testing Review
- Quality assurance report
- Close out reports

CONTROLLED DISCLOSURE

4.5 OTHER REQUIREMENTS OF THE CONTRACTOR

The *Contractor* is to comply with all legislated safety requirements as well as *Eskom's* health and safety standards.

5. CODES AND STANDARDS

The complete detailed designs report is to comply with the following codes and standards:

5.1 GENERAL

- 240-54179170, Classification and Designation of Technical Documentation Standard.
- 240-71432150, Plant Labelling Standard.
- GIT general labelling standard for communication and power cables.
- 240-86973501, Engineering Drawing Standard Common Requirements.
- SANS 10400, The Application of the National Building Regulations

The latest edition, including all amendments up to date of tender of the following specifications, publications and codes of practice shall be read in conjunction with this specification and shall be deemed to form part thereof:

- Occupational Health and Safety Act 85 of 1993 and regulations as amended
- Compulsory standards:

- Compulsory specification for circuit-breakers, as published by Government Notice No. R. 967 (Government Gazette 29265) of 6 October 2006. (VC 8036)
- Compulsory specification for earth leakage protection units, as published by Government Notice No. 2286 (Government Gazette 10987) of 16 October 1987. (VC 8035)
- Compulsory specification for manually operated switches for fixed installations, as published by Government Notice No. R. 438 (Government Gazette 18779) of 3 April 1998. (VC 8003)
- Compulsory specification for plugs, socket-outlets and socket-outlet adaptors, as published by Government Notice No. R. 1075 (Government Gazette 33763) of 19 November 2010. (VC 8008)
- Compulsory specification for the safety of electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V), as published by Government Notice No. R. 1165 (Government Gazette 25306) of 15 August 2003. (VC 8075)
- Compulsory specification for safety of flexible cords for electrical appliances, as published by Government Notice No. R. 1079 (Government Gazette 33763) of 19 November 2010. (VC 8006)

Applicable SANS standards:

- SANS 10142-1 (The Wiring of Premises - Part 1: Low-voltage Installations)
- SANS 152 (SABS 152), Low-voltage air-break switches, air-break disconnectors, air-break switch-disconnectors, and fuse-combination units. (Superseded by SANS 60947-3.)
- SANS 156: Moulded-case circuit-breakers
- SANS 164-0, Plug and socket-outlet systems for household and similar purposes for use in South Africa – Part 0: General and safety requirements
- SANS 164-1, Plug and socket-outlet systems for household and similar purposes for use in South Africa – Part 1: Conventional system, 16 A 250 V a.c.
- SANS 164-2, Plug and socket-outlet systems for household and similar purposes for use in South Africa – Part 2: IEC system, 16 A 250 V a.c.

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- SANS 164-3, Plug and socket-outlet systems for household and similar purposes for use in South Africa – Part 3: Conventional system, 6 A 250 V a.c.
- SANS 164-4, Plug and socket-outlet systems for household and similar purposes for use in South Africa – Part 4: Dedicated system, 16 A 250 V a.c.
- SANS 164-6, Plug and socket-outlet systems for household and similar purposes for use in South Africa – Part 6: Two-pole systems, 16 A 250 V a.c., for connection of class II equipment.
- SANS 337, Stove couplers
- SANS 529, Heat-resisting wiring cables
- SANS 556-1, Low-voltage switchgear – Part 1: Circuit-breakers
- SANS 556-2-1, Low-voltage switchgear Part 2-1: Earth leakage circuit-breakers
- SANS 556-2-2, Low-voltage switchgear Part 2-2: Earth leakage switches
- SANS 767-1, Earth leakage protection units – Part 1: Fixed earth leakage protection circuit-breakers
- SANS 950, unplasticized polyvinyl chloride rigid conduit and fittings for use in electrical installations.
- SANS 1012, Electric light dimmers
- SANS 1063, Earth rods, couplers and connections
- SANS 1065-1 (SABS 1065-1), Metal conduits and fittings (screwed-end and plain-end) for electrical wiring – Part 1: Metal conduits. (Superseded by SANS 61386-1 and SANS 61386-21.)
- SANS 1065-2 (SABS 1065-2), Metal conduits and fittings (screwed-end and plain-end) for electrical wiring – Part 2: Metal fittings. (Superseded by SANS 61386-1 and SANS 61386-21.)
- SANS 1085, Wall outlet boxes for the enclosure of electrical accessories
- SANS 1195, Busbars
- SANS 1213, Mechanical cable glands
- SANS 1239, Plugs, socket-outlets and couplers for industrial purposes
- SANS 1411-1, Materials of insulated electric cables and flexible cords – Part 1: Conductors
- SANS 1433-1, Electrical terminals and connectors – Part 1: Terminal blocks having screw and screwless terminals
- SANS 1973-1, Low-voltage switchgear and controlgear ASSEMBLIES Part 1: Type-tested ASSEMBLIES with stated deviations and a rated short-circuit withstand strength above 10 kA
- SANS 1973-3, Low-voltage switchgear and controlgear ASSEMBLIES Part 3: Safety of ASSEMBLIES with a rated prospective short-circuit current of up to and including 10 kA
- SANS 1973-8, Low-voltage switchgear and controlgear ASSEMBLIES Part 8: Safety of minimally tested ASSEMBLIES (MTA) with a rated short-circuit current above 10 kA and a rated busbar current of up to and including 1 600 A a.c. and d.c.
- SANS 1507-1, Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V) – Part 1: General.
- SANS 1507-2, Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V) – Part 2: Wiring cables
- SANS 1507-3, Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V) – Part 3: PVC distribution cables
- SANS 1574-3, Electric flexible cores, cords and cables with solid extruded dielectric insulation – Part 3: PVC-insulated cores and cables
- SANS 1574-5, Electric flexible cores, cords and cables with solid extruded dielectric insulation – Part 5: Rubber-insulated cores and cables
- SANS 1765, Low-voltage switchgear and controlgear assemblies (distribution boards) with a rated short-circuit withstand strength up to and including 10 kA
- SANS 1777, Photoelectric control units for lighting (PECUs)
- SANS 10199, The design and installation of earth electrodes
- SANS 10313, Protection against lightning – Physical damage to structures and life hazard

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- SANS 60309-1/IEC 60309-1, Plugs, socket-outlets and couplers for industrial purposes - Part 1: General requirements
- SANS 60439-1/IEC 60439-1, Low-voltage switchgear and controlgear assemblies - Part 1: Type-tested and partially type-tested assemblies
- SANS 60529/IEC 60529, Degrees of protection provided by enclosures(IP Code)
- SANS 60669-1/IEC 60669-1, Switches for household and similar fixed electrical installations – Part 1: General requirements.
- SANS 60934, Circuit-breakers for equipment (CBE)
- SANS 60947-2/IEC 60947-2, Low-voltage switchgear and controlgear – Part 2: Circuit-breakers
- SANS 60947-3/IEC 60947-3, Low-voltage switchgear and controlgear - Part 3: Switches, disconnectors, switch-disconnectors and fuse combination units
- SANS 60947-4-1/IEC 60947-4-1, Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters
- SANS 60947-4-2/IEC 60947-4-2, Low-voltage switchgear and controlgear - Part 4-2: Contactors and motor-starters - AC semiconductor motor controllers and starters
- SANS 60947-4-3/IEC 60947-4-3, Low-voltage switchgear and controlgear – Part 4-3: Contactors and motor-starters - AC semiconductor controllers and contactors for non-motor loads
- SANS 60947-5-2/IEC 60947-5-2, Low-voltage switchgear and controlgear - Part 5-2: Control circuit devices and switching elements - Proximity switches
- SANS 61084-1/IEC 61084-1, Cable trunking and ducting systems for electrical installations - Part 1: General requirements
- SANS 61312-3/IEC/TS 61312-3, Protection against lightning electromagnetic impulse - Part 3: Requirements of surge protective devices (SPDs)
- SANS 61386-1/IEC 61386-1, Conduit systems for cable management – Part 1: General requirements
- SANS 61386-21/IEC 61386-21, Conduit systems for cable management - Part 21: Particular requirements – Rigid conduit systems
- SANS 61386-22/IEC 61386-22, Conduit systems for cable management - Part 22: Particular requirements – Pliable conduit systems
- SANS 61386-23/IEC 61386-23, Conduit systems for cable management - Part 23: Particular requirements – Flexible conduit systems
- SANS 61439-1, Low-voltage switchgear and controlgear assemblies Part 1: General rules
- SANS 61643-1/IEC 61643-1, Low-voltage surge protective devices - Part 1: Surge protective devices connected to low-voltage power distribution systems - Requirements and tests
- SANS 61643-12/IEC 61643-12, Low-voltage surge protective devices – Part 12: Surge protective devices connected to low-voltage power distribution systems - Selection and application principles
- SANS 62208, Empty enclosures for low-voltage switchgear and controlgear assemblies-General requirements
- SANS 62305-1/IEC 62305-1, Protection against lightning - Part 1: General principles
- SANS 62305-2/IEC 62305-2, Protection against lightning - Part 2: Risk management
- SANS 62305-3/IEC 62305-3, Protection against lightning – Part 3: Physical damage to structures and life hazard
- SANS 62305-4/IEC 62305-4, Protection against lightning - Part 4: Electrical and electronic systems within structures
- SATS 17576, Light emitting diode products for lighting: Performance requirements
- SANS 890-1, Ballasts for fluorescent lamps Part 1: Ballasts for lamps for operation with starters (class A lamps)
- SANS 890-2, Ballasts for fluorescent lamps Part 2: Ballasts for lamps for operation without starters (class B lamps)

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- SANS 1041, Tubular fluorescent lamps for general service
- SANS 1464-22, Safety of luminaires Part 22: Luminaires for emergency lighting
- SANS 1662, Self-ballasted LED tubular lamps for general lighting services > 50 V - Safety requirements
- SANS 60598-2-2, Luminaires Part 2-2: Particular requirements - Recessed luminaires
- SANS 62560, Self-ballasted LED-lamps for general lighting services by voltage > 50 V - Safety specification
- SANS 62504, General lighting - Light emitting diode (LED) products and related equipment - Terms and definitions
- SANS 10313: The protection of structures against lightning.
- SANS 10198-3: The selection, handling and installation of electric power cables of rating not exceeding 33kV Part 3: Earthing systems - general provisions, South African National Standards, Pretoria.
- SANS 10198-12: The selection, handling and installation of electric power cables of rating not exceeding 33kV Part 12: Installation of earthing system, South African National Standards, Pretoria.
- IEC 61439-1: General Rules
- IEC 61439-2: Power Switchgear and Controlgear Assemblies
- IEEE 81: IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System
- SANS 204: Energy Efficiency in Buildings
- SANS 475: Luminaires for interior lighting, streetlighting and floodlighting - Performance requirements
- SANS 10098: Public lighting
- SANS 10108: The classification of hazardous locations and the selection of apparatus for use in such locations
- SANS 10114-1: Interior lighting Part 1: Artificial lighting of interiors
- SANS 10114-2: Interior lighting Part 2: Emergency lighting
- Electrical Installation Regulations, 2009 as amended (Promulgated in terms of the Occupational Health and Safety Act by GNR 242 of 6 March 2009).
- Equipment used shall originate from Suppliers which have been certified in accordance with SABS ISO 9001 (ISO 9001) or SABS ISO 9002 (ISO 9002) for quality assurance.
- Manufacturer's specifications and installation instructions
- Local by-laws

5.2 MECHANICAL

- N/A

5.3 ELECTRICAL

- 240-56356396 Earthing and Lighting Protection
- 240-103059202, Capacity of Essential Power Supplies for Telecommunication, Protection and Telecontrol Equipment of the Transmission System.
- 240-53114248, Specification for Thyristor and switch mode chargers, AC/DC to DC/AC converters and inverter/uninterruptible power supplies.
- 240-56356510 Definitions of Terms Applicable to DC Emergency Supplies Standard
- 240-56535959 Management of Emergency AC and DC Supplies at Non-Nuclear Sites Standard
- 240-56357424 MV and LV Switchgear Protection Standard
- 240-56357421 Measurements and Metering Standard

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- 240-62581162 Generation Energy Management and Data Acquisition System (EMDAS) Standard
- 240-56359083 Metering and Measurement Systems for Power Stations in Generation Standard
- 240-56227516 LV Switchgear Control Gear Assembly Associated Component for Voltage 1000V AC and 1500V Standard
- 240-56227443 Requirements for Control and Power Cables for Power stations Standard
- 240-55714363 Coal Fired Power Stations Lighting and Small Power Installation Standard
- 240-56227426 Management of Power Station MV and LV Protection and Settings Standard

5.4 CONTROL AND INSTRUMENTATION

- N/A

5.5 CIVIL

- 240-56364545, Structural Design and Engineering Standard.
- Applicable SANS standards listed in the documents above based on the final scope requirements.
- National Building Regulations

6. AUTHORISATION

This document has been seen and accepted by:

Name	Designation
Palesa Moleko	ERE Project Manager
Kameel Burath	ERE Engineer Civil & Structural
Tshepo Phiri	ERE Engineering Manager (Acting)
Byron Thomas	ERE Engineer Civil & Structural
Burton Witbooi	ERE Snr Advisor Architecture
Carol Buthane	EAL Senior Electrical Supervisor
Kgosi Mogosi	ERE Snr Supervisor Tech Facilities
Nonkululeko Mhlanga	ERE Snr Supervisor Tech Facilities
Thando Mafatle	ERE Manager Project Services

7. REVISIONS

Date	Rev.	Compiler	Remarks
November 2022	1	A.S. KOENANE	First Issue
August 2023	2	A.S. KOENANE	Re-issue

8. DEVELOPMENT TEAM

- A. Koenane

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9. ACKNOWLEDGEMENTS

The stakeholders and signatories on the document.

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