Zwartkop Golf Estate Home Owners Association

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REQUIREMENTS FOR SMALL-SCALE EMBEDDED GENERATION

The application process to become a small-scale embedded generator in Zwartkop Golf Estate

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Objective

The objective of the first phase is to initiate the required systems and procedures to ensure homeowner compliance and improved billing systems complementary to operational effectiveness. This phase will consist of introducing the new billing software to the ZHOA billing team which includes automated readings and system failures (leak detection, tampering etc.), to set up all application processes compliant with the requirements for becoming an SSEG (set out in this document below), and to comply with the required Standards and Regulations set out in Appendix 1 (page 18).

A synopsis of the proposed implementation of the first phase is set out below:

- Replacing the current water and electric meters with Kamstrup-manufactured meters.
- The proposed scope contains identifying the meter kiosks that will be replaced with the electric meters and wiring but this phase will consist of only replacing and installing the electric meters inside the meter kiosks compliant with the Standards and Regulations (Appendix 1, page 18).
- Installation will be completed by an approved Electrician and Plumber, selected by the ZHOA.
- The billing software developed by Kamstrup will be initiated for this phase as a trial-and-error run for the ZHOA billing team.
- EHL Engineering Services (Pty) Ltd's responsibility will entail purchasing required equipment on behalf of ZHOA and managing and supervising installations.

Foreword

Small Scale Embedded Generation (SSEG) will play an integral part in the future of electricity generation yet how exactly, still needs to be determined. ZHOA acknowledges that we must keep developing and improving to deliver more efficient energy. This document sets standards that will change as development progress and will be updated as and when required.

ZHOA believes that SSEG is primarily to assist private individuals in maintaining their daily routine/lifestyle during load shedding or power outages. Hence, a grid-tie connection should therefore ever be installed for to-generation only, therefore ZHOA will only allow a grid-tie system to comprise a battery backup system to enable the client to continue his lifestyle during outages.

It is important to ensure that you have the latest version of the various application forms and other relevant documents before proceeding with an SSEG application. Note that this document should be read in conjunction with the standard terms and conditions of ZHOA. These are available on the ZHOA website: HOA - Zwartkop Golf Estate.

Indemnity

Anyone using these Requirements for Embedded Generation in part or in full as a basis for their own small-scale embedded generation program does so on the basis that they indemnify and hold harmless Zwartkop Home Owners Association its successors or assigns in respect of any claim, action, liability, loss, damage or lawsuit arising from their use of these Requirements.

Scope

This document's purpose is to guide ZHOA requirements and application process for connecting all forms of small-scale sustainable embedded generation such as photovoltaic panels to the ZHOA electricity network, including both renewable energy and cogeneration.

The approval process for a small-scale embedded generation (SSEG) installation in Zwartkop varies depending on the size of the system and customer category. This guide applies to systems with a generation capacity smaller than 100kVA, and all SSEG applicants up to this limit are required to comply with the conditions and process

described herein.

This document does not apply to those who wish to install a system with a generation capacity of greater than 100kVA should this be the objective a meeting must be arranged with ZHOA to establish the requirements and application process, for 1MVA, NERSA approval will be required.

Glossary

Alternating current

The flow of electrical energy that follows a sine wave and changes direction at a fixed frequency (i.e., it 'alternates'). Most residential and commercial uses of electricity require alternating currents.

Anti-Islanding

The ability of an SSEG installation to disconnect the SSE generator instantly and automatically from the local utility grid whenever there is a power outage in the utility grid, thus preventing the export of electricity to the utility grid from the SSEG. This is done primarily to protect utility workers who may be working on the utility grid and who may be unaware that the grid is still being energized by the SSEG.

Bi-directional meter

A meter that separately measures electricity flow in both directions (import and export)

Cogeneration

The generation of electricity using waste heat.

Customer

In the context of this document, customers are ZHOA's electricity consumers who also generate electricity through small-scale embedded generation.

Dedicated network

Section of the utility grid that exclusively supplies a single customer.

Direct Current

The flow of electrical energy in one constant direction. Direct current is typically converted to alternating current for practical purposes as most modern uses of electricity require alternating current.

Generating capacity

The maximum amount of electricity, measured in kilovolt ampere (kVA) (limited either by hardware or by software settings) which can flow out of the generation equipment into the customer's alternating current wiring system. This is therefore the maximum alternating current power flow which can be generated.

Grid-tied SSEG

SSEG that is connected to the utility's electricity grid either directly or through a customer's internal wiring is said to be "grid-tied". SSEG that is connected to the grid through a reverse power flow blocking contactor is also considered to be grid-tied.

Grid-tied hybrid SSEG

Grid-tied SSEG that islands after interruption of the utility supply or when the applicable electrical service conditions are outside stated limits or out of required tolerances and then supplies the load from the inverter, operating in the stored-energy mode via a suitably interlocked change-over switch, is said to be a "grid-tied hybrid" SSEG installation.

Inverter

A power device that converts direct current to alternating current at a voltage and frequency which enables the generator to be connected to the utility grid.

Isolated

A section of an electrical network which is disconnected from all other possible sources of electrical potential is said to be isolated.

Load profile

The variation of the customer's rate of electricity consumption (or demand) over time.

Low voltage

Voltage levels up to and including 1kV. (1kV= 1000 volts)

Medium voltage

Voltage levels greater than 1kV up to and including 33kV.

Off-grid SSEG

SSEG that is physically separated and electrically isolated from and can never be connected to the utility electricity grid – either directly or through a customer's internal wiring – is said to be "off-grid". Consumer loads cannot be simultaneously connected to the utility grid and the SSEG installation, and export of energy onto the utility grid by the generator must not be possible. An SSEG that is connected to the grid through a reverse power flow blocking contractor is not considered to be off the grid.

Passive standby UPS utilised as an off-grid hybrid SSEG

This applies to any UPS operation functioning according to the following principle:

a. The normal mode of operation consists of supplying the load from the grid as a primary power source.

b. When the latter is outside stated limits, the load is supplied from the UPS inverter, operating in stored-energy mode.

Such a system is regarded as off-grid provided it is equipped with a suitably interlocked change-over switch, selectable as follows:

i. Charger/rectifier mode (normal): Batteries are charged by the SSEG installation or, if required, by the grid. The grid is the primary power source for all the loads, or;

ii. Inverter mode (when the grid supply is interrupted, or applicable electrical service conditions are outside stated limits or required tolerances). The grid supply is disconnected, and selected loads are supplied from the inverter, within the rating of the energy storage or SSEG.

Point of Common Coupling

The nearest point on the electrical network where more than one customer is connected.

Point of Connection

An electrical node on a distribution system where the customer's electrical assets are physically connected to the utility's grid.

Pr. Eng., Pr. Tech Eng., Pr. Cert Eng. and Pr. Techni Eng.

This refers to a professional engineer, professional technologist, professional certificated engineer, or professional engineering technician who is registered with the Engineering Council of South Africa (ECSA) under the discipline of electrical.

Reverse power flow

The flow of energy from the customer electricity installation onto the utility grid (i.e., export) because of the instantaneous generation exceeds the instantaneous consumption at the generation site in question.

Reverse power flow blocking

A device which prevents power flowing from an embedded generator back onto the utility grid.

Shared network

A section of the utility grid that supplies more than one customer.

SSEG-Small-scale embedded generator

A small-scale embedded generator for these Requirements is an embedded generator with a generation capacity of less than 100kVA.

Suitably interlocked change-over switch

Switch required for grid-tied hybrid SSEG and a passive standby UPS utilised as off-grid hybrid SSEG to interrupt the grid supply. Switch requirements are listed in Appendix 4.

Utility

The electricity distribution service provider is responsible for the electricity grid infrastructure to which the customer is connected.

Utility Network (or Utility Grid)

The interconnected network of wires, transformers, and other equipment, covering all voltage ranges, and belonging to ZHOA supplies customers in the Zwartkop distribution area with electricity.

Wheeling - Not permitted in the ZHOA network

The deemed transportation of electricity, over a utility's electrical network from an SSEG to a third-party electricity customer.

ZHOA

'ZHOA' refers to Zwartkop Home Owners Association and will be referred to as such throughout this document.

Abbreviations

ADMD	After Diversity Maximum Demand Advanced Metering Infrastructure
DC	Direct Current
DSD	Distribution System Development
ECSA	Engineering Council of South Africa
EG	Embedded Generation
kVA	kilovolt-ampere (unit of electrical power, often similar in magnitude to kW)
kW	kilowatt (unit of electrical power)
kWp	kilowatt peak (the rated peak output of PV panels)
LV	Low voltage
MV	Medium voltage
MVA	Megavolt-ampere (1000kVA)
NERSA	National Energy Regulator of South Africa
NMD	Notified Maximum Demand
PCC	Point of common coupling
PoC	Point of Connection
PV	Photovoltaic
RPP	Renewable Power Plant
SSEG	Small-scale Embedded Generation/Generator
VAT	Value-added tax

Important Notices

Compliance with the Law

ZHOA bylaws state that no generation equipment may be connected to the grid without the explicit consent of ZHOA.

It is explicitly emphasised that a grid-connected SSEG installation which has been issued only with a Certificate of Compliance (CoC) **has not been authorised** to connect to the ZHOA electricity grid.

Clause 2 of the Electricity Installation Regulations of the Occupational Health and Safety Act states that it is the property owner who carries the responsibility for the safety of the electrical installation on the property. This includes everything related to SSEG installations on the property.

Failure to obtain this consent constitutes an offence in terms of section 27(2) and (3) of the Electricity Act, 1987 (Act 41 of 1987), and makes the perpetrator guilty of an offence and liable on conviction to a fine and/or imprisonment. (Also refer to ZHOA bylaws section).

Furthermore, the installation may be in contravention of the Occupational Health and Safety Act, for which punitive sanctions apply.

Customers found to have illegally connected SSEG to the grid (either before or after their electricity meter) will be instructed to have the installation disconnected from the grid. A Certificate of Compliance issued by an authorised electrical contractor will be required as proof of such disconnection.

Should the customer fail to have the SSEG disconnected from the grid, ZHOA will disconnect the electricity supply to the property (as provisioned for in the Electricity Supply By- Law).

Customers wishing to connect SSEG legally to the ZHOA grid will be required to follow the normal application procedure as detailed in these Requirements.

No exemption from any of the requirements will be granted for “retrospective applications”.

Generating licences

Existing legislation requires that anyone generating electricity “not for own use” must obtain a generating licence from the National Energy Regulator of South Africa (NERSA). NERSA has issued a communication giving licence exemption to SSEG installations in municipal areas under 100kVA.

ZHOA will register and authorise grid connection of SSEGs up to a maximum of 100kVA without evidence of a generation licence unless legislation changes.

Customers authorised by ZHOA may still be in future required by NERSA to obtain a generating licence. Customers are responsible directly to NERSA for obtaining a generating licence and ZHOA accepts no liability should NERSA refuse a generating licence and ZHOA subsequently withdraws registration and authorisation. ZHOA might be obliged to report to NERSA regularly regarding all grid-connected generation. Should NERSA refuse a generating licence, the generator must be disconnected from the grid unless the customer has received an exemption from NERSA in this regard. Any queries requiring clarity in this area must be discussed with NERSA.

Anyone wanting to connect more than 1 MVA must produce evidence of compliance with Sections 8, 9 and 10 of the Electricity Regulation Act regarding the licensing of generation and the registration of generation with the Regulator failing which the application will not be considered.

Professional Sign-off

Until

1. SANS 10142-Parts 1, 3 and 4 (The Wiring of Premises) are updated and published, and
2. Accredited embedded generation installation and commissioning electricians/technicians exist, all embedded generation systems installed on the ZHOA grid must be certified as complying with the requirements as follows:
    - ECSA-registered professional engineers, ECSA-registered professional technologists and certificated engineers may certify industrial, commercial, and residential SSEG installations. (Discipline: Electrical)
    - ECSA-registered professional technicians may only certify residential SSEG installations. (Discipline: Electrical)

Testing of Inverters

Until a SABS mark is issued for inverters, ZHOA will require proof of test certificates, of type tests having been successfully carried out by a third-party test house certifying compliance of the inverters with NRS097-2. Details of requirements regarding the Type Testing of inverters are found in Appendix 3 (page 22).

1. Introduction

Heightened environmental awareness, dramatic increases in the price of electricity, rapidly decreasing costs of photovoltaic (PV) panels, and the risk of national power blackouts have all resulted in electricity distributors around the country being inundated with requests to allow electricity customers to connect PV and other SSEGs to the electricity grid. Such SSEGs would be connected to the electrical Installation on the customer's premises which is in turn connected to, and supplied by the ZHOA electricity network – thus these generators are 'embedded' in the local electricity grid.

The parallel connection of any generator to the electrical grid, however, powered, has numerous implications for the local electricity utility. The most pressing is the safety of the utility staff, the public and the user of the SSEG. Further implications include the impact of the physical presence of the generation on neighbours (e.g., visual, noise), the impact on the quality of the local electrical supply, and metering and billing issues. There is therefore a strong need for such practice to be regulated for the general benefit and protection of customers and manageability of the distribution network.

Consequently, the ZHOA's Electricity Supply By-law requires that anyone wanting to connect a generator to the ZHOA electricity grid must obtain explicit consent from ZHOA. This document outlines the requirements in this regard and lays out the associated application processes.

Although the electricity distribution industry is highly regulated, SSEGs have not yet been adequately covered in national policy or legislation. In this void, ZHOA has developed policies and practices which it believes are consistent with broader national policy.

ZHOA is a City of Tshwane customer and therefore ZHOA will not purchase electricity at a greater cost than the relevant City of Tshwane tariff. The City of Tshwane's standard energy charge will therefore be used as a baseline.

2. Defining a small-scale embedded generation

Small-scale embedded generation (SSEG) refers to power generation under 1MVA, such as PV systems, small wind turbines and diesel/petrol standby generators which are located on residential, commercial, and industrial sites where electricity is also consumed. SSEG contrast with large-scale wind farms and PV parks that generate large amounts of power, typically in the multi-Megawatt range. Most of the electricity generated by an SSEG is consumed directly at the site but times arise when generation exceeds consumption and typically a limited amount of power flow in reverse - from the customer onto the utility grid. An SSEG, therefore, generates electricity that is "embedded" in the local electricity distribution network in that it is connected to the utility network on the customer's side of the utility's electricity meter.

3. Who the document is for?

This guideline is to assist customers who wish to connect an SSEG, with a generation capacity smaller than 100kVA, to the ZHOA electricity grid. It is intended to guide in this regard to:

- Residential building owners.
- SSEG installers.
- Energy consultants commissioned to design SSEG systems.
- Professional Engineers or Technologists involved in SSEG commissioning.

All customers must want to install a grid-tied SSEG, regardless of generation capacity, complete the relevant sections of the application process in full, and that written approval is received from ZHOA before system installation commences. ZHOA needs to ensure that, amongst other considerations, the SSEG installation can be accommodated on the electrical network and that the total SSEG generation capacity of the network has not been exceeded. Equipment should therefore not be purchased before obtaining written approval from ZHOA as approval is not guaranteed and ZHOA will not be held liable for equipment expenses where approval is denied.

This document does not apply to those who wish to install a system with a generation capacity between 100kVA and 1MVA or greater than 1MVA (1000kVA). For such systems, a meeting should be arranged with ZHOA to establish the requirements and application process. Anyone wanting to connect more than 1MVA will not be able to connect under the conditions of these requirements. In addition, a generating licence or exemption letter from NERSA will be required before the connection is considered.

4. SSEG systems not permitted

Transfer of power to a different location is not permitted:

The power produced by the SSEG must be utilised on the property on which the generator is located or fed onto the utility network for purchase by ZHOA. The following are not permissible:

Installation on a different property to where the power is used (e.g., installing PV panels on a neighbour's house's roof)

Supplying power from an SSEG on your premises to other premises (e.g., selling power to neighbours or other premises elsewhere in Zwartkop). This is also known as wheeling which is not allowed on the ZHOA electricity network.

5. SSEG Installations for net-grid connections with battery backup supply.

Grid-tie Inverters will only be accepted where the system can operate in Island mode with battery backup. This can either be an inverter with integrated UPS functionality or two systems linked together.

Grid-tied inverters are generally not designed to operate in "island mode" where the generator supplies power to a portion of the customer's network during a general power outage. Should the inverter be able to operate in an island state, it must be effectively isolated from the ZHOA grid during operation (as is legally required of any standby generator). SANS 10142-1:2017 Annexure P gives an example of what is required in this regard. Once the power to the ZHOA grid is restored, the SSEG may not be connected or reconnected to the grid until

1. 20-minute delay has passed
2. It has been properly synchronised with it.

If the system can't delay the switch back, then ZHOA will install equipment at the customer's cost.

A registered person in terms of the Electrical Installation Regulations (2009) must install the generator and issue a Certificate of Compliance to the owner of the generator is to be connected to the existing internal wiring of the property. Requirements of SANS 10142-1 – Clause 7.12 (Alternative supplies) applies.

Note: Approvals from the various HOAs are also a requirement. It is the responsibility of the prospective stand-alone generator owner to obtain the necessary approvals from the HOA directly.

6. SSEG Installations only for off-grid operation. No feed-in.

SSEGs are not connected to the electricity grid in any way and are thus 'off-grid' SSEGs. Customers with SSEG installations that they deem to be off-grid will be required to submit the following to substantiate that the SSEG installation is off-grid as defined and that the Electricity Supply By-laws, therefore, do not apply to it:

A completed "Declaration for Off-grid Small Scale Embedded Generation form" (SSEG-OG-D, Appendix 6, page 28) with details of the customer and the installation, declaring that the SSEG installation is deemed to be off-grid.

A certificate of compliance (CoC) and test certificate signed by an ECSA registered technician/engineer for electrical installations certifying that the SSEG installation is physically separated from the ZHOA grid and the part of the installation on the property that is being supplied from the ZHOA network. If a suitably interlocked change-over switch is required for a passive standby UPS utilised as an off-grid hybrid SSEG,

the certificate of compliance and the test report must certify that the change-over switch complies with the requirements as detailed in Appendix 4 (page 24).

A schematic diagram showing details of the SSEG installation about the rest of the installation and the ZHOA's grid signed by an ECSA-registered technician/engineer.

1. ZHOA inspection.

An SSEG installation connected to the ZHOA electricity grid through a reverse power flow blocking relay is not considered to be operating as an off-grid device. It is grid-connected and must comply with all the requirements detailed in these Requirements.

Note: Approvals from the various HOAs are also a requirement. It is the responsibility of the prospective stand-alone generator owner to obtain the necessary approvals from the HOA directly.

7. SSEG system decommissioning

ZHOA requires notice of an SSEG system which has been decommissioned. An SSEG system which has been decommissioned must be disconnected from the grid at the customer's cost.

A decommissioning application found in the SSEG-GT-A (Appendix 6, page 27) form must be completed and submitted to the ZHOA office.

8. Change of property ownership

When the transfer of ownership of a property takes place which has SSEG installed, the new owner will be required to sign a new contract (SSEG-GT-A, Appendix 6, page 27) or the SSEG system must be decommissioned (SSEG-GT-A, Appendix 6, page 27) as detailed in the paragraph above. The Certificate of Compliance which is required to be issued as a condition of the transfer of ownership of the property must include a statement regarding the state of connection or disconnection. At the time that the customer ceases to be on the SSEG tariff, any remaining credit balance will be refunded to the customer on written request provided that the customer has no other outstanding debt.

9. Web access to historical graphs of consumption and excess generation

Electricity customers will be able to access historical graphs of their premises' electricity consumption and excess generation.

10. Section A: Residential Small-scale embedded generators

10.1 General Requirements: Residential

10.1.1 Generation size limitations

ZHOA is following a considered, calculated approach regarding the introduction of embedded generation onto its electricity grid. The maximum energy permissible to be fed back onto the grid is 1200kWh/month per phase. The maximum connection allowed is specified in Table 1.

Table 1: Residential SSEG size limitations as derived from NRS 097-2-3

No. of Phases	Service connection Service Circuit Breaker Size (A)	Maximum Total Generation Capacity of SSEG* (kVA)
1	60A or 80A	4.6
3	60A or 80A	13.8

** Generation Capacity refers to the total output capacity of the generator. For PV systems, this refers to the maximum output of the inverter as limited either by hardware or software settings. The system*

designer/installer will provide guidance here.

The generation size limits in the table apply to normal residential connections on a shared low-voltage (LV) network. Customers who wish to apply for an installation with a generation capacity exceeding the limits in the above table should consult with ZHOA before commencing with their formal application.

In the event of operating conditions resulting in electricity network parameters not meeting statutory minimum quality-of-supply standards – to impose peak generation limits on embedded generator installations.

Note: A single-phase Inverter can be installed at a three-phase connection if the capacity is 4,6 kVA or less. However, it is the responsibility of the customer to ensure that their load is balanced across all three phases. A qualified electrician, engineer or technologist should be consulted here.

10.1.2 Metering and Tariffs

Residential customers may adopt one of two approaches to connecting SSEG to the grid:

i. Customers wanting to connect SSEG to the grid without being compensated for reverse power flow will be required to install reverse power flow blocking protection to prevent reverse power flow onto the electricity grid.

ii. Residential customers installing SSEG who wish to participate in the SSEG tariff must have a bi-directional meter installed. ZHOA will provide and install the requisite meters. The SSEG tariff is limited to 1200kWh per phase per billing period.

Customers (whether with single or three-phase supplies) wishing to participate in the SSEG tariff will have to adapt their electrical installations in such a way that metering will be accommodated in a meter kiosk in the road reserve. This does not apply where an acceptable meter kiosk or meter ripple box already exists on the street-front property boundary or side wall of the premises.

Tariffs are determined annually by ZHOA. The current tariffs are to be found on the ZHOA website and SSEG-GT-A (Appendix 6, page 27) form. The Eskom standard energy charge will be used as a baseline.

The applicable SSEG tariff is the R*esidential small-scale embedded generation tariff* and comprises A rate per kWh at which ZHOA will purchase residential generation up to a maximum of 1200kWh per phase per billing period. ZHOA will purchase from SSEG based on the current Eskom tariff structure excluding VAT.

10.1.3 Customer's Load profile management

The SSEG tariff has been structured in such a way that customers will find it most beneficial, from a financial and practical point of view, to ensure that they utilise as much of the generated electricity as they can and avoid or minimise reverse power flow. For example, where a PV system is installed, loads should be shifted to occur during the middle of the day when generation is typically at its highest – when the sun is shining. This means that customers should arrange that loads such as pool pumps, geysers etc. are switched on during this time – from mid-morning to mid-afternoon (roughly from 10:00 until 15:00) when PV generation is at a maximum and are off after sunset.

10.1.4 Who pays for what?

In general, ZHOA will pay for the changes to the grid and the customer for changes at their specific premises.

- Currently, ZHOA is responsible for all the costs involved in the supply and installation of meters.
- The cost of changing an existing meter will be borne by ZHOA.
- The customer will be responsible for any rearrangement or re-inspection of the installation or meter accommodation including the moving of the metering point to the property boundary should it be required.
- The customer will be responsible for the cost of any specialist grid studies (although such studies are unlikely in the case of residential SSEG installations).

- The customer will be responsible for any changes required to the utility network upstream of the connection point because of the SSEG installation (although the need for such changes is unlikely).
- The customer will be responsible for all the costs associated with specialist tests that need to be carried out, e.g., Inverter testing, as well as for obtaining the required certification of the design and installation as detailed below.

10.1.5 Applicable technical standards

Most of the technical requirements for SSEGs are covered in the following standards (note that these do not necessarily cover all requirements for SSEG systems - see Appendix 1 (page 19) for the complete list):

- NRS 097-2: Grid interconnection of embedded generation: Part 2 Small-scale embedded generation
- South African Renewable Power Plant Grid Code

The above standards cover aspects such as voltage range; flicker; DC injection; frequency operating range; harmonics and waveform distortion; power factor; synchronization; safe disconnection from the network; sudden voltage dips and peaks; voltage change; anti-islanding; DC injection; network faults; response to utility recovery; isolation; earthing; short-circuit protection; labelling.

The design and installation of all SSEG equipment will need to comply with these requirements. Consult with your supplier and/or installer to ensure that these conditions are met.

10.1.6 How to apply for permission to install Grid-Tied SSEG

The SSEG-GT-A (Appendix 6, page 27) application form must be completed for all forms of grid-tied embedded electricity generation, including renewable energy and cogeneration. This form deals with applications for approval to install small-scale embedded generation plants. (Off-Grid installations must be declared as laid out in Section 6 on page 12).

The forms are available on the ZHOA website. The text box below highlights some important points to consider before applying.

Purchasing your equipment: SSEG equipment that is to connect to the grid must comply with all regulatory requirements and national standards. It is therefore important for customers to be familiar with these requirements **before purchasing the equipment**. This is of relevance to the inverter. Specific technical information and certificates are required for submission with the initial application form. It is the responsibility of the customer to ensure that the equipment complies with the required standards.

Where there is no existing electricity service connection: Where an SSEG is to be connected at a location where there is currently no connection to the utility network, an "Application form for new electricity supply service**"** should be submitted simultaneously as a separate document to the SSEG application form. This application form can be found on the ZHOA website.

Future expansion: Consent to connect the SSEG to the electricity grid is only granted for the declared generation capacity. Customers wishing to increase the capacity of their generation or make changes to their current installation must obtain approval for the expansion or change. The application must again be made through the submission of a completed SSEG-GT-A (Appendix 6, page 27) application form and required documents.

Professional sign-off: As detailed on page 10, the final installed SSEG system must be signed off on commissioning as complying with ZHOA requirements by a professional engineer or technologist registered with ECSA. For more information regarding professional personnel, visit: https://www.ecsa.co.za/default.aspx

STEP 1: VISIT ZHOA WEBSITE

Visit the ZHOA website and download the relevant application form/s as noted above. Alternatively,

the forms are obtainable from the ZHOA office situated at Old Johannesburg Rd, Clubview Centurion. ZHOA requires both basic and technical information about the proposed SSEG project to ensure that all SSEG connections are done safely and legally and in compliance with all requirements.

STEP 2: COMPLETE SSEG-GT-A APPLICATION FORM AND PROVIDE ZHOA WITH DETAIL OF THE PROPOSED INSTALLATION

The SSEG-GT-A (Appendix 6, page 27) form must be filled in for all installations which are to be grid-tied. ZHOA requires that the application form/s be signed by the property owner. Details of the proposed installer must also be provided. The property owner may need support from the proposed installer or a professional. Details that will need consideration:

Preliminary design: a simple circuit diagram showing major system components and point of common coupling (PCC) must be provided **and signed off by an ECSA registered technician / engineer**

Earthing arrangement: this must be in accordance to SANS 10142-1. Earthing requirements for common earthing systems are described in NRS 097-2-1.

Various electrical parameters of the system: these sections require information on the electrical specifications of the SSEG system.

System protection detail: this includes information about the synchronizing method, anti-islanding, power quality, etc.

Proposed peak power generation output: maximum power expected to be generated must be detailed in the application form. This must be within the maximum power limits given earlier in this document.

STEP 3: OBTAIN PERMISSION FROM HOA

SSEG installations will require prior approval from the estate HOA. Note that photovoltaic (PV) SSEG applications will first require aesthetical approval from the HOA. Applications to connect to the grid will not be considered until all relevant approvals have been obtained. All applicable documentation must attach to the application.

STEP 4: SUBMIT THE COMPLETED APPLICATION FORM AND ATTACHMENTS

Once the relevant forms (“SSEG-GT-A”, Appendix 6, page 27) and PV specification / NRS certification of the system have been completed and consent has been obtained from the relevant HOA, the form must be submitted to ZHOA together with the system details. (Old Johannesburg Rd, Clubview Centurion)

STEP 5: ZHOA ISSUES “PERMISSION TO INSTALL” LETTER

After due consideration of the application, the applicant will be informed in writing whether the application has been successful. Once notified through a “Permission to Install” SSEG-L1 letter of a successful application, the applicant may commence installation.

STEP 6: INSTALLATION COMMENCEMENT UPON APPROVAL

The successful applicant may now commence with the installation and commissioning of the SSEG system. Once fully installed, the system is ready for testing and commissioning by the SSEG installer. Note that permanent connection of the SSEG system to the electricity grid is only permitted on receipt of written permission from ZHOA. However, the SSEG may temporarily connect to the utility grid for the commissioning process only, where it must once again be disconnected until the “Commissioning Approval letter SSEG-L2” is granted by ZHOA.

The Supplemental contract must be completed. This is a legally required contract that governs the relationship between ZHOA and the customer. The contract is valid for 1 year and can be renewed annually.

STEP 7: COMMISSIONING DOCUMENTATION TO BE SUBMITTED TO ZHOA

As detailed on page 10, the commissioning of the system must be undertaken by ECSA-registered Pr. Eng., Pr. Tech. Eng., Pr. Cert. Eng., or Pr. Tech. Eng., who must complete and sign off the ZHOA SSEG Commissioning Test Certificate

In addition to the Commissioning Report, the following documentation must also be completed and submitted to the ZHOA office:

- Copy of final as-built circuit diagram, signed by an ECSA registered technician/engineer.
- An electrical installation Certificate of Compliance as per SANS 10142-1.
- A signed Supplemental Contract for Embedded Generation.

ZHOA will inspect the installation. (For any re-inspection due to faults in the installation, ZHOA will charge a re-inspection fee)

STEP 8 CUSTOMER PAYS FOR ANY REQUIRED METERING CHANGES (if required)

Payment should be made as instructed in the Quotation letter.

STEP 9: INSTALLATION AND COMMISSIONING OF METER

If a change to the metering is required, ZHOA will install and commission the new meter. If all of the above is satisfactory, ZHOA will issue a “Commissioning Approval SSEG-L2” letter.

STEP 10: CUSTOMER PLACED ON APPROPRIATE TARIFF AND GENERATION COMMENCES

The customer will be placed on the appropriate tariff which will be applied from the date the grid tie meter was commissioned, or if no change was required, from the date of issue of the Commissioning Approval Letter.

STEP 11: REPEAT THE PROCESS IN THE CASE OF SSEG CAPACITY MODIFICATION OR EXPANSION

Should an expansion or a change to the system be required, a new application (SSEG-GT-A, Appendix 6, page 27)) must be completed. (This includes the change of property ownership)

10.1.7 Annual Renewal

This contract period is only valid for 1 year as the rules and regulations in respect of solar installations may have changed or been adjusted and it is important to certify the quality of supply into the ZHOA grid annually. The Customer must prevail himself of all the documents and changes and if required make the necessary changes to their system. It is therefore required that an SSEG customer must submit the test certificate for grid tie (SSEG-CERT, Appendix 6, pages 29 to 31) signed by an ECSA registered technician/engineer, Certificate of Compliance (CoC) & SSEG application form annually to our offices. This entails that a qualified person must test your system annually and by issuing the Certificate of Compliance for this installation he or she takes full responsibility for the quality of power to be injected into the grid for the contract period.

11. Section B: Appendices

B.1 Appendix 1: Relevant Standards and Regulations

ZHOA requires that SSEG installations comply with the necessary standards and regulations for the system to be approved and put into commission. This section provides an overview of these legislative requirements. The Professional Engineer / Technologist will highlight aspects most applicable to the SSEG system in question.

List of Standards and Regulations

There are several standards and regulations that the project developer must be aware of. The most relevant standards and regulations that must be complied with are:

- Electricity Regulation Act, Act 4 of 2006 and Electricity Regulation Amendment Act, 28 of 2007 as amended
- South African Distribution Code (all parts)
- South African Grid Code (all parts)
- South African Renewable Power Plants Grid Code
- Occupational Health and Safety Act 1993 as amended
- ZHOA Electricity Supply By-Law
- SANS 10142: The Wiring of Premises
- SANS 474/ NRS 057 Code of Practice for Electricity Metering
- NRS 048: Electricity Supply– Quality of Supply
- NRS 097-1: Code of Practice for the interconnection of embedded generation to electricity distribution networks: Part 1 MV and HV (Eskom 240-61268576 / DST 34-1765: Standard for the interconnection of embedded generation, is applicable until published)
- NRS 097-2: Grid interconnection of embedded generation: Part 2 Small-scale embedded generation

Guidance on their applicability and coverage is given below.

Standards of Importance

Of the compliance standards and regulations stated above, two of these standards are the most important for embedded generation, namely:

1. NRS 097-2: Grid interconnection of embedded generation: Part 2 Small-scale embedded generation
2. South African Renewable Power Plants Grid Code

These two set most regulatory requirements for compliance to be granted by ZHOA for the installation and operation of an SSEG and therefore should be consulted with care. This section will provide an overview of key aspects of both documents. These overviews should be seen only as summaries, and the standards themselves will need to be referred to for a complete picture. Applicants will require assistance from their installer and professional engineer/technologist to ensure full compliance.

NRS 097-2-1 (Part 2: Small-scale Embedded Generation, Section 1)

This document serves as the standard for the interconnection of SSEGs to the utility network and applies to embedded generators smaller than 1000kVA connected to LV networks of type single, dual or three-phase.

NRS 097-2-3 (Part 2: Small-scale Embedded Generation, Section 3)

This document provides simplified utility connection criteria for low-voltage connected generators.

South African Renewable Power Plants Grid Code (SARPPGC)

This document sets out the technical and design grid connection requirements for renewable power plants (RPP) to connect to the transmission or distribution network in South Africa. This guideline is of concern to embedded generators of Category A that are connected to a low-voltage (LV) network.

i. Category A: 0 – 1MVA (Only LV connected RPPs)

This category includes RPPs with a rated power of less than 1 MVA and connected to the LV voltage (typically called 'small or micro turbines'). This category shall further be divided into 3 sub-categories:

ii. Category A1: 0 – 13,8kVA

This sub-category includes RPPs of Category A with rated power in the range of 0 to 13,8kVA.

iii. Category A2: 13,8kVA – 100kVA

This sub-category includes RPPs of Category A with rated power in the range greater than 13,8kVA but less than 100kVA.

iv. Category A3: 100kVA – 1MVA

This sub-category includes RPPs of Category A with rated power in the range of 100kVA but less than 1MVA. This category also includes RPPs of Category A1 and A2 with a rated power of less than 100kVA that are directly connected to an MV-LV transformer.

Note: RPPs with a rated power greater than 4,6kVA must be balanced three-phase.

Other Standards and Legislation

i. Electricity Regulation Act, Act 4 of 2006 (ERA)

All applicants should familiarize themselves with the ERA. The act states that no person may, without a licence issued by the regulator (NERSA), operate any generation facility. The ERA holds that exemption is held for non-grid-tied projects. Note that NERSA has issued a communication giving licence exemption to SSEG installations in municipal areas under 100kW.

ii. South African Distribution Code

The South African Distribution Code applies to all entities connected to the distribution network, including EGs. It sets the basic rules for connecting to the distribution network, ensures non-discrimination to all users connected to the distribution network and specifies the technical requirements to ensure the safety and reliability of the distribution network. A more detailed guideline about the connection of SSEGs to the utility network and the specific requirements involved is found in NRS 097-2-1.

iii. South African Grid Code

The South African Grid Code contains the connection conditions that are required by all generators, distributors, and end-users (customers) connected to the utility grid, as well as the standards used to plan and develop the transmission system. Page 5 of the Network Code provides a summary of the grid code requirements applicable to specific ratings of non-hydro units, while page 6 provides those for hydro units. For SSEGs, the requirements for ratings below 20MVA should be adhered to accordingly as per the South African Grid Code.

iv. Occupational Health and Safety Act, 1993

The Occupational Health and Safety Act provides for the health and safety of the people by ensuring that all undertakings are conducted in such a manner so that those who are, or who may be, directly affected by such activity are not negatively harmed as far as possible and are not exposed to dangers to their health and safety.

v. ZHOA's Electricity Supply By-Law

This document provides the general conditions of the supply of electricity, outlines the responsibility of the customers, systems of supply, measurement of electricity and the electrical contractors' responsibilities.

vi. SANS 10142-1 The Wiring of Premises - Low-voltage installations

This document serves as the South African national standard for the wiring of premises in low-voltage networks. The document aims to ensure that people, animals, and property are protected from dangers that arise during normal as well as fault conditions, due to the operation of an electrical installation. Compliance with the standards and regulations as laid out in SANS 10142-1 is required, and proof should

be provided via an electrical installation certificate of compliance. The implication is that a qualified electrician is required to sign off on your system.

vii. *SANS 10142-2 The Wiring of Premises - Medium-Voltage installations above 1kVac not exceeding 22kVac and up to and including 3 000kW installed capacity*

This document serves as the South African national standard for the wiring of premises in medium-voltage networks. The document aims to ensure that people, animals, and property are protected from dangers that arise during normal as well as fault conditions, due to the operation of an electrical installation. Compliance with the standards and regulations as laid out in SANS 10142-2 is required, and proof should be provided via an electrical installation certificate of compliance. The implication is that a qualified electrician is required to sign off on your system.

viii. *SANS 474 / NRS 057 Code of Practice for Electricity Metering*

SANS 474 specifies the metering procedures, standards and other such requirements that must be adhered to by electricity licensees and their agents. It refers specifically to new and existing metering installations for billing. It further specifies the initial calibration and certification requirements as well as compliance testing of metering installations and the subsequent procedures to ensure continued compliance. It specifies the procedures for the manipulation and storage of metering data and sets a standard format for the numbering of electricity meters.

For more specific details about the metering for SSEG purposes, NRS 097-2-1 should be consulted, and the requirements as defined by ZHOA must be adhered to.

ix. *NRS 048*

The NRS 048 series covers the quality of supply parameters, specifications and practices that must be undertaken to ensure correct and safe operation. NRS 048-2 and NRS 048-4 have the most relevance to the operation and connection of SSEGs to the utility network:

NRS 048-2: ‘Voltage characteristics, compatibility levels, limits and assessment methods’ set the standards and compatibility levels for the quality of supply for utility connections as well as for stand-alone systems. It is intended that generation licensees ensure compliance with the compatibility levels set in this document under normal operating conditions.

NRS 048-4: ‘Application Requirements for utilities’ sets the technical standards and Requirements for the connection of new customers. It also sets the technical procedures for the evaluation of existing customers concerning harmonics, voltage unbalances and voltage flicker.

B.2 Appendix 2: HOA Approvals

Architectural and Aesthetical rules

1. SOLAR PANELS

"The use of solar panels for the heating of water is encouraged. Only the solar panels (either the vacuum tube-type or flat panel-type) may be visible – no external geyser, header tanks or coiled pipes may be visible. The solar panels must be incorporated flush onto the adjoining structure and may not be placed on an elevated structure".

"The roof design from inception must allow for immediate or future installation of solar panels. Panels on concrete roofs must be within a screened yard and may not be visible from any direction."

"All retrofitted geysers on flat roofs are to be enclosed in an aesthetically pleasing enclosure. (Details to be submitted for approval)"

2. STANDBY GENERATORS

"All standby generators must comply with the minimum requirements as set out by the ZHOA. Generators must be installed in such a way that it does not create a nuisance to neighbours. In addition to the requirements above, generators that are permanently or semi-permanently installed (semi-permanently shall be a unit being in the same position for more than 30 days), must be visibly screened and indicated on plans approved by the HOA".

B.3 Appendix 3: Inverter Type Testing Requirements

ZHOA's requirements for grid-tied inverter (GTIs) and ancillary equipment type test certification are as follows:

1. A 3rd party accredited body must perform the inverter-type test certification in terms of NRS 097-2-1. The accredited body must be SANAS accredited or by a member of the recognition arrangements of the International Laboratory Accreditation Co-operation (ILAC) or the International Accreditation Forum (IAF) in terms of ISO/IEC 17025:2005 for photovoltaic systems. The accreditation bodies must provide accreditation documentation for the specific test location.
2. The accredited body must:
    a. Issue a Certificate of Conformity for all GTIs and ancillary equipment (e.g. network and system grid protection voltage and frequency Contactors for the centralised disconnect switch) in terms of the requirements of the current NRS 097-2-1 document.
    b. Provide summary Test Report [excluding sensitive information test results] comprising of:
        i. Report reference number, test laboratory name, customer/applicant's name and reference, test specification and report form, test item description/name/model/types, ratings, lab and testing location, name and signature of test person and approval authority, manufacturer name and dress, test report documentation version control.
        ii. Test item, test case verdicts [N/A, pass and fail], test and issue dates, general remarks.
        iii. Copy of GTIs and ancillary equipment nameplate data.
        iv. General product information, preferably with the inclusion of the GTIs and ancillary equipment electrical block diagram.
        v. Summary of NRS 097-2-1 indicating all clauses, clause description/requirement/test, result/remark, and verdict [N/A, pass or fail].
        vi. Test overview summary.
3. NRS 097-2-1: 2017 was published on 8 March 2017 and replaces NRS 097-2-1: 2010. Inverter requirements are as follows:
    a. Retrospective compliance of installed NRS 097-2-1: 2010 type tested inverters to the new NRS 097-2-1: 2017 version: Retrospective compliance of the installed SSEG base with the new version is not required.
    b. New installations with existing certified NRS 097-2-1: 2010 type tested inverters:
        i. SSEG installations and applications in the process (inclusive of SSEG system modification or expansion) will be accepted until 31 December 2018 only.
        ii. Commissioned inverter settings shall be per the new NRS 097-2-1: 2017 version.
    c. New inverter type test certification:
        i. All the existing NRS097-2-1: 2010 type tested inverters must be SANAS re-certified per new NRS097-2-1: 2017 with effect from 1 January 2019 if the inverter is being considered for a new embedded generation application.
        ii. New inverter-type test certifications must be per the new NRS 097-2-1: 2017 version and the embedded generation installation using such inverters shall be compliant with the new version.

B.4 Appendix 4: Suitably interlocked change-over switch for grid-tied hybrid SSEG and a passive standby UPS utilised as off-grid hybrid SSEG

a. This includes interrupters, transfer switches, bypass switches, isolation switches and tie switches.

b. The switch shall provide feedback of its position to the inverter/charger so that if the contacts fail to operate or malfunction [e.g., fused-closed contacts, inadvertent energising of the change-over switch coil, etc.], use of the inverter mode will be impossible.

c. The requirements of SANS 10142-1 Section 7.12.2.5 are applicable.

d. It shall be a separate, controllable switch, compatible with the applicable electrical service conditions and the performance requirements of the passive standby UPS, per SANS / IEC 60947-6-1 and the following product specifications:

- Static transfer systems (STS): SANS / IEC 62310-3.
- Automatic transfer systems (ATS): SANS / IEC 60947-6-1.
- Manual isolation, tie, and transfer switches (MTS): SANS / IEC 60947-3.

e. The switch shall have a rated lightning impulse withstand voltage (BIL) of 4 kV at 1,2/50 µs per SANS / IEC 60947-1 (Tables H.1 and 12).

f. Characteristics of the transfer shall be break-before-make (open transition) – no transient cross-conduction during transfer. The transfer time of the switch shall be ≥ 20ms.

g. The contactor gap of the switch shall exceed 4 mm per SANS 60950-1, S2.10.3.3 and Table 2K for a fixed installation with overvoltage category 2.

Note: The Certificate of Compliance with the accompanied test report must provide detail of the suitably interlocked change-over switch as above in Sections 3 and 4 of the SANS 10142-1 Test reports.

B.5 Appendix 5: Battery backup required

ZHOA will only permit systems to connect to the grid if the system comprises a battery backup system of a minimum of 3 kWh, thus enabling the client to continue his lifestyle during load shedding or power outages.

B.6 Appendix 6: Application forms

- SSEG-GT-A Application Grid tie
- SSEG-OG-D Application Off Grid (No-feed-in)
- SSEG-CERT Test Certificate
- Installation guidelines for SSEG - PV Solar panels inverters

APPLICATION FOR THE CONNECTION OF GRID-TIED SMALL-SCALE EMBEDDED GENERATION

SSEG-GT-A

This application form is for the connection of any type of grid-tied small-scale embedded generation (SSEG) to the electrical installation of residential customers. (Typically, photovoltaic (PV))

Between "Zwartkop Home Owners Association", (hereafter referred to as "ZHOA" and

A. DETAIL OF STAND OWNER: (hereafter referred to as the "customer")

Name		**Surname**	
ID No		**Stand No**	
Postal Address		**Code**	
Email Address		**Mobile No**	

B.1. ELECTRICAL CONTRACTOR:

Name & Surname	
ZHOA Registration number	

B.2. ECSA REGISTERED ENGINEER:

Name & Surname	
Professional registration number	

C. APPLICATION TYPE: (Complete and tick the appropriate box)

New installation		**Change of property owner**	
System modifications or expansion		**Annual Renewal**	

ENERGY SOURCE FOR EMBEDDED GENERATION
e.g., photo voltaic

CREDIT ON ZHOA STATEMENT
Who will receive the advantage if a tenant occupies

Owner ☐ Tenant ☐

SSEG TARIFF 2022/23: For the POC phase ZHOA will implement Net Metering whereby the SSEG supplier will be compensated at the same rate at which ZHOA purchases electricity from the City of Tshwane. A 4-quadrant meter must be installed to enable the stand owner to feed and measure excess generated energy into the grid.

D. NOTES:

1. *Grid-tied hybrid SSEG must be connected to the existing wiring of the property via a suitably interlocked change-over switch. In such cases, the Certificate of Compliance (CoC) for electrical installations from a qualified electrician must indicate accordingly. The test certificate and circuit diagram must be signed off by an ECSA-registered Engineer/Technician (Discipline: Electrical). Grid-tied hybrid SSEG should be configured such that the system operates in anti-islanding modes, i.e., after interruption of the utility supply, or when the applicable electrical service conditions are outside supplier limits or out of required tolerances the inverters must disconnect from the grid.*
2. *If you are declaring an off-grid system, you must complete the "Declaration for off-grid small scale embedded generation (SSEG-OG-D)" form.*
3. *Please note that registration is **NOT** required for solar water heaters or geysers.*
4. *The connection to the grid must be inspected on installation. **The contract is valid for one year.** A new application is required annually. **The installation should at all times adhere to the Terms & Conditions and NRS048.***

E. AGREEMENT TO THE TERMS AND CONDITIONS (http://www.zwartkopgolfestate.co.za/HOA.html)

I/We declare that the abovementioned information is correct and accept that the supply of the service will be per the Terms and Conditions for the supply of electricity by Zwartkop Home Owners Association. Also, refer to the following document "Requirements for Small-Scale embedded generation" (SSEG-M).

SIGNATURE STAND OWNER: _____ **DATE:** _____

DECLARATION FOR OFF-GRID NO-FEED-IN SMALL-SCALE EMBEDDED GENERATION

Document date: 22 June 2023 **SSEG-OG-D**

This form is for the declaration of any small-scale embedded generation (SSEG) including:

- Passive standby UPS utilized as off-grid hybrid SSEG; - SSEG alternative supply in terms of SANS 10142-1:2017;
- Electrically separated off-grid SSEG installations that are not interlocked with the utility electricity grid as switched alternative

Between "Zwartkop Home Owners Association", (hereafter referred to as "ZHOA" and

A. DETAIL OF STAND OWNER: (hereafter referred to as the "customer")			
Name		**Surname**	
ID No		**Stand No**	
Postal Address		**Code**	
Email Address			
Mobile No 1		**Mobile No 2**	

B.1. ELECTRICAL CONTRACTOR:		**B.2. ECSA REGISTERED ENGINEER:**	
Name & Surname		**Name & Surname**	
ZHOA Registration number		**Professional registration number**	

C. APPLICATION TYPE:	**NEW**		**MODIFICATION**		
PRIMARY SOURCE FOR EMBEDDED GENERATION					
TYPE OF ENERGY CONVERSION (e.g., static inverter for PV.)					
TOTAL CAPACITY OF THE OFF-GRID EMBEDDED GENERATION (kVA)					
Energy from embedded generation to be used within a customer's electrical installation and NO excess to be exported to the grid, ECSA registered technician/engineer acknowledges reverse blocking	Signature of registered technician/engineer				

D. NOTES:

1. *Documents to be submitted for **new installation**: (a) A schematic diagram showing details of the off-grid SSEG installation about the wiring of the premises and the ZHOA electricity grid signed by an ECSA registered technician/engineer certifying that the SSEG installation is physically from the ZHOA grid and the part of the installation on the property that is being supplied from the ZHOA network, (b) Test certificate signed by an ECSA registered technician/engineer, (c) Certificate of compliance signed by an electrical contractor.*
2. *Documents to be submitted to **move from grid-tied to off-grid/no-feed-in**: (a) SSEG-OG-D form signed by an ECSA registered technician/engineer to acknowledge that no excess power will be exported to the grid.*
3. *A Certificate of Compliance (CoC) and a Test certificate is only required if an off-grid installation is integrated and interlocked with a change-over switch between the utility electricity grid and the customer electrical installation, as follows: (a) Passive standby UPS utilized as off-grid hybrid SSEG as defined in the ZHOA requirements for SSEG document, (b) SSEG alternative supply in terms of SANS 10142-1:2017.*

E. AGREEMENT TO THE TERMS AND CONDITIONS (http://www.zwartkopgolfestate.co.za/HOA.html)

I/We declare that the abovementioned information is correct and accept that the supply of the service will be per the Terms and Conditions for the supply of electricity by Zwartkop Home Owners Association. Also, refer to the following document "Requirements for Small-Scale embedded generation" (SSEG-M).

SIGNATURE STAND OWNER: _____ **DATE:** _____

SSEG -CERT

TEST CERTIFICATE FOR SOLAR INSTALLATION

DATE OF TEST: _____

Additional Test Sheet No [ ] of COC No [ ]

CERTIFIED BY: _____ DATE : _____

ECSA PROFESSIONAL REGISTRATION NUMBER (Discipline - Electrical): _____

The person certifying this Test Certificate for this installation takes full responsibility for the quality of power to be injected into the grid.

ACCEPTED BY ZHOA: _____ DATE : _____

The address covered by _____

this test: Stand no: _____

	GENERAL COMMENTS ABOUT THE TEST						
1	The Current Connection Type	60A		80A		3 x 60A	
2	Connection Downgraded	Yes		No			
3	New Connection Type	60A		80A		3 x 60A	
4	Phase	Single		3 Phase			
5	Reverse feed connection to phase (3 Phase)	Red		White		Blue	
6	AMF	Stand alone		Build In			
7	AMF Functionality tested, in working order	Yes		No			
8	AMF delay of 20 minutes programmed	Yes		No			
9	On-Load System Voltage						
10	Back feed limiter settings (kW)						
11	Pure sine wave	Yes		No			

COMMENTS

SOLAR INVERTER

	SOLAR INVERTER	UNITS	DETAIL
1	INVERTER MANUFACTURER		
2	MODEL NUMBER AND SERIAL NUMBER		
3	SPECIFY THE TYPE OF INVERTER: GTI, HYBRID, OFF-GRID		
4	MAX PV GENERATION POWER	W	
5	Vmax PV	Vdc	
6	MPPT voltage range	Vdc	
7	BATTERY RATED VOLTAGE	Vdc	
8	BATTERY VOLTAGE RANGE	Vdc	
9	BATTERY MAX CHARGE/DISCHARGE CURRENT	Adc	
10	BATTERY TYPE AND CAPACITY	kWhr	
11	GRID/BACKUP RATED VOLTAGE	Vac	
12	GRID/BACKUP FREQUENCY	Hz	
13	GRID OUTPUT RATED CURRENT	Aac	
14	GRID OUTPUT MAX APPARENT POWER	KVA	
15	GRID INPUT RATED CURRENT	Aac	
16	GRID INPUT RATED APPARENT POWER	VA	
17	BACK-UP RATED APPARENT POWER	VA	
18	INSTALLED PV GENERATION POWER	W	

SOLAR ARRAY STRING 1

	SOLAR ARRAY STRING 1	UNITS	SINGLE PANEL	STRING
1	PV MANUFACTURER			
2	TYPE			
3	NUMBER OF PANELS CONNECTED IN STRING			
4	PEAK POWER (Pmax)	W		
5	OPEN CIRCUIT VOLTAGE (Voc)	V		
6	MAX POWER VOLTAGE (Vmp)	V		
7	SHORT CIRCUIT CURRENT (Isc)	A		
8	MAX POWER CURRENT (Imp)	A		
9	EARTH CONNECTIVITY OF ARRAY (TO EARTH SPIKE)	Ω		
10	EARTH CONNECTION TO SPD	Y/N		YES / N O
11	THE POLARITY OF DC CABLES IS MARKED	Y/N		YES / NO
12	PV ARRAY INSULATION TEST IF POSSIBLE	MΩ		
13	IRRADIANCE DURING TEST	W/m²		
14	STRING CONNECTIVITY TO SUITABLE DC ISOLATOR	Y/N	YES / NO	
15	STRING CONNECTIVITY TO DC FUSE	Y/N	YES / NO	
16	ELECTRICAL INSULATION IS GOOD	Y/N	YES / NO	
17	NO DAMAGE TO CABLES DURING INSTALLATION	Y/N	YES / NO	
18	THE PROTECTIVE EARTH CONNECTION IS AS IT SHOULD BE	Y/N	YES / NO	

SOLAR ARRAY STRING 2

	SOLAR ARRAY STRING 2	UNITS	SINGLE PANEL	STRING
1	PV MANUFACTURER			
2	TYPE			
3	NUMBER OF PANELS CONNECTED IN STRING			
4	PEAK POWER (Pmax)	W		
5	OPEN CIRCUIT VOLTAGE (Voc)	V		
6	MAX POWER VOLTAGE (Vmp)	V		
7	SHORT CIRCUIT CURRENT (Isc)	A		
8	MAX POWER CURRENT (Imp)	A		
9	EARTH CONNECTIVITY OF ARRAY (TO EARTH SPIKE)	Ω		
10	EARTH CONNECTION TO SPD	Y/N		YES / NO
11	THE POLARITY OF DC CABLES MARKED	Y/N		YES / NO
12	PV ARRAY INSULATION TEST IF POSSIBLE	MΩ		
13	IRRADIANCE DURING TEST	W/m²		
14	STRING CONNECTIVITY TO SUITABLE DC ISOLATOR	Y/N	YES / NO	
15	STRING CONNECTIVITY TO DC FUSE	Y/N	YES / NO	
16	ELECTRICAL INSULATION IS GOOD	Y/N	YES / NO	
17	NO DAMAGE TO CABLES DURING INSTALLATION	Y/N	YES / NO	
18	THE PROTECTIVE EARTH CONNECTION IS AS IT SHOULD BE	Y/N	YES / NO	

SOLAR ARRAY STRING 3

	SOLAR ARRAY STRING 1	UNITS	SINGLE PANEL	STRING
1	PV MANUFACTURER			
2	TYPE			
3	NUMBER OF PANELS CONNECTED IN STRING			
4	PEAK POWER (Pmax)	W		
5	OPEN CIRCUIT VOLTAGE (Voc)	V		
6	MAX POWER VOLTAGE (Vmp)	V		
7	SHORT CIRCUIT CURRENT (Isc)	A		
8	MAX POWER CURRENT (Imp)	A		
9	EARTH CONNECTIVITY OF ARRAY (TO EARTH SPIKE)	Ω		
10	EARTH CONNECTION TO SPD	Y/N		YES / NO
11	THE POLARITY OF DC CABLES IS MARKED	Y/N		YES / NO
12	PV ARRAY INSULATION TEST IF POSSIBLE	MΩ		
13	IRRADIANCE DURING TEST	W/m²		
14	STRING CONNECTIVITY TO SUITABLE DC ISOLATOR	Y/N	YES / NO	
15	STRING CONNECTIVITY TO DC FUSE	Y/N	YES / NO	
16	ELECTRICAL INSULATION IS GOOD	Y/N	YES / NO	
17	NO DAMAGE TO CABLES DURING INSTALLATION	Y/N	YES / NO	
18	THE PROTECTIVE EARTH CONNECTION IS AS IT SHOULD BE	Y/N	YES / NO	

Installation guidelines for SSEG / PV solar panels & inverters in Zwartkop

All installations must conform to the current relevant SANS codes, as applicable at the time of installation, which might be amended at any time.

1. Ensure all parts of the installation adhere to the manufacturer's specifications.
2. Materials utilized should be compliant with the relevant SANS codes.
3. Mechanically protect DC Wires at the entry point, either on the roof or elsewhere, as applicable.
4. DC wiring must be installed in metal wire ways or non-flammable wire ways if not protected. However, if protected it is advisable to still install in metal wire ways.
5. Open wire ways and or open wiring is not permitted and is against Sans regulations.
6. There should be a separate earth electrode installed with a maximum earth resistance of 10 Ohm, connected with a 16mm² copper, or equivalent conductor from the solar panels.
7. All solar panels and rails must be bonded with the same conductor size with a minimum of 6mm², or bigger earth wire and be connected to the earth electrode as mentioned above.
8. The earth electrode must be bonded with the same conductor size, with a minimum of 6mm² to the inverter and DB's. It shall also be bonded to the supplier earth to create equal potential bonding.
9. Color coding is paramount on all wiring, especially the DC wires.
10. These installations are deemed as high risk and therefore surge protection is compulsory, class 2 SPDs will suffice.
11. Surge protection devices must be of the gapped type.
12. AC and DC wiring may not be installed in the same wire way or DB. There must be a divider between AC and DC.
13. Adequate labelling is an absolute necessity.
14. A manual change-over switch must be installed.

Document date: 22 June 2023