

Title: **USER REQUIREMENT SPECIFICATION FOR RESIDENTIAL SOLAR PHOTOVOLTAIC (PV) AND BATTERY ENERGY STORAGE SYSTEMS (BESS)**

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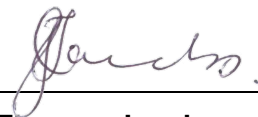
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Executive Summary

Eskom is committed to accelerating the adoption of renewable energy technologies and supporting the transition toward a cleaner, more resilient energy future. As part of this strategic direction, residential solar photovoltaic (PV) systems integrated with Battery Energy Storage Systems (BESS) have been identified as a critical solution for enhancing energy security, reducing grid dependence, and improving customer service delivery. These systems play a central role in Eskom's broader objectives of sustainability, decarbonisation, and modernisation of the distribution network.

This User Requirement Specification (URS) defines the minimum functional, technical, operational, and support requirements for residential-scale solar PV and BESS installations within Eskom's Distribution Division. The URS applies specifically to 20A to 60A single-phase hybrid systems and provides guidance to Engineering, Procurement, and Construction (EPC) Contractors responsible for feasibility analysis, design, engineering, procurement, installation, testing, commissioning, training, and ongoing maintenance.

The document establishes a standardised framework that ensures all residential PV-BESS installations are safe, compliant, reliable, and aligned with Eskom's technical governance standards, regulatory obligations, and customer expectations. It sets out defined roles and responsibilities, quality requirements, documentation deliverables, and performance expectations to ensure uniformity across all installations.

In addition to technical and functional performance, the URS emphasises customer experience and system lifecycle support. This includes feasibility studies, structural assessments, design reviews, installation quality assurance, training of relevant Eskom personnel, and a mandatory post-installation support period as indicated in the Technical Schedules.

1. Introduction

Eskom is committed to expanding the adoption of renewable energy technologies, improving energy efficiency, and reducing its overall carbon footprint in line with national energy policies and sustainability goals. As part of this commitment, residential solar photovoltaic (PV) solutions, particularly hybrid systems incorporating Battery Energy Storage Systems (BESS), form a critical pillar in supporting South Africa's transition to a cleaner and more resilient energy future.

This User Requirement Specification (URS) defines the minimum performance, functional, and operational requirements for residential solar PV and BESS installations. It applies specifically to 20A to 60A single-phase systems intended for residential customers and serves as a reference document for Engineering, Procurement, and Construction (EPC) Contractors responsible for the design, supply, installation, testing, commissioning, training, and maintenance of these systems.

2. Supporting Clauses

2.1 Scope

This specification applies to all residential-scale solar PV and BESS installations undertaken within Eskom's distribution network. The scope encompasses:

- a) Customer feasibility study/analysis: The Contractor shall facilitate and demonstrate the ability to conduct a feasibility study which will show the potential benefits to customer. This includes the provision of a quote and high-level design.
- b) Site Assessment: Perform a thorough site evaluation, including an assessment of the equipment arrangement.
- c) The solutions that shall be offered include a 5kW, 8kW, 10kW and 12kW single-phase solutions.
- d) System Design and Engineering: Development of detailed designs for 20A to 60A single-phase residential solar PV systems, including hybrid configurations with battery storage.
- e) Structural Assessment: Contractor shall choose the mounting structure and perform a structural analysis (or request the services of a structural engineer) to verify the load bearing capacity of the roof, prepare a module allocation plan including hook positions, cable routing and laying and determine inlets and cable length.
- f) Procurement and Supply: Provision of all materials, equipment, and components necessary for complete system functionality in accordance with approved standards and specifications.
- g) Installation and Construction: Mechanical and electrical installation of PV modules, inverters, battery systems, wiring, and balance of plant components.
- h) Testing and Commissioning: Verification of system performance, compliance testing, and functional commissioning in line with Eskom and regulatory requirements.
- i) Training: Development and delivery of user and maintenance training, and submission of all associated technical documentation, drawings, and manuals.
- j) Operation and Maintenance: Provision of post-installation support, including preventative and corrective maintenance for a defined period after commissioning.
- k) Only customers that have internet access shall be considered for these solutions. In cases where the customer does not have internet access, the Contractor shall offer a solution to provide such services.
- l) Customer After Sales Installation Support: To ensure optimal performance and customer satisfaction, the Contractor shall provide comprehensive installation support and after-sales service for a period of as specified in the Technical Schedules following the commissioning of the rooftop PV system.

2.1.1 Purpose

The purpose of this URS is to establish a clear and standardised set of performance, functional, operational, and support requirements for residential solar PV-BESS installations implemented within Eskom's distribution network. This document ensures that all EPC Contractors deliver solutions that are safe, reliable, compliant, and aligned with Eskom's strategic objectives for renewable energy integration.

The URS provides a definitive reference that enables consistent planning, design, installation, testing, commissioning, and maintenance of residential-scale PV and BESS systems. It serves to:

- Ensure uniformity and quality across all installations.
- Protect customer and system integrity through standardised technical and safety requirements.
- Support Eskom's long-term sustainability goals by enabling effective adoption of hybrid renewable energy systems.
- Facilitate a seamless customer experience from feasibility analysis through to post-installation support.

2.1.2 Applicability

This document is applicable exclusively to Eskom's Distribution Division.

2.2 Normative/Informative References

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

2.2.1 Normative

- [1] ISO 9001 Quality Management Systems.
- [2] 240-75655504: Corrosion Protection Standard for New Indoor and Outdoor Eskom Equipment, Components, Materials and Structures Manufactured from Steel Standard
- [3] 240-171000418: Major Equipment Requirements for Distribution Solar PV and BESS: SSEG and Microgrids
- [4] 240-105658000: Supplier Quality Management Specification
- [5] SANS 10142-1: The wiring of premises Part 1: Low-voltage installations.
- [6] 240-120804300: Standard for The Labelling of Electrical Equipment within ESKOM Wires Networks
- [7] 240-170000103: Lithium Iron Phosphate Batteries Standard
- [8] 240-170000189: Standard for Current and Future Metering Implementation
- [9] 240-170000777: Engineering Instruction for Operating LV Networks with Small Scale Embedded Generators (SSEG)
- [10] 240-55410927: Cyber Security Standard for Operational Technology
- [11] 240-57649065: LV Protection Standard
- [12] 240-57855874: Photovoltaic Modules and Regulators
- [13] 240-61182045: Maintenance Engineering Standard for Batteries and Chargers
- [14] 240-62629353: Specification for Panel Labelling Standard
- [15] 240-64636794: Generic Equipment Specification Wire, Wire Marking, Cable Numbering, Fibre Optical Cable Installation and Labelling
- [16] 240-75661043: Services Standard

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- [17] 240-84924080: Metering Requirements for Small Scale Embedded Generation
 - [18] 240-76628631: Standard for Sealing of Metering Equipment
 - [19] 240-55146411: Standard for Energy Meter Kiosks: Secure Pole-Top Multi-Way Metering Kiosks
 - [20] 240-75883830: Steel Grades and Welding Requirements for Steelwork and Overhead Line Hardware Components
 - [21] 240-75655380: Low Voltage Services Section 1: Electrification
 - [22] 240-61704085: The Standard for Concentric Service Cable with Tinned Copper and Coated Steel
 - [23] NRS 097-2-1:2024 Small-scale Embedded Generation, Utility Interface
 - [24] SANS 10400 – The Application of the National Building Regulations.
 - [25] SANS 60269-1: Low-voltage fuses Part 1: General requirements
 - [26] SANS 60269-6:2021: Low-voltage fuses Part 6: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems
 - [27] SANS 62930: Electric cables for photovoltaic systems with a voltage rating of 1,5 kV DC
 - [28] SANS 62852: Connectors for DC-application in photovoltaic systems - Safety requirements and tests
 - [29] SANS 60529: Degrees of protection provided by enclosures (IP Code)
 - [30] SANS 50025-2: Hot rolled products of structural steels Part 2: Technical delivery conditions for non-alloy structural steels
 - [31] 240-103407540: Commissioning Standard for Embedded Generators in Low Voltage Installations

2.2.2 Informative

None.

2.3 Definitions

2.3.1 General

Definition	Description
Distributed Energy Resources	Generators, including loads having a generating mode (such as electrical energy storage systems) connected to the low or medium voltage distribution network, with their auxiliaries, protection, and connection equipment.
Small Scale Embedded Generator	Embedded generator rated at up to 1 MVA which includes the energy conversion device (devices), the static power converter (converters), if applicable, and the control and protection gear within a customer's network that operates in synchronism with low-voltage networks. For avoidance of any doubt, the point of generator connection must be at low voltage even if the point of utility supply is not at low voltage.

2.3.2 Disclosure Classification

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

2.4 Abbreviations

Abbreviation	Description
AC	Alternating Current
BESS	Battery Energy Storage System
BMS	Battery Management System
CMMS	Computerised Maintenance Management System
CMS	Control and Monitoring System
CNC	Customer Network Centre
CoC	Certificate of Compliance
DC	Direct Current
DDR	Document/Drawing Change Request
DDT	DDR and Document Tracking System
DER	Distributed Energy Resources
Dx	Eskom's Distribution Division
DoEL	Department of Employment and Labour
EMS	Energy Management System
EPC	Engineering, Procurement and Construction
IEC	International Electrotechnical Commission
LFP	Lithium-iron-phosphate
M&O	Maintenance and Operations
MES	Maintenance Engineering Strategy
MIS	Maintenance Implementation Standard
OEM	Original Equipment Manufacturer
OPC	OLE (Object Linking and Embedding) for Process Control
OU	Operating Unit
PV	Photovoltaic
QEM	Quality Event Management
SSEG	Small Scale Embedded Generator
URS	User Requirement Specification

2.5 Roles and Responsibilities

- a) The appointed technical evaluation team will be responsible for ensuring that all successful tender submissions meet the requirements set forth in this document. During the execution phase, the assigned project manager (PM) will oversee compliance of the manufactured, delivered, and constructed products with this specification, or any agreed-upon and approved deviations.

- b) Regarding Maintenance and Operations (M&O), the respective OU/Cluster M&O Managers will be responsible for overseeing all contractual M&O activities. The Contractor, in coordination with the OEMs, will develop and deliver the required Maintenance Engineering Strategies (MES), Maintenance Implementation Standards (MIS), and associated documentation for all relevant asset classes included in the solution.
- c) Eskom will provide the necessary templates and guidance for this process. At the commencement of the M&O phase, the OU/Cluster M&O Managers will ensure the entry of all required plant data into the CMMS (Maximo) system.
- d) Additionally, the Contractor will be responsible for capacity building within Eskom, particularly with respect to training and the development of training materials. All M&O activities performed by the Contractor shall adhere to Eskom Dx's standard processes, such as work management systems and dispatching, to ensure a seamless handover to Eskom Dx at the end of the initial or extended contract period. During this phase, the Contractor shall involve relevant M&O staff in all activities to facilitate effective knowledge transfer and ensure a smooth transition.
- e) The Contractor shall also facilitate the generation of SAP material numbers, Buyers Guides and DDTs.

2.6 Process for Monitoring

Not applicable.

2.7 Related/Supporting Documents

Not applicable.

3. Requirements

3.1 General Requirements

- a) All EPC Contractors undertaking Solar PV system installations must hold valid SAPVIA PV GreenCard accreditation or equivalent.
- b) All PV installation work shall be carried out or supervised by PV GreenCard–certified or equivalent personnel who also hold valid DoEL registration as Electrical Contractors or Registered Persons.
- c) Where design and engineering services are required, these must be formally approved by a suitably qualified Pr. Eng or Pr. Tech.Eng registered with the Engineering Council of South Africa (ECSA). Similarly, any civil or structural elements related to PV mounting structures must be reviewed and endorsed by a competent structural engineer registered with ECSA.
- d) The Contractor is fully responsible for the complete engineering design of the Solar PV system and any associated infrastructure, ensuring that the installation is safe, reliable, and fully compliant with applicable Eskom, SANS, NRS, and IEC standards.
- e) The Contractor shall also ensure the availability of at least one Installation Electrician (IE) or Electrical Tester for single-phase installations, who is qualified to inspect the works and issue a valid Certificate of Compliance (CoC) for the completed residential-scale PV-BESS installation.
- f) Contractors must also demonstrate proven experience in completing at least five (5) residential hybrid installations of similar capacity and must provide evidence of local technical support capability and spare part availability within South Africa.

3.2 Functional Requirements

- a) All design, supply, installation, testing, and commissioning activities for the solar PV system shall comply with all relevant South African statutory, regulatory, and industry standards/guidelines (SAPVIA or equivalent). The Contractor is responsible for ensuring full legal compliance and obtaining all required permits, licences, and certifications before any work begins.

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- b) The Contractor is fully responsible for the complete lifecycle of the residential solar PV and BESS installation, beginning with a feasibility study and detailed site assessment and thereafter continuing through design, engineering, manufacturing, procurement, and supply of all required materials and documentation. This responsibility extends to the delivery of equipment to site, offloading, installation, construction, erection, and the execution of both off-site Factory Acceptance Testing and on-site Site Acceptance Testing.
- c) As part of their obligations, the Contractor must undertake all commissioning activities, including functional performance testing, the provision of samples where required, and the preparation of complete design records. This includes detailed design documentation, as-built drawings, asset governance documentation, test certificates, bills of quantities and comprehensive maintenance and operating manuals. All submissions must comply with the general and performance requirements defined in this specification.
- d) The Contractor is further required to develop and submit all asset governance documentation requested by Eskom, such as concept designs, design philosophies, detailed design packs, manufacturing and test certificates, bills of quantities and all user and maintenance manuals for the equipment supplied. Documentation must be complete, traceable and aligned with Eskom's quality and technical governance processes.
- e) Training must be provided to relevant OU personnel to ensure smooth and effective handover of the system at the end of the maintenance and operation support period. This includes training on system operation, maintenance activities, safety procedures and monitoring tools.
- f) The Contractor must ensure that all design and installation activities conform to recognised and up-to-date engineering practices. Where the Contractor proposes deviations from any of the specified requirements, such deviations shall be clearly justified, technically supported and submitted to Eskom for approval.
- g) During installation, and even during the first on-site assessments, the Contractor may have to work on or from elevated platforms. Therefore, all regulations of the Occupational Health and Safety Act and Eskom's safety standards and other regulations and guidelines must be adhered to in order to ensure a safe working environment.

3.3 Technical Overview and System Operation

- a) This specification stipulates the user requirements regarding the design, supply, installation, testing and commissioning of residential solar PV systems integrated with BESS for single-phase installations rated between 20A and 60A. These systems are intended to provide reliable, efficient and sustainable electricity to residential households, supporting Eskom's transition toward a modernised, resilient and renewable-enabled distribution network.
- b) The integrated solution makes use of solar PV modules to capture sunlight and convert it into electrical energy. This energy is then regulated by an appropriate charge controller or inverter-charger to ensure that the battery storage system is charged within safe operating limits, protected against overcharging and prevented from deep discharge that may shorten its lifespan. During daylight hours the PV array supplies power directly to the household's electrical loads, while any excess generation is stored in the BESS for later use. When solar energy is insufficient, such as at night, during cloudy weather or during power outages, the stored energy is automatically used to supply household loads.
- c) The inverter converts the direct current produced by the PV modules and stored in the BESS into alternating current compatible with residential appliances and Eskom's distribution network.
- d) Where permissible and subject to regulatory approval, the system shall support grid-interactive operation, allowing bidirectional flow of electricity. This enables customers to export surplus energy back into the grid, contributing to Eskom's distributed generation strategy while improving network resilience and customer participation in clean energy initiatives.
- e) For households where no smart meter is present, the Contractor shall include a suitable Eskom-compliant smart meter as part of the solution.

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- f) The specification is intended to cater to a diverse range of residential environments, including grid-connected urban households, rural homes and unelectrified dwellings where systems may be required to operate independently of the grid. The document therefore includes both universal technical requirements and provisions to address site-specific environmental and operational conditions.

3.4 Modes of Operation

The solution will support the following modes of operation:

- a) Seamless and automatic islanding and synchronisation, to and from the grid in the event of an outage.
- b) User-configurable prioritisation of PV energy production to either essential loads, or battery storage first, with the excess supplied to the other.
- c) Support the feature to export any excess energy to the grid-facing connection, up to a specified power limit.
- d) Programmable behaviour to perform scheduled grid charge and discharges in a 24h period, using various setting setpoints and measurements. This and similar functions will allow for flexible peak-shaving schedules to be programmed, and in addition allow for:
 - 1) Limiting the rate of BESS discharge,
 - 2) Setup of BESS SOC limits to start and stop discharging at,
 - 3) At least six programmable time-periods per day where different charge, discharge, thresholds, export enable / disable, and other settings can be automatically switched between, supporting a minute-resolution time setting,
 - 4) Load shaving during times of peak grid demand or similar, up to 100% of the BESS' peak AC discharge rate, sustained for its full capacity.

3.5 Customer Feasibility Study/Analysis

- a) The Contractor shall conduct a comprehensive customer feasibility study to determine the suitability and potential benefits of installing a residential solar PV and BESS.
- b) The Contractor shall clearly demonstrate the method and process by which the customer feasibility study and technical analysis will be conducted. This must include a step-by-step outline of how customer engagements, assessments, and data collection will take place. The Contractor shall specify whether the feasibility study will be performed through an on-site visit, an online web-based assessment platform, a remote consultation process, or a combination of these approaches.
- c) The feasibility study shall further highlight the potential customer benefits, including reduced reliance on the Eskom grid, improved resilience during load-shedding, long-term cost savings, and overall energy efficiency gains.
- d) Any risks, limitations, or site-specific constraints must be clearly identified.
- e) All findings shall be compiled into a user-friendly report to ensure the customer can make an informed decision before proceeding to the next stage of the project.

3.6 Site Assessment

- a) Before commencing any work, the Contractor must conduct a thorough inspection of the site and customer premises to identify statutory and site-specific requirements. This includes gathering initial on-site data to assess the project's overall potential by conducting physical site visits, capturing GPS coordinates, elevation, roof orientation, tilt angles, and any obstructions that may affect system performance.

- b) As part of the site assessment, the Contractor must verify grid connection requirements, assess the capacity and condition of the existing electrical infrastructure, and identify any municipal, regulatory, or compliance constraints that may affect the project.
- c) Photographs of the roof structure, shading areas, electrical room, and access routes shall be taken to support the assessment.
- d) The Contractor must also evaluate available space for PV modules and battery enclosures, review the condition of the existing electrical infrastructure, and identify suitable grid connection points and phase configuration. Additional tasks include identifying shading sources such as trees or nearby buildings, collecting local irradiance and weather information, and assessing site accessibility for installation and future maintenance.
- e) The Contractor shall also analyse the customer's historical electricity consumption and load profile to correctly size the system.
- f) The required deliverables include a detailed site inspection report with photos and measurements, an initial feasibility checklist, and a preliminary go/no-go recommendation together with a feasibility study report, energy yield & savings estimation and preliminary system sizing and layout.
- g) Following the site visit, the contractor shall conduct a full technical and financial feasibility analysis to determine whether the installation is viable.

3.7 Structural Assessment

- a) The Contractor shall be responsible for selecting a suitable mounting structure that is compatible with the customer's roofing type, material, and structural integrity.
- b) As part of this obligation, the Contractor shall perform a full structural assessment to ensure that the roof can safely support the additional static and dynamic loads imposed by the PV modules, mounting hardware, and associated equipment.
- c) Where necessary, the Contractor shall appoint or consult with a professional structural engineer, registered with ECSA, to verify roof load-bearing capacity and certify that the proposed installation complies with relevant building and safety standards.
- d) The Contractor shall also prepare a detailed module allocation plan showing the placement of PV panels, rail positioning, hook or bracket locations, and any roof penetrations required. This plan must consider structural beams, trusses, rafters, spacing, and roof condition.

3.8 System Design and Engineering

- a) The Contractor shall be responsible for the complete system design and engineering of residential solar PV installations ranging from 20A to 60A single-phase supply configurations. This includes the development of detailed electrical, civil, and integration designs.
- b) The Contractor shall develop a complete set of design documentation, including a detailed single-line diagram (SLD), layout drawings, and electrical schematics for the full PV system. These documents shall clearly illustrate all system components such as PV modules, inverters, DC and AC protection devices, cabling routes, earthing and bonding arrangements, isolators, combiner boxes, mounting structures, metering equipment, and all communication and monitoring networks. The drawings must accurately reflect the intended installation, show all interfaces with Eskom infrastructure, and comply with relevant SANS, IEC, and Eskom standards.
- c) The Contractor shall design the Solar PV system using a site-specific solar resource assessment informed by a minimum of 10 years of reliable meteorological data. This assessment shall include analysis of irradiance, ambient temperature, shading impacts, seasonal variations, and weather patterns that may influence system performance. The design must optimise energy yield, consider panel orientation and tilt, validate expected generation profiles, and incorporate loss factors such as soiling, temperature derating, and inverter efficiency.
- d) The Contractor must also ensure that system performance modelling is carried out using industry-standard software.

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- e) The design shall take into consideration OEM recommendations and requirements, regulatory and safety best practices.
- f) The Contractor shall further determine optimal cable routing paths, both internal and external, ensuring the design minimises cable length, avoids hazards, and maintains compliance with SANS 10142-1, The wiring of premises Part 1: Low-voltage installations [5]. Cable lengths, entry points, conduits, and protective measures shall be clearly defined in the design documentation.
- g) Detailed drawings, such as single-line diagrams, layout drawings, equipment schedules, and bill of materials shall be submitted for review and approval.
- h) The Contractor shall ensure that all designs are installation-ready and suitable for approval.
- i) All designs must be checked, signed, and approved by a registered Professional Engineer (Pr.Eng) or Professional Engineering Technologist (Pr.Tech.Eng) in accordance with the Engineering Profession Act (Act No. 46 of 2000).

3.9 Equipment Technical Requirements

- a) Photovoltaic Panels: The technical specifications applicable to PV panels shall be in accordance with the latest revision of 240-171000418: Major Equipment Requirements for Distribution Solar PV and BESS: SSEG and Microgrids [3]. It shall be the Contractor's responsibility to ensure full compliance with the requirements set out in the latest approved revision of this specification at the time of design, procurement, and installation.
- b) Batteries: The technical specifications applicable to the batteries shall be in accordance with the latest revision of:
 - 240-171000418: Major Equipment Requirements for Distribution Solar PV and BESS: SSEG and Microgrids [3]
 - 240-170000103: Lithium Iron Phosphate Batteries Standard [7]

The Contractor shall ensure full compliance with the requirements set out in the latest approved revision of this specification at the time of design, procurement, and installation.

- c) Inverters: The technical specifications applicable to inverters shall be in accordance with the latest revision of 240-171000418: Major Equipment Requirements for Distribution Solar PV and BESS: SSEG and Microgrids [3]. It shall be the Contractor's responsibility to ensure full compliance with the requirements set out in the latest approved revision of this specification at the time of design, procurement, and installation.
- d) AC and DC Protective Devices: The technical specifications applicable to AC and DC protective devices shall be in accordance with the latest revision of 240-171000418: Major Equipment Requirements for Distribution Solar PV and BESS: SSEG and Microgrids [3]. It shall be the Contractor's responsibility to ensure full compliance with the requirements set out in the latest approved revision of this specification at the time of design, procurement, and installation.
- e) This section outlines the technical requirements applicable to both the AC and DC reticulation components of the system.
- f) All wiring shall comply with SANS 10142-1, The wiring of premises Part 1: Low-voltage installations [5].
- g) For all outdoor installations the combiner and fuse boxes shall be rated for external environments, specifically designed to withstand corrosive conditions, with a minimum design life of 25 years. These boxes shall remain corrosion-free throughout their lifespan and provide at least IP65 ingress protection as defined by SANS 60529: Degrees of protection provided by enclosures (IP Code) [29].
- h) The DC combiner box shall include, at a minimum overvoltage protection.
- i) Surge protection shall be provided on both the DC and AC sides of the solar system.

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- j) The combiner box shall be equipped with sun shields if exposed to direct sunlight. To prevent overheating, reduced terminal occupancy is considered in the design. The installation location shall be easily accessible and provide a secure working base.
- k) The fuse box shall also be equipped with sun shields when exposed to direct sunlight, and reduced terminal occupancy is considered to prevent overheating. The installation location must be easily accessible and provide a secure base for working on the device.
- l) This section outlines the requirements concerning enclosures:
- 1) All enclosures shall be protected against water and dust ingress as per ingress protection ratings specified in SANS 60529: Degrees of protection provided by enclosures (IP Code) [29].
 - 2) Outdoor enclosures shall include measures to prevent condensation build-up.
 - 3) The structural material shall be at least 2mm thick and made from 3CR12 stainless steel or other corrosion-resistant materials.
 - 4) All enclosures must be protected against vermin and insect intrusion.
 - 5) All enclosures shall be adequately reinforced and fitted with handling facilities (as per ISO standards) to allow for safe transportation, handling, and placement using standard cranes, sling sets, forklifts, or other lifting equipment.
 - 6) Corrosion protection shall be applied to all metallic enclosures according to 240-75655504: Corrosion Protection Standard for New Indoor and Outdoor Eskom Equipment, Components, Materials and Structures Manufactured from Steel Standard [2].
 - 7) Energy meter kiosks shall comply with the requirements outlined in standard 240-55146411: Standard for Energy Meter Kiosks – Secure Pole-Top Multi-Way Metering Kiosks [19].
 - 8) An earth stud shall be provided for all enclosures where the earth stud shall be an M8 35mm stainless steel set screw (welded onto the bottom), spring washer and nut.
 - 9) The neutral bar shall be effectively connected to this earth stud by a green/yellow 10mm² PVC insulated earthing conductor.
 - 10) When the system operates in off-grid mode, a dedicated neutral-to-earth bond must be established.
 - 11) All earth connections shall be as short as possible and shall not be coiled.
 - 12) Supply and service cable glands shall be provided for the fitment of cables.
 - 13) The doors' surrounds shall incorporate a splash-proof sill around the inner border of the door opening of the kiosk.
 - 14) The roof shall form part of the box and shall not be a separate item.
 - 15) Indents shall be made to the roof to create a slight pitch on the roof to allow water to run off.
 - 16) All enclosure doors must be recessed to be flush with the sides of the enclosure.
 - 17) Exterior doors shall be reinforced with additional steel strength members, diagonally welded on the inside surface from corner to corner.
 - 18) Heavy-duty hinges shall be used for all exterior doors.
 - 19) The doors shall be fitted with stainless steel internal hinges.
 - 20) The enclosure shall be lockable by means of an 8 mm diameter shackle padlock.
 - 21) A four-point locking mechanism (top-centre, bottom-centre, left-centre, right-centre) with bars operated by a heavy-duty door handle shall be installed.
 - 22) A box shall be installed over the lever lock to protect the locking mechanism from vandalism. The box shall have 5 x 20 mm slotted holes over the top and side surfaces of the box.

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- 23) Alternative locking mechanisms may be proposed for review by Eskom. The proposal shall include operational details and information on the effectiveness of the system in preventing unauthorized access.
- m) This section outlines the requirements concerning steel structures:
- 1) Where applicable (as indicated in the Technical Schedules), steel used in the fabrication of structural steelwork shall comply with the latest requirements of SANS 50025-2: Hot rolled products of structural steels Part 2: Technical delivery conditions for non-alloy structural steels [30] unless otherwise specified. All imported steel shall undergo a landing test that includes mechanical (tensile, impact, and bending) testing and chemical composition.
 - 2) Where applicable (as indicated in the Technical Schedules), all structures and hardware components utilized to construct the mounting structure for proposed system shall comply with Table 1 of 240-75883830: Steel Grades and Welding Requirements for Steelwork and Overhead Line Hardware Components [20].
 - 3) The technical requirements relating to structure foundations, site layout considerations, and site soil classification shall comply with the latest revision of 240-171000418: Major Equipment Requirements for Distribution Solar PV and BESS: SSEG and Microgrids [3].

3.10 Installation and Construction Requirements

- a) The Contractor shall carry out all installation and construction activities in accordance with approved designs.
- b) The Contractor shall ensure that the installation is conducted in a safe, controlled, and professional manner, following all applicable the Occupational Health and Safety Act and Eskom's safety requirements.
- c) The installation shall include mounting of PV modules, installation of inverters, batteries, distribution equipment, protection devices, cabling, conduits, and associated balance-of-system components.
- d) The Contractor shall ensure correct placement, alignment, and secure fixing of all equipment.
- e) All electrical connections must be correctly sized, terminated, and tested to ensure compliance with SANS 10142-1 requirements.
- f) The Contractor shall ensure that DC and AC cable routing is neat, protected, mechanically secured, and free from hazards such as sharp edges, heat sources, moisture ingress, or potential mechanical damage.
- g) The service connections may be overhead or underground depending on the cost, suitability, and other factors. If cables are to be underground, the cable shall be buried at least 600mm below ground level. The trench detail shall be in accordance with DDT 0854.
- h) Routing of cables, installation of equipment and mounting of equipment aligns with industry best practices (SAPVIA or equivalent guidelines) and OEM recommendations.
- i) The Contractor shall manage all construction activities on-site, including housekeeping, material handling, waste removal, and coordination of work areas to minimise disruption to the customer.
- j) Where roof work is required, the Contractor must implement proper fall-arrest and working-at-height measures.
- k) The Contractor shall take full responsibility for protecting the customer's property during the installation and shall restore any affected areas to their original condition upon completion.
- l) The bedding & blanket layers of the trench (trench bedding) shall be free of stones, sharp objects and rocks that may cause damage to the cable. If the site material does not meet this requirement, then bedding and blanket layers soil shall be imported.
- m) The backfill shall be carried out using the same material excavated from the trench provided it is free from rocks and other sharp objects which may damage the concentric cable. If the site material does not meet this requirement, then backfill soil shall be imported.

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- n) The service connection shall be a concentric cable in accordance with 240-61704085: The Standard for Concentric Service Cable with Tinned Copper and Coated Steel [22]. The standard size shall be 6mm² for 20A supplies.
- o) A protective HDPE pipe shall be installed around the concentric cable as illustrated in drawing D-DT-0367 and D-DT-0360. The pipe shall be secured to the pole with stainless steel strapping D-DT-3131.
- p) Where the concentric cable enters the dwelling, suitable protection shall be applied around the cable to prevent damage to the insulation. (Where metallic dwellings are entered a steel compression gland shall be used.)
- q) The concentric cable used on all new services shall be installed without joints from the smart split meter pole-top box into the small power distribution unit or readyboard, which is mounted in the customer's premises.
- r) Compliance with standards 240-75655380: Low Voltage Services Section 1: Electrification [21] and 240-75661043: Services Standard [16] is mandatory to meet the electrification requirements outlined in the scope.
- s) The installation of smart meters will be managed and executed by Eskom unless otherwise specified within the Technical Schedule.
- t) GSM Smart Meters (with Internal/Plug-in Modem) are to be used for rural or scattered households, where installing a data concentrator wouldn't be practical.
- u) Single-phase smart meters to be used are depicted in 1, unless otherwise specified.

Table 1: Single-phase smart meters

SAP Material No.	Material Description	Product Description	Product Drawing Reference
0750644	METER ELECT SERV: SMART(1PH BS GSM) 80A	SINGLE PHASE BS SPLIT SMART METER WITH CIU + INTERNAL/PLUG-IN GSM MODEM	D-DT-9423
0750639	METER ELECT SERV: SMART(1PH BS PLC) 80A	SINGLE PHASE BS SPLIT PLC SMART METER WITH CIU	D-DT 9422

- v) All labelling of panels shall comply with the requirements of Eskom standard 240-62629353: Specification for Panel Labelling Standard [17].
- w) All markings of wiring and cables in substations shall comply with the requirements of Eskom standard 240-64636794: Generic Equipment Specification Wire, Wire Marking, Cable Numbering, Fibre Optical Cable Installation and Labelling [18].
- x) Upon installation of all equipment, the Contractor shall perform commissioning tests, system verification, and functional checks as specified in the commissioning requirements of this specification.

3.11 Testing and Commissioning

- a) Commissioning tests and requirements for embedded generators in low-voltage installations shall comply with the latest revision of 240-103407540: Commissioning Standard for Embedded Generators in Low Voltage Installations [31]. The Contractor shall be fully responsible for ensuring complete compliance with all provisions of the most recent approved revision of this standard before any commissioning activities are carried out.

- b) The Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), administered by the Chief Inspector of Occupational Health and Safety under the Department of Labour, mandates that all electrical installations must comply with the requirements of SANS 10142-1. The Act also requires that a Certificate of Compliance (CoC) be issued for each installation by an accredited person, such as a master installation electrician, installation electrician, or a single-phase electrical tester, as defined in the standard. This certificate must be in the format prescribed in SANS 10142-1 (refer to section 8.8).
- c) In line with these requirements, every electrical installation must be properly inspected and tested, and a valid CoC must be issued to the owner. Eskom is responsible for ensuring that a CoC has been issued before the electrical supply is connected.

3.12 Handover and Training

- a) The contractor shall be responsible for the development and delivery of comprehensive user and maintenance training to ensure that the customer can safely and effectively operate, monitor, and maintain the solar PV and battery storage system.
- b) Training shall cover system functionality, normal operating conditions, safety protocols, emergency procedures, inverter and battery management system (BMS) interfaces, energy monitoring platforms, and basic troubleshooting steps.
- c) The contractor shall tailor the training to the customer's level of technical understanding and ensure that all critical safety considerations, such as isolation procedures, normal and emergency shut-down, start-up sequences, and protection device functions, are clearly explained.
- d) The Contractor shall train the customer with regards to the use of specific applications that the customer can utilise to interface with the installed system.
- e) Maintenance training shall include guidance on routine inspections, cleaning requirements for PV modules, monitoring battery performance, identifying warning indicators or system faults, and understanding when professional servicing or warranty interventions are required. The contractor shall also provide instructions on how to maintain compliance with manufacturer recommendations and regulatory requirements over the system's operational life.
- f) As part of the handover process, the contractor shall compile and submit a complete set of technical documentation for the installed system. This shall include all:
 - 1) As-built drawings (single-line diagrams, layout drawings, block diagrams, cable schedules, and equipment placement)
 - 2) System design documentation
 - 3) Product datasheets
 - 4) EGI-Compliance Test Report
 - 5) Commissioning reports
 - 6) Configuration File / Settings Sheet
 - 7) Certificate of Compliance (CoC)
 - 8) Equipment Warranties
- g) The Contractor shall also provide user manuals, maintenance guides, and quick-reference instructions in a clear and accessible format. All documentation shall be submitted in both digital and printed form (where specified) and must reflect the final installed configuration.
- h) The Contractor shall ensure that the customer receives all required information for regulatory compliance, future maintenance, and warranty support.

3.13 Maintenance and Operational Support Requirements

- a) Inclusive Maintenance: The Contractor shall provide full maintenance and operational support for each residential solar PV-BESS installation during the defined support period (as stipulated in the Technical Schedule).
- b) All maintenance activities shall comply with Eskom Distribution's standard processes, including work management, dispatching, safety procedures, and documentation protocols.
- c) The proposed residential-scale PV-BESS must provide real-time monitoring of key operational parameters through a secure mobile and web-based platform. This monitoring shall track PV generation, battery performance, household load consumption and grid interaction. The monitoring solution must be capable of remote firmware updates and storage of historical performance data, incident/fault and operation logs.
- d) The Contractor is expected to have a ticketing system that manages and supports maintenance related activities (preventative maintenance, corrective maintenance and after-sales support functions) that integrates with Eskom's works and asset management processes. The proposed integration shall be demonstrated by the Contractor.
- e) The Contractor shall demonstrate the manner in which they shall perform Fleet Management with regards to equipment deployed and installed.

3.14 Customer After Sales Installation Support

The support shall include, but not be limited to, the following:

- a) Technical Assistance: Provide remote and on-site technical support for troubleshooting system performance issues, inverter faults, and connectivity problems.
- b) System Monitoring: Enable and maintain access to the PV monitoring platform for real-time performance tracking and alerts.
- c) Preventive Maintenance: Conduct at least two scheduled maintenance visits during the 12-month period to inspect, clean, and verify system integrity.
- d) Corrective Maintenance: Respond to any system failures or component malfunctions within 48 hours of notification.
- e) Customer Training: Deliver initial training on system operation, safety procedures, and monitoring tools during installation handover.
- f) Helpdesk Availability: Provide a dedicated customer support line (phone/email) either during business hours or at all hours (24/7) as stipulated in the Technical Schedule, with emergency support for critical failures.
- g) Response Times:
 - 1) Remote support: within 24 hours of request.
 - 2) On-site intervention: within 48 hours of request if required.
- h) Documentation: The customer is to be supplied with the following documentation:
 - 1) Operation & Maintenance (O&M) manual.
 - 2) Warranty certificates for all components.
 - 3) Contact details for support escalation.
 - 4) Certificate of Compliance (CoC).
- i) Performance Guarantee: Ensure system uptime of $\geq 98\%$ during the support period, excluding force majeure events. Provide monthly performance reports upon request.
- j) End of Support: At the conclusion of the specified maintenance period (as per the Technical Schedule), offer options for extended service agreements and performance monitoring.

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3.15 Equipment Warranties

The Contractor shall provide an equipment warranty in accordance with the minimum requirements outlined in 2. In addition to, and without limiting, the defects liability period, the Contractor shall offer a comprehensive warranty covering all equipment, including strategic components. No equipment warranty provided shall limit or negate any other warranties.

Upon achieving operational acceptance of the installation, the Contractor shall transfer the ownership of all manufacturer equipment warranties to the customer.

Table 2: PV-BESS Equipment Warranty

Equipment	Minimum Warranty Period (in Years)
PV Module - Product Warranty against Manufacturing defects	10
PV Modules – Performance	25
Mounting Structures – Duration of Warranty (Materials)	20
Mounting Structures – Lifetime Design Warranty	25
Inverter	10
Batteries	10
Civil Works	1

4. Authorization

This document has been seen and accepted by:

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5. Revisions

Date	Rev.	Compiler	Remarks
Nov 2025	1	MY Bux	First issue User requirement specification document compiled for the installation of solar PV and BESS for residential applications.

6. Development team

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

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- Tertius Hyman

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7. Acknowledgements

Not applicable.