

Basic EG Connection Technical Requirements

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Cover Note – Applicability and Requirements of the Pilbara Harmonised Technical Rules

This document outlines the requirements for connecting Basic Embedded Generation to Horizon Power's systems. In accordance with the requirements of Section 3.5 of the Pilbara Harmonised Technical Rules, this document also forms the procedure setting out Horizon Power's requirements for the connection of Basic Embedded Generation to the Horizon Power's low voltage distribution system via inverters in the Pilbara Grid.

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1 Introduction

The purpose of this document is to:

1. provide Proponents of Basic Embedded Generation (EG) connections, information about their obligations for connection to and interfacing with Horizon Power's low voltage (LV) distribution network (Electricity System);
2. enable Horizon Power to meet its obligations to ensure the safe and reliable operation of the Horizon Power Electricity System for personnel, Consumers and the general public; and
3. meet Horizon Power's obligations under Section 3.5 of the Pilbara Harmonised Technical Rules, in providing Horizon Power's requirements for the connection of Basic Embedded Generation to the Horizon Power's low voltage distribution system via inverters in the Pilbara Grid.

This document applies to all Consumer connected Basic EG connections, regardless of whether such systems export electricity into the Electricity System or not.

This document applies to Basic EG connections inclusive of alterations and modifications to existing Basic EG connections. Basic EG connections are intended for installation on Consumer premises that are connected to a Horizon Power network via a standard connection service as defined in the WA Service and Installation Requirements. A Basic EG connection may be installed at a Consumer connection that has a larger capacity than a standard connection service.

The Basic EG Connections Technical Requirements are prepared by Horizon Power under the Horizon Power Technical Rules Clause 3.5 and conform with the National Distributed Energy Resources Connection Guidelines for Basic EG Connections as published by Energy Networks Australia (ENA), with the exception of the deviations set out in Appendix A.

For all enquiries, please contact Renewables@horizonpower.com.au.

1.1 Scope – Inclusions

Consistent with the Energy Networks Australia (ENA) Distributed Energy Resources Grid Connection Guidelines, Horizon Power has five types of EG connections, as shown in Table 1.

This document applies to new **Basic EG connection** or modification to existing Basic EG connection, which consists of inverter energy system (IES) with or without energy storage system (ESS).

Table 1: Connection Types

Connection Type	Connection Voltage	Technology Type	Capacity	Relevant Standard
Basic EG connection	Up to 1 kV	IES without ESS	≤30 kVA three-phase ≤10 kVA single-phase	Basic EG Connection Technical Requirements (This document)
		IES with DC Coupled ESS	≤30 kVA three-phase ≤10 kVA single-phase	
		IES with AC Coupled ESS	≤30 kVA three-phase ≤15 kVA single-phase (IES ≤10 kVA, ESS ≤10 kVA)	

Connection Type	Connection Voltage	Technology Type	Capacity	Relevant Standard
Low Voltage EG Connection	Up to 1 kV	Any LV connected IES not covered by or not meeting the requirements of the Basic EG Connection Technical Requirements (This document)	IES $\leq$ 1000 kVA, ESS $\leq$ 1000 kVA	Low Voltage EG Connection Technical Requirements
		Non-inverter based	>30 kVA and $\leq$ 1 MVA three-phase $\leq$ 10 kVA single-phase	
Medium Voltage Connection	1 kV to 35 kV	Any	Any size up to 10 MW	Horizon Power Technical Rules
High Voltage Connection	>35 kV	Any	Any size up to 10 MW	Horizon Power Technical Rules
Registered Generator Connection ¹	>35 kV	Any	>10 MW	Horizon Power Technical Rules

A Basic EG connection is defined as an EG system with a total system capacity less than or equal to the values outline in Table 6 that is:

1. intended to be connected to and capable of operating in parallel with any part of the LV Electricity System;
2. connected at a voltage of less than or equal to 1kV;
3. involving minimal or no augmentation of the Electricity System; and
4. meeting all other technical requirements set out in this document.

1.2 Subcategories

Not used.

1.3 Scope – Exclusions

This document does NOT apply to the following connection types:

1. EG units covered by Horizon Power's LV EG connection Technical Requirements.

¹ According to the Energy Networks Australia (ENA) Distributed Energy Resources Grid Connection Guidelines - Framework and Principles this applies to any connection by a generator who is required to register with AEMO in the National Electricity Market. In the case of Horizon Power, a Registered Generator Connection is any High Voltage Connection greater than 10 MW.

2. EG units covered by the Technical Requirements for medium or high voltage (MV/HV) connected EG's.
3. Non IES systems.
4. Electric vehicles, unless the electric vehicle charger being installed has the capability to export electricity into either the Consumer's premises or the Electricity System (in which case the requirements shall apply).
5. Distributed Energy Resources (DER) systems that do not generate electricity, including demand response/demand management systems, unless they impact on the ability of the Basic EG connection to meet these Technical Requirements.
6. Off-grid systems such as Standalone Power Systems (SPS). Please refer to Section 4.5.2.2 for more information.

1.4 Proponent Obligations

The general obligations of Proponents include the obligation to:

1. Set Basic EG connections to have settings applicable to region "Australia C" per AS/NZS 4777.2.
2. Set Basic EG connections with ESS to prevent charging from the grid and discharging into the grid during defined periods (Refer to Section 4.3.5).
3. Comply with the Energy Management requirements (Refer to Section 4.3.4) including installation of a Horizon Power supplied secure gateway device and selection of an inverter compatible with the supplied gateway device.
4. Comply with the requirements in this document as well as relevant national standards, industry codes, legislation and regulations, and any local planning and building requirements, except where otherwise stated in this document. Please refer to Section 3 for more information.
5. Ensure that the Basic EG connection is compatible with the characteristics of Horizon Power's supply as defined in Section 2 of the Horizon Power Technical Rules.
6. Ensure that any Inverter Energy System (IES) shall be tested by an authorised testing laboratory and certified as being compliant with IEC 62116 for active anti-islanding protection as per AS/NZS 4777.2.
7. Not connect additional inverters, make modifications, upgrades or install additional Basic EG units, including ESS, without submitting a new application to Horizon Power.
8. Notify Horizon Power in writing if an existing Basic EG connection is permanently disconnected. Notification shall be provided within two months following the date of disconnection.
9. Comply with Horizon Power's Connection Agreement.
10. Design, procure equipment, install and operate the Basic EG connection in compliance with the requirements in this document as well as all other applicable Australian Standards and Regulations and the Horizon Power Technical Rules.
11. Ensure all design and installation works for Basic EG connections with renewable energy sources, including ESS, shall be undertaken by a Solar Accreditation Australia (SAA) accredited person, with valid certification appropriate to installation type at the time of the connection application.
12. Update any settings in relation to a Basic EG connection upon request from Horizon Power.

13. Provide Horizon Power with full and unrestricted access to the Basic EG connection, main switchboard, and any power supply, network connection, or secure gateway device (SGD) installed as part of the Basic EG connection, to perform any up front and ongoing works, including but not limited to inspection, maintenance and replacement of the secure gateway device and audits for compliance purposes. Such access shall also extend to Horizon Power's authorised contractors to the extent that their authorisation permits.

1.5 Horizon Power and Proponents to Act Reasonably

1.5.1 Acting reasonably

Horizon Power and Proponents shall act reasonably towards each other regarding all matters under these Basic EG Technical Requirements.

Whenever the Horizon Power or a Proponent is required to make a determination, form an opinion, give approval, make any request, exercise a discretion or perform any act under these Rules, it shall be formed, given, made, exercised or performed reasonably and on reasonable grounds, and not capriciously or arbitrarily refused, or unduly delayed.

1.5.2 Dispute Resolution

Resolution of all disputes concerning these Technical Requirements shall be on the basis of Chapter 10 of the Access Code.

1.6 Existing Basic EG Connections

The Proponent's obligations in Section 1.4 apply where they relate to existing (and new) Basic EG connections.

All existing Basic EG connections shall comply with the relevant technical requirements that applied at the time the connection was approved to connect to the grid. Horizon Power may direct a Proponent to change the settings on an existing Basic EG connection at any time, including to meet the current technical requirements, or for other reasons it determines necessary.

1.7 Modifications or Upgrades to Existing Basic EG Connections

If a Proponent seeks to modify or upgrade an existing Basic EG connection, a new application shall be submitted and the modified or upgraded Basic EG connection shall comply with the requirements in this document.

If a Proponent seeks to install an additional Basic EG system to a premises with an existing approved Basic EG connection the following requirements shall apply:

1. The Proponent shall submit a new application.
2. The Proponent's obligations in Section 1.4 shall apply.
3. The existing Basic EG connection shall be updated to comply with the most recent Energy Management Requirements in Section 4.3.4 of this document.
4. The existing Basic EG connection shall be updated to comprise of inverters that are configured for region "Australia C" in accordance with AS/NZS 4777.2.
5. The complete Basic EG connection (existing system plus additional system) shall comply with all the requirements in Table 6, including Maximum Aggregate System Capacity, Site Generation Limits, Energy Management Requirements, Operational Envelopes, Export Limits and Phase Balance requirements.

6. For all other technical requirements, the existing Basic EG connection may comply with the relevant technical requirements that applied at the time that connection was approved to connect to the grid.
7. The additional Basic EG connection shall meet the requirements set out in this document.
8. If the Total System Capacity (including the existing and the additional systems) exceeds the Basic EG connection thresholds for Maximum Aggregate System Capacity in Table 6, both the existing and the additional systems shall comply with the requirements of HPC-9DJ-13-0002-2019 Low Voltage EG Connection Technical Requirements.

If a Proponent seeks to replace an inverter under warranty, which was connected in accordance with an earlier version of these technical requirements, that inverter can be replaced under warranty where:

1. The replacement inverter is the same make and model (like-for-like); and
2. The replacement is for warranty purposes; and
3. The replacement inverter shall be capable of Volt-Var power quality response mode, short duration undervoltage ride-through and be configured with settings applicable to region "Australia C" per AS/NZS 4777.2; and
4. The inverter is configured to comply with the existing connection agreement.

Where any of the above requirements in 1. to 4. cannot be met, compliance with the latest Technical Requirements will be required.

1.8 Modifications to Settings on Existing Basic EG Connections

Following commissioning of a Basic EG connection the system settings should generally not need to be changed. In cases where Horizon Power has approved a change in setting on an existing Basic EG connection, the approved change in setting is deemed to comply with relevant Technical Requirements that applied at the time of that connection.

1.9 Renewable Energy Buyback

Renewable Energy Buyback may be offered on a 'net export' basis. Please refer to the Eligibility Calculator on Horizon Power's website and associated 'Terms and Conditions' for details (<https://www.horizonpower.com.au/solar/buyback/>).

2 Definitions and Abbreviations

2.1 Definitions

Table 2 provides a list of definitions relevant to this document and apply in addition to defined terms listed in the relevant Australian Standards (including AS/NZS 3000 and AS/NZS 4777), WAER and Electricity (Licensing) Regulations.

Table 2: Definitions

Term	Definition
Authorised Agent	An Authorised Agent is a registered party with an agreement with Horizon Power that is responsible for (and has the permission to) control the Basic EG Connection to meet Energy Management requirements.
Break before make switch	A switch that opens a connection prior to closing the new connection.
Central protection	Central protection is the protection contemplated by AS/NZS 4777 (grid connection of energy systems via inverters) installed to perform the functions of: coordinating multiple inverter energy system installations at one site, providing protection for the entire inverter energy system installation and islanding protection to the connected grid as well as preserving safety of grid personnel and the general public.
Connection point	As defined in Western Australian Service and Installation Requirements (WASIR).
Connection service	As defined in Western Australian Service and Installation Requirements (WASIR).
Consumer	The party to the connection agreement with Horizon Power for the provision of a retail supply or covered service at a connection point.
Coordination	The use of technologies such as Embedded Generation local or remote control to adjust consumption by, or export from, Distributed Energy Resources for the benefit of the Electricity System.
Current Transformer (CT)	A current transformer is used for measurement of alternating electric currents.
DERMS_Connected	Refer to Energy Management.
Distributed Energy Resources (DER)	Power generation or storage units that are connected directly to the Electricity System. A general description for the range of distributed energy devices such as dispersed power generation (including solar PV), energy storage, demand management and smart inverters located at Consumer premises or connected directly to the Electricity System. Whilst DER is often used to refer to renewable generation sources, it also includes dispersed non-renewable generation sources.

Term	Definition
Distributed Energy Resources Management System (DERMS)	Horizon Power's control system for managing distributed energy resources.
Electrical installation	As defined in AS/NZS 3000.
Electricity system	The electricity grid owned and operated by Horizon Power and connected to the Premises.
Embedded generating unit	A generating unit connected within an Electricity System and not having direct access to the transmission network.
Energy Management (previously DERMS_Connected)	A type of Generation Control, where the output from a EG can be directly or remotely managed by Horizon Power, as required, to protect the safety of personnel or the public, manage threats to power system security, and or to prevent damage to electrical plant and equipment.
Energy Storage System (ESS)	A system comprising one or more energy storage devices that store electricity generated by distributed energy resources or directly from the grid, and that can discharge the electricity to loads.
ESS capacity	The Energy Storage System capacity (kVA) Note ESS Capacity does not refer to the <i>energy</i> capacity (i.e. kWh) it refers to the IES capacity directly associated to the ESS (kVA).
Final loads	All electrical loads on the Consumer's premises not part of the Renewable Energy Installation.
Generating unit	The plant used in the production of electricity and all related equipment essential to its functioning as a single entity.
Generation	The production of electrical power by converting another form of energy in a generating unit.
Generation control	The use of technologies such as EG local or remote control and DERMS to control the output of the EG.
Generation management	Refer to Generation Control.
Generator	A person who owns, operates or controls a generating unit.
Grid	The Electricity System.
Grid Connected	Where the Basic EG Connection is capable of operation in parallel with the Electricity System.
Hosting Capacity	The capacity of the Electricity System to accept or manage the output of a Consumer's DER whether because of a technical limitation, insufficient reserve generating capacity or contractual constraint.
Installer	The person who installs and commissions the Basic EG connection on behalf of the proponent.

Term	Definition
Inverter	The device forming part of an EG system which: a) limits the DER Source Electricity exported to the Electricity System; b) complies with the Technical Requirements; c) may convert direct current generated electrical energy into alternating current electrical energy; and d) relates to the AS/NZS 4777 definition.
Inverter Energy System (IES)	A system comprising of one or more inverters that convert direct current to alternating current.
IES capacity	The inverter energy system nameplate rating (kVA).
Low Voltage (LV)	The mains voltages as most commonly used in any given network by domestic and light industrial and commercial consumers (typically 240 V, 415 V).
Make before break switch	A switch that results in a momentary, or longer, connection between grid supply and the downstream Generation supply circuits when performing a changeover.
Maximum system capacity	The maximum nameplate rating (kVA) of an individual Basic EG connection at a premises.
Maximum aggregate system capacity	The maximum allowable aggregate nameplate rating across all Basic EG connections at a premises. The maximum allowable total system capacity for Basic EG connections on different strata titles, but at the same network connection point (e.g. retirement villages) is defined at the connection point.
Medium Voltage (MV) / High Voltage (HV)	Any voltage greater than 1 kV AC.
Metering equipment	As applicable, the import, export, bi-directional, parallel and revenue meters installed at the Premises to measure the import and export of electricity to the Consumer's Premises.
Multiple mode inverter	An inverter that operates in more than one mode; for example, having grid-interactive functionality when mains voltage is present, and stand-alone functionality when disconnected from mains supply. A stand-alone inverter that can inject energy into the grid would be considered a multiple-mode inverter.
Notice of Completion	A notice of completion as required under Regulation 52 of the <i>Electricity (Licensing) Regulations 1991</i> (WA).
Off-grid system	A property which does not have Horizon Power's metering system on their Premises and / or is not connected to Horizon Power's Electricity System; this document is not applicable to an off-grid system except circumstances discussed in Section 4.5.2.2).

Term	Definition
Operating Envelope	Time-based periods where an Energy Storage System shall locally manage its export of energy into the grid and consumption of energy from the grid.
Power conversion equipment	An electrical device that converts one kind of electrical power from a voltage or current source into another kind of electrical power with respect to voltage, current and frequency. This category is for devices which are not IES but are connected between a renewable energy generator and an application circuit. Examples include DC/DC converters and charge controllers. Shall have the same meaning as defined in AS/NZS 4777.
Preliminary notice	The preliminary notice for notifiable works shall be provided as per the Electricity (Licensing) Regulations 1991.
Premises	The premises nominated in the Application Documents, or existing Connection Agreement, owned or occupied by the Consumer, which must be the same Consumer supplied at that premises in accordance with a Connection Agreement.
Proponent	A person proposing to become a Generator (the relevant owner, operator or controller of the generating system (or their agent)).
Photovoltaic (PV)	A renewable energy generation device that creates electrical energy as a result of harnessing energy from the sun collected on photovoltaic cells.
Registered generator	For Horizon Power this means a generator greater than 10 MW.
Secure gateway device (SGD)	This is the control interface between the Proponent's Basic EG connection and Horizon Power's communications system. This device is for the purposes of Energy Management of the Basic EG connection.
Service apparatus	As defined in Western Australian Service and Installation Requirements (WASIR).
Site generation limit	The generation threshold that the embedded generation system cannot exceed, measured downstream of the connection point.
Stand-alone inverter	An inverter that is not designed to inject power into the grid, and is used for the supply of extra-low (ELV) and/or low voltage (LV) electric power to a single load, or an electrical installation via batteries or a renewable resource, PV, wind, hydro etc. The inverter may or may not contain a charging function.
Standard connection service	As defined in Western Australian Service and Installation Requirements (WASIR).
Smart Connect Solar	Smart Connect Solar is an internet-connected solar solution which enables the connection of additional renewable energy on Horizon Power's systems whilst maintaining system reliability. Smart Connect Solar is Horizon Power's product name for the connection of embedded generation with Energy Management.

Term	Definition
System diagram	A conceptual diagram that illustrates the relationships between separate subsystems using lines.
System impact study	A system study to assess the impact of renewable energy connection on Horizon Power's Electricity System and generation.
System instability	A disturbance to the Electricity System that affects the reliability and quality of power to Consumers.
Technical Requirements	The provisions set out in this document, including any relevant requirements in the Horizon Power Technical Rules HPC-9DJ-01-0001-2012.
Total system capacity	The aggregate nameplate rating (kVA) of all individual EG systems at a premises. The total system capacity for Basic EG connections on different strata titles, but at the same network connection point (e.g. retirement villages), is defined as the aggregate nameplate rating (kVA) of all individual EG systems at the connection point.
Vehicle-to-Building (V2B)	An electric vehicle that storage system that is capable of exporting energy into the Consumer's premises but not the Electricity System, resulting in a minimal-export configuration (also referred to as Vehicle-to-Building or V2B).
Vehicle-to-Grid (V2G)	An electric vehicle that storage system that is capable of exporting energy into the Electricity System, resulting in either a full or partial export configuration (also referred to as Vehicle-to-Grid or V2G).
Wind	A renewable energy generation device that creates electrical energy as a result of harnessing moving air.

2.2 Acronyms

Table 3 provides a list of all acronyms used in this document.

Table 3: Acronyms

Abbreviation or Acronym	Definition
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
API	Application Programming Interface
AS/NZS	A jointly developed Australian and New Zealand Standard
CEC	Clean Energy Council
CT	Current Transformer
DER	Distributed Energy Resources
DERMS	Distributed Energy Resources Management System

Abbreviation or Acronym	Definition
DRM	Demand Response Mode
EG	Embedded Generation
ENA	Energy Networks Australia
ESS	Energy Storage System
HV	High Voltage
IEC	International Electrotechnical Commission
IES	Inverter Energy System
LV	Low Voltage
MEN	Multiple Earthed Neutral
MV	Medium Voltage
NIA	Network Impact Assessment
NMI	National Metering Identifier
PV	Photovoltaic
REBS	Renewable Energy Buyback Scheme
SAA	Solar Accreditation Australia
SCADA	Supervisory Control and Data Acquisition
SGD	Secure Gateway Device
SIS	System Impact Study
V2B	Vehicle-to-Building
V2G	Vehicle-to-Grid
WAER	Western Australian Electrical Requirements
WASIR	Western Australian Service and Installation Requirements

2.3 Terminology

The following instructional terms are to be interpreted as follows:

1. The word 'shall' indicates a mandatory requirement
2. The word 'may' indicates a requirement that may be mandatorily imposed on the Proponent
3. The word 'should' indicates a recommendation that will not be mandatorily imposed on the Proponent.

3 Relevant Rules, Regulations, Standards and Codes

3.1 Relevant Rules, Regulations, Standards and Codes

Table 4² lists reference material containing requirements for the design, manufacture, installation, testing and commissioning, and operation and maintenance of all plant and equipment for Basic EG connections to the Horizon Power Electricity System.

Unless otherwise stated within this document, the Proponent shall comply with the current versions of all relevant legislation, regulations, codes, technical requirements, Australian Standards, and applicable industry guidelines listed here, and any local planning and building requirements, as well as any other applicable requirements not explicitly stated.

Table 4: Relevant Rules, Regulations, Standards and Codes

Horizon Power and Other Documents	
WA Service and Installation Requirements (WASIR)	
Pilbara Harmonised Technical Rules	
HPC-9DJ-01-0001-2012	Horizon Power Technical Rules
Legislation and Regulations	
WA Electricity Industry (Code of Conduct) Regulations 2005	
WA Electricity Licensing Regulation 1991	
WA Electricity Act 1945	
WA Electrical Requirements (WAER)	
Electricity Industry (Network Quality and Reliability of Supply) Code 2005	
Electricity Regulations, WA, 1947	
Codes	
WA Electricity Industry (Metering) Code 2012	
Australian and International Standards	
AS/NZS 3000	Electrical Installations (Wiring Rules)
AS/NZS 3011	Electrical Installations – Secondary batteries installed in buildings
AS/NZS 3017	Electrical installations – Verification guidelines
AS/NZS 3100	Approval and Test Specification – General Requirements for Electrical Equipment
AS/NZS 4777.1	Grid Connection of Energy Systems via Inverters

² The Relevant Standards, Codes, Legislation and Regulation have been provided in a single table for convenience, rather than in separate sections as suggested in the National Distributed Energy Resources Connection Guidelines for Basic Micro EG Connections.

AS/NZS 4777.2	Grid Connection of Energy Systems via Inverters
AS/NZS 5033	Installation and Safety Requirements for Photovoltaic Arrays
AS/NZS 5139	Electrical Installations – Safety of Battery Systems for use with Power Conversion Equipment
AS 60947.6.1: 2015	Low-voltage switchgear and controlgear Part 6.1: Multiple function equipment— Transfer switching equipment
AS IEC 62619:2017	Safety Requirements for lithium cells and batteries
IEC 62109 (all parts)	Safety of Power Converters for use in Photovoltaic Power Systems
IEC 62116	Utility-Interconnected Photovoltaic Inverters – Test Procedure of Islanding Prevention Measures
Guidelines	
Battery Energy Storage Systems: A guide for Electrical Contractor	
National Distributed Energy Resources Grid Connection Guidelines - Framework and Principles	
National Distributed Energy Resources Grid Connection Guidelines - Framework and Principles - Technical Guidelines for Basic EG Connections	

3.2 Order of Precedence

In the event of any inconsistency arising in the requirements outlined in the reference documents listed in Table 4, the following order of precedence in Table 5 shall apply.

Table 5: Order of Precedence (Highest to Lowest)

Order	Reference Document
1	Legislation
2	Regulations
3	Technical Requirements
4	Australian Standards, Codes and Guidelines

The Proponent shall notify Horizon Power of any such conflict prior to undertaking work in relation to this document.

4 Technical Requirements

All Basic EG connections that operate in parallel with Horizon Power Electricity System whether they are exporting, partial-exporting or non-export systems, shall comply with all relevant technical requirements in this document.

Table 6 summarises the key technical requirements and considerations for different subcategories of Basic EG connections. Additional technical requirements also apply and are contained in relevant sections of this document.

Notes in relation to Table 6:

- 1 Proponents shall ensure that all Basic EG connections are set to region “Australia C” per AS/NZS 4777.2.
- 2 Proponents shall comply with Energy Management requirements, and install equipment required to interface to Horizon Power’s Distributed Energy Resources Management Systems (DERMS). Selection of an inverter compatible with the supplied gateway device is required for all new Basic EG connections. Please refer to Section 4.3.4.
- 3 Export limit represents a limit applied to the generation of active power (kW) from the Basic EG connection expressed at the connection point.
- 4 Refer to Appendix B for applicable system diagrams and connection arrangement for each subcategory of Basic EG connection.
- 5 System Impact Study: Refer to Section 4.14.

4.1 Labelling and Signage

For Basic EG connections labels and signs on the installation, including cables shall be as per AS/NZS 4777 (all parts), AS/NZS 3000, AS/NZS 5033 and AS/NZS 5139.

The Basic EG connection must include a durable single sided schematic-wiring diagram of the installation showing all equipment and switches affixed on the site adjacent the inverter system.

Additional labelling requirements also apply for Energy Management. Please refer to Appendix F.

4.2 Maximum System Capacity

The maximum system capacities for IES are shown in Table 6. Note that inverter generation limiting is permitted.

4.2.1 Inverter Energy System (IES) without Energy Storage System (ESS)

For IES without ESS:

- The maximum system capacity for a single-phase Basic EG IES connection on a single-phase supply is 10 kVA.
- The maximum aggregate system capacity for a single-phase Basic EG IES connection (with either a single-phase inverter or any combination of single-phase inverters) on a three-phase supply is 9 kVA, with a maximum inverter capacity of 3kVA on any one phase.
- The maximum system capacity for a three-phase Basic EG IES connection is 30 kVA, noting the required site generation limit is 8kVA per phase in accordance with Section 4.3.6.

4.2.2 Inverter Energy System (IES) with DC Coupled Energy Storage System (ESS)

For IES with DC coupled ESS:

- The maximum system capacity for a single-phase Basic EG connection on a single-phase supply, including the IES and ESS capacity, is 10 kVA.
- The maximum aggregate system capacity for a single-phase Basic EG IES connection (with either a single-phase inverter or any combination of single-phase inverters) on a three-phase supply, including the IES and ESS capacity, is 10 kVA, with a maximum inverter capacity of 5kVA on any one phase.
- The maximum system capacity for a three-phase Basic EG including the IES and ESS capacity is 30 kVA, noting the required site generation limit is 8kVA per phase in accordance with Section 4.3.6.

4.2.3 Inverter Energy System (IES) with AC Coupled Energy Storage System (ESS)

For IES with AC coupled ESS:

- The maximum system capacity for a single-phase Basic EG connection on a single-phase supply, including the IES and ESS, is 15 kVA where $IES \leq 10$ kVA and $ESS \leq 10$ kVA, noting the required site generation limit is 15kVA in accordance with Section 4.3.6.
- The maximum aggregate system capacity for a single-phase Basic EG IES connection (with either a single-phase inverter or any combination of single-phase inverters) on a three-phase supply, is 9 kVA for IES and 10 kVA for ESS, with a maximum inverter capacity of 3kVA IES and 5kVA ESS on any one phase.
- The maximum system capacity for a three-phase Basic EG including the IES and ESS is 30 kVA where $IES \leq 30$ kVA and $ESS \leq 15$ kVA, noting the required site generation limit is 8kVA per phase in accordance with Section 4.3.6.

4.2.4 Connections on different strata titles, but at the same connection point

The maximum system capacity for connections on different strata titles, but at the same network connection point (e.g. retirement villages) is defined as the aggregate system capacity at the connection point.

Table 6: Summary of Key Technical Requirements

Technical Requirement	All Network Areas			
Maximum Aggregate System Capacity <i>(Note Site Generation Limits also apply – see below)</i>	Proponent's Supply Arrangement (WASIR Connection Service Type)	Basic EG Connection Type (Inverter Phasing)	Maximum Aggregate System Capacity	
	Single-Phase	Single-Phase	IES without ESS	≤10 kVA
			IES with DC Coupled ESS	
			IES with AC Coupled ESS	≤15 kVA in aggregate (IES ≤10 kVA, ESS ≤10 kVA)
	Three Phase	Single-Phase or multiple Single-Phase inverters	IES without ESS	≤3 kVA per phase
			IES with DC Coupled ESS	≤10 kVA in aggregate ≤5 kVA per phase
			IES with AC Coupled ESS	IES ≤9 kVA in aggregate ESS ≤10 kVA in aggregate IES ≤3 kVA per phase ESS ≤5 kVA per phase
		Three Phase	IES without ESS	≤10 kVA per phase
			IES with DC Coupled ESS	
			IES with AC Coupled ESS	≤30 kVA in aggregate IES ≤ 10 kVA per phase ESS ≤ 5 kVA per phase
Site Generation Limit Downstream of Connection Point	Proponent's Supply Arrangement	Basic EG Connection Type (Inverter Phasing)	Site Generation Limit (Refer to Section 4.3.6)	
	Single-Phase	Single-Phase	15 kVA	
	Three-Phase	Single Phase	8 kVA per phase	
		Three-Phase		

Technical Requirement	All Network Areas
Energy Management	Customers are required to have Energy Management (Refer to Section 4.3.4)
Operating Envelopes	Customers installing ESS are required to meet Operating Envelope requirements (Refer to Section 4.3.5).
Maximum Aggregate Export Limit at the Connection Point	5 kW per phase
Additional Export Limit Control Requirements at the Connection Point	Under certain circumstances only, as determined by Horizon Power (Refer to Section 4.3.2)
Phase Balancing Requirements	No more than 3 kVA unbalance between any phases as per AS/NZS 4777.1 at the connection point. Where a multiple-phase IES is used and comprised of individual single-phase inverters: • the difference in current injected into any two phases shall not exceed 3 kVA; and • where the nameplate rating of any two individual IES differs by more than 3 kVA Central Protection shall be installed in accordance with Section 4.7.2.
Network Impact Assessment	A Network Impact Assessment will be performed by Horizon Power
System Impact Study	A System Impact Study is generally not required but may be necessary in areas with limited Hosting Capacity or local network constraints
System Diagram (refer Appendix B)	Diagram E (refer to Appendix B)

4.3 Generation Control

Basic EG connections require Generation Control in accordance with the following requirements.

4.3.1 Export Limits at the Connection Point

The following export limits apply for all subcategories of Basic EG connections and apply at the connection point at all times. Where multiple single-phase or three-phase Basic EG connections exist behind the same connection point the export limit is the maximum aggregate export limit accounting for all Individual Basic EG connections:

1. Single-phase Basic EG connection (including ESS) – the export limit shall be set to equal 5 kW.
2. Three-phase Basic EG connection (including ESS) – the export limit shall be set to equal 5 kW per phase.

The export limit is to be interpreted as a maximum “soft limit”, consistent with the definition of “soft limit” per AS/NZS 4777.1 and AS/NZS 4777.2.

The export limit control function shall monitor the response of the inverter or multiple inverter combination to the soft limit. Where the soft limit is exceeded the export limit control function shall operate to reduce the power output of the inverter or multiple inverter combination such that the export limit at the connection point is met within 15 seconds.

Export limit control functions may be integrated into the inverter or managed using an external device and shall not interfere with the anti-islanding protection of the inverter(s). The settings for export limit controls shall be password protected.

4.3.2 Additional Export Limits at the Connection Point

In the event of network or contractual constraints, Horizon Power may require any subcategory of Basic EG connection (including ESS) to permanently have a lower export limit than that defined in Section 4.3.1, including a zero-export limit. Where a lower export limit is required, it shall not be exceeded for more than 15 seconds at the connection point, consistent with the definition of “soft limit” per AS/NZS 4777.1 and AS/NZS 4777.2.

4.3.3 Main switch compatibility

Section 4.5.1 contains information on the installation main switch requirements. In circumstances where the export limits at the connection point in Section 4.3.1 above exceed the capability of the installation main switch at the Premises, the Proponent shall reduce the export limit at the connection point so that it is less than or equal to the main switch capability.

The Proponent may separately apply to Horizon Power for an increase in the allowable network service capacity so that the Proponent can upgrade the installation main switch and service protection device, where relevant, to increase the export limits to the values in Section 4.3.1. Where such an upgrade is not approved by Horizon Power the Basic EG export limits at the connection point shall be limited to avoid exceeding the rating of the installation main switch.

4.3.4 Energy Management

4.3.4.1 General

Energy Management is the remote monitoring and control of the Basic EG connection to protect the safety of personnel or the public, manage threats to power system security, and prevent damage to electrical plant and equipment. Energy Management allows Horizon Power to connect to the proponent’s Basic EG connection via Horizon Power’s Distributed Energy Resources Management System (DERMS), and via the Consumer’s Inverter Manufacturer portal, to monitor and control the Basic

EG connection and to remotely disconnect the Basic EG connection from and reconnect it to the Electricity System.

Proponents require Energy Management to be active at the time of connection, including providing the required equipment for Energy Management. Horizon Power will provision and supply a Secure Gateway Device (SGD) to the installer at the time of application approval, for installation and commissioning with the Basic EG connection. Horizon Power will own and maintain the SGD.

The following table outlines the Proponent obligations in relation to Energy Management:

Table 7: Energy Management Requirements

Requirement
Select inverters compatible with the supplied gateway device. Compatible inverters are listed on Horizon Power's website at: www.horizonpower.com.au/contractors-installers/connect-solar-battery-ev/smart-connect-solar/#inverters .
Provide a single-phase 240 V AC general purpose outlet (GPO) with an external weatherproof switch in accordance with Appendix F. The GPO will supply power to a Secure Gateway Device (SGD).
Provide an enclosure which will house the GPO along with all terminations of the ethernet internet and inverter communications in accordance with Appendix F.
Provide a suitably protected and IP rated hard-wired ethernet cable connection (minimum CAT 5e) rated 300V RMS or greater between each inverter communications port and the SGD enclosure.
Provide a hard-wired ethernet internet connection with a Dynamic Host Configuration Protocol (DHCP) service. The ethernet internet connection will be connected to the Consumer's internet connection and will be used to connect the supplied SGD to the internet and Horizon Power's DERMS. The internet connection will also be used to connect the Basic EG connection to the inverter manufacturer's platform (Inverter communications will be passed through the SGD via the hardwired internet connection to the inverter manufacturer's platform). The internet connection shall be active at all times. The Basic EG connection may be disconnected during periods where an active internet connection is not available.
Install and commission the GPO, external weatherproof switch, SGD enclosure, and ethernet cable connection between each inverter and SGD enclosure in accordance with Appendix F.
Install and commission the hard-wired ethernet internet connection and SGD (provided by Horizon Power) in accordance with Appendix F. Connect the SGD to the internet via the hard-wired ethernet internet connection, to each inverter via the specified Ethernet cable(s), and to the power supply.
Allow Horizon Power to remotely monitor and control the LV EG connection via Horizon Power's Distributed Energy Resources Management System (DERMS) and connect to the inverters comprising the Basic EG connection via the Consumers Inverter Manufacturer portal, <i>including changing of inverter settings as required</i> .

The SGD shall be supplied by Horizon Power for installation by the Proponent, and the Proponent shall test and commission the SGD. Installation and commissioning of the SGD shall be completed by an installer accredited with SwitchDin.

If the SGD installation is required to be modified or replaced by Horizon Power at some point after the commissioning of the Basic EG connection, the Proponent shall cooperate with Horizon Power to test and commissioning the SGD.

Please refer to Appendix F for more information on Energy Management.

4.3.4.2 Energy Storage Systems

The general requirements for Energy Management apply to inverters connecting ESS. Energy Management of the ESS shall be commissioned at time of installation, in accordance with the requirements of Section 4.3.4.1.

For Basic EG connections with ESS, the inverters connecting ESS shall be:

- on the compatible inverter list; and
- connected to the Secure Gateway Device via a hardwired ethernet connection.

This requirement applies for all inverters connecting ESS (DC coupled and AC coupled).

To add a new inverter to the compatible inverter list, Installers may contact SwitchDin (www.switchdin.com).

4.3.5 Operating Envelopes for Energy Storage Systems

Inverters connecting ESS shall meet the Operating Envelope requirements defined in Table 8.

Horizon Power's systems typically experience minimum load conditions during the middle of the day, and peak load conditions in the evening. Operating Envelopes assist Horizon Power to manage these conditions by restricting BESS discharging (into the Grid) and restricting BESS charging (from the Grid) during specific time periods.

Refer to Section 4.3.8 for further details on requirements for charging from the Grid.

For the avoidance of doubt, use of self-consumption mode on inverters is permitted and meets the requirements of Table 8. It is the responsibility of the Installer to configure the inverter to meet the Operating Envelope requirements and provide the necessary information (refer Appendix C).

In certain circumstances Horizon Power may apply settings that differ to the requirements below. Application of settings may be through a request to the Proponent, or remotely managed through the inverter manufacturers portal.

Table 8: Operating Envelope Requirements

From	To	Requirements	
		Charging from the Grid	Discharging into the Grid
00:00	09:59	Permitted	Permitted
10:00	15:00	Permitted	Not Permitted
15:00	18:00	Permitted	Permitted
18:00	21:00	Not Permitted	Permitted
21:00	23:59	Permitted	Permitted

4.3.6 Site Generation Limit Downstream of Connection Point

The site generation limit downstream of the connection point shall be used where the aggregated nameplate capacity of all inverters and inverter energy system exceed the site generation limits of Table 6.

This includes any combination of AC coupled BESS, DC coupled BESS or other IES (PV or other energy source). The site generation limit downstream of the connection point shall be the same as the AS/NZS 4777.2 soft limit for the generation limit control function.

The site generation limit for any combination of IES shall be the allowed maximum concurrent output level to the AC electrical installation from all inverter energy systems on the network connection service. The site generation limit applied to the combined output of all IES shall be equal to the site generation limits of Table 6. This is only permissible with Inverters and IES that conform to the generation limit control function of AS/NZS 4777.2 or AS/NZS 4777.1.

4.3.7 Phase Balancing Control

For Basic EG connections, the Proponent shall ensure there is no more than 3 kVA unbalance between any phases as per AS/NZS 4777.1 at the connection point.

Phase balancing control does not apply to single-phase inverters on single-phase systems.

Where a multiple-phase IES and/or ESS is used and comprises a three-phase inverter, the inverter shall satisfy the current balance requirements in Section 2.11 of AS/NZS 4777.2.

Where a multiple-phase IES is used and comprises individual single-phase inverters, or single-phase-inverters in combination with three-phase inverters:

1. the difference in current injected into any two phases shall not exceed 12.5 amps (being 3 kVA at 240 V) for more than 15 seconds; and
2. Where the nameplate rating of any two individual inverters differs by more than 3 kVA Central Protection shall be installed in accordance with Section 4.7.2.

Irrespective of the method used to mitigate the current phase unbalance on a site, the requirements of AS/NZS 3000 clause 3.4.1 shall be met.

4.3.8 Charging of ESS from the Electricity System

Under normal operation, charging of ESS is permitted only for customers adhering to the technical requirements of this document. Periods where charging from the Grid shall be restricted may apply. Refer the Operating Envelope requirements defined in Section 4.3.5.

ESS is permitted to charge outside of normal operation in two circumstances:

1. to manage overfrequency disturbance events, in accordance with AS/NZS 4777.2 (Sections 3.4.3 and 4.5.3.1) for region "Australia C".
2. to maintain battery health. One cycle of the ESS per month (in aggregate) is permitted for this purpose.

Horizon Power may at any time direct the enabling or disabling of ESS charging, with settings as required by Horizon Power.

Any Proponent found to be charging ESS from the Grid not in accordance with these requirements, may have their Basic EG connection disconnected from the Electricity System until the Basic EG connection is shown to have been modified to meet these technical requirements.

4.4 Inverter Energy System (IES)

4.4.1 General

The following requirements apply to Inverter Energy Systems (IES):

1. IES shall be tested by an authorised testing laboratory and be certified as being compliant with AS/NZS 4777.2 (latest version of all parts) with an accreditation number.
2. IES shall comprise of inverters that are registered with CEC as approved grid connect inverters and included on the SGD compatible inverter list in Appendix F. The CEC inverter listing shall not have expired at the time of connection application and IES installation.
3. IES shall comprise of inverters that are tested by an authorised testing laboratory and certified as being compliant with IEC 62116 for active anti islanding protection.
4. IES shall comprise of inverters installed in compliance with the latest version of AS/NZS 4777.1.
5. IES shall comprise of inverters that are configured for region “Australia C”.

4.4.2 Energy Storage System (ESS)

ESS capable of supplying electricity to a Premises or the Electricity System is considered Grid Connected, unless the ESS is connected behind a break-before-make switch in compliance with AS/NZS IEC 60947.6.1.

Where an ESS is considered to be Grid Connected:

1. It shall comply with the technical requirements in this document including the general requirements in Section 4.4.1.
2. The installation of the ESS shall comply with AS/NZS 5139.
3. The maximum capacity of the ESS shall not exceed the requirements in Section 4.2.
4. The Export limit for the ESS will be considered as part of the aggregated Export limit at the Connection Point in accordance with Section 4.3.1.
5. The ESS inverter must be set and adhere to the Operating Envelope requirements in Section 4.3.5.

The installation and commissioning of ESS shall be certified as compliant by an accredited person.

4.4.3 Electric Vehicles

An electric vehicle shall be considered a Basic EG connection when the nameplate capacity of the inverter meets the capacity requirements for a Basic EG connection in Table 1 and:

1. it is capable of exporting energy into the Consumer’s premises but not the Electricity System, resulting in a minimal-export configuration (also referred to as Vehicle-to-Building or V2B);
2. it is capable of exporting energy into the Electricity System, resulting in either a full or partial export configuration (also referred to as Vehicle-to-Grid or V2G); or
3. the electric vehicle charger being installed has the capability to export electricity into either the Consumer’s premises or the Electricity System.

The inverters for electric vehicles considered a Basic EG connection shall comply with these technical requirements in this document. Where an electric vehicle is a Basic EG connection or part of a Basic EG connection it shall comply with requirements of section 4.3.8.

4.5 Network Connection and Isolation

Network connection and isolation requirements for Basic EG connections shall be as per AS/NZS 4777.1 and AS/NZS 3000 including, but not be limited to:

1. As a minimum, mechanical isolation shall be as per AS/NZS 3000 in that the isolator shall always be readily accessible.
2. Any means of isolation (where lockable) shall be able to be locked in the open position only.
3. For PV systems, isolation requirements shall be as per AS/NZS 5033.

In all cases, the network connection service and service apparatus at the time of the Basic EG system installation shall comply with WA Electrical Requirements (WAER), and the WA Service and Installation Requirements (WASIR).

The Proponent shall ensure the capacity of the Basic EG connection is within the capacity of the electrical installation and network connection service and shall not cause the electrical installation, connection service or service apparatus to be overloaded in any combination of Basic EG connection operation.

Note that in accordance with Section 6.1 of the WAER, the addition of Embedded Generation is considered an alteration, and the network connection service, service apparatus and modifications to the electrical installation must comply with all relevant requirements (WAER, WASIR and the Basic EG Connection Technical Requirements) at the time of installation.

4.5.1 Main switch

All electrical installations with a Basic EG connection shall have an installation main switch or switches installed as prescribed by AS/NZS 3000, the WAER, WASIR and Horizon Power's Technical Rules. In accordance with WASIR requirements, the main switch(es) shall be a circuit breaker rated to the lesser value of:

- The network connection service capacity (being 63A single phase or 32A/phase for three phase standard connection service) or the Consumer's requested and agreed calculated maximum demand; or
- where multiple main switches are installed, the sum of the current ratings of the individual protection devices shall not exceed the lesser value of network connection service capacity or service protection device (SPD) rating, where the network connection service capacity can be found in the WASIR, table 3.

Please also refer to Section 4.3.3 dealing with the main switch compatibility with export limits.

4.5.2 Changeover switches

Changeover switches shall comply with AS 60947.6.1.

4.5.2.1 *Make before break*

If the Basic EG connection meets any of the following requirements it shall be considered as a Grid Connected Basic EG connection. In these circumstances the Proponent shall submit a connection application to Horizon Power prior to any connection being made and the Basic EG connection will be required to comply with the technical requirements in this document.

1. The Basic EG connection is connected behind a make before break switch that results in a momentary (however brief), or longer, connection between grid supply and Generation supply circuits when performing a changeover; or

2. The Basic EG connection includes a multiple mode inverter with uninterruptible power supply (UPS) mode functionality that is Grid Connected but also supplies an Off-grid circuit.

Irrespective of whether the make before break switch is of automatic or manual type, the Proponent shall:

1. comply with Energy Management requirements to allow Horizon Power to manage the power system and cater for re-connection of step loads on the system (please refer to Section 4.3.4 for more information on Energy Management); and
2. ensure that immediately after connection to the Electricity System the change in demand drawn from the Electricity System is limited so that the maximum change in demand supplied to the Premises is achieved following a linear ramp rate in no less than 60 seconds.

4.5.2.2 Break before make

Any Basic EG connection behind a break-before-make switch that isolates the changeover circuit when transferring between grid supply to generation supply will be considered as an Off-grid system.

Horizon Power will not permit use of an automatic break before make switch for the purpose of connecting the Electricity System to a Premises with an Off-grid system. Any break before make changeover switch must be of manual type.

The Proponent shall submit a connection application to Horizon Power for approval prior to installation of a break before make switch. Information in the connection application informs Horizon Power about the Off-grid arrangement so that Horizon Power can manage the power system adequately during changeover events.

4.6 Earthing

The earthing requirements for Basic EG connections shall include:

1. For IES, earthing requirements shall conform with AS/NZS 4777.1 and AS/NZS 3000.
2. For ESS, earthing requirements shall conform with AS/NZS 5139.
3. For PV systems, earthing requirements shall conform with AS/NZS 5033.

4.7 Protection

4.7.1 Inverter Integrated Protection

Inverter integrated protection requirements shall be as per AS/NZS 4777.1 and AS/NZS 4777.2 for Basic EG connections. Proponents shall ensure that all Basic EG connection settings are set to region "Australia C" unless otherwise instructed in this document or by Horizon Power. A summary of these settings associated with region "Australia C" are provided in Appendix E.

Passive anti-islanding requirements and settings shall be as per Table 4.1 and Table 4.2 in AS/NZS 4777.2 for region "Australia C".

Active anti-islanding protection requirements shall be as per AS/NZS 4777.2 and IEC 62116.

4.7.1.1 Security of protective function settings

The settings of the protective function settings shall be secured against inadvertent or unauthorised change. Changes to the settings shall require the use of a tool and special instructions not provided to unauthorised personnel.

In certain circumstances Horizon Power may request the Proponent apply settings that differ from the region “Australia C” settings.

4.7.1.2 Automatic disconnection

The automatic disconnection device shall prevent both active and reactive power from entering the Horizon Power Electricity System when the automatic disconnection device operates in accordance with AS/NZS 4777.2, Section 4.2.

4.7.1.3 Sustained operation for voltage variations

The automatic disconnection device shall disconnect the Basic EG connection within 3 seconds when the average voltage for a 10-minute period exceeds the setting per Table 4.3 in AS/NZS 4777.2 for region “Australia C”.

4.7.1.4 Sustained operation for frequency variations

The Basic EG connection shall maintain continuous operation for frequency variations within the limits specified in Table 4.4 in AS/NZS 4777.2 for region “Australia C”.

4.7.2 Central Protection

Where central protection is required for phase balance protection, the requirements in Table 1 of AS/NZS 4777.1 apply, except the Basic EG connection shall be disconnected by automatic operation of the disconnection device when the maximum current imbalance at the connection point exceeds 12.5 amps (being 3 kVA at 240 V) for 30 seconds. Please also refer to Section 4.3.7 for more information on conditions where central protection is required.

4.7.3 Interlocking

Where multiple single-phase inverters are connected to more than one phase:

- Inverters shall operate to achieve the balancing requirements of Section 4.3.7; and
- phase balance protection as per Clause 3.4.4 of AS/NZS 4777.1 is required, with exceptions outlined within Clause 5.4.4 in AS/NZS 4777.1.

4.8 Operational Voltage and Frequency

Horizon Power’s supply characteristics are defined in Section 2 of the Horizon Power Technical Rules. The operating voltage and frequency requirements of the Basic EG connection can be found in Section 4.7.1.

The automatic disconnection device shall disconnect the Basic EG connection when the average voltage for a 10-minute period exceeds the setting per Table 4.3 in AS/NZS 4777.2 for region “Australia C”.

The Proponent shall be responsible for ensuring that the maximum voltage rise within the Premises complies with AS/NZS 4777.1 and shall submit evidence for Horizon Power’s record keeping in the form of Schedule 4 - Cable Data.

4.9 Metering

This section refers to the Horizon Power’s revenue metering equipment at the Proponent’s connection point to Horizon Power’s network.

4.9.1 Approved Meters

Only Horizon Power approved metering equipment in accordance with Horizon Power Metering Standards and the WA Metering Code shall be used. If the Proponent has existing non-conforming

metering equipment, then they shall be replaced as a part of the installation of the Basic EG connection at the Proponent's cost.

4.9.2 Approved Installers

The meter shall be installed by Horizon Power or its approved contractor.

4.9.3 Upgrading of Enclosure

To meet the meter installation requirements of Section 11 of the WA Distribution Connections Manual, the Proponent may be required to upgrade the enclosure where the metering equipment is housed.

4.9.4 Measurement of Metering Equipment

Horizon Power shall perform measurements in accordance with the Metering Code and Horizon Power Metrology Procedures.

4.9.5 Cost of Metering Equipment

If a meter replacement is required, the cost of materials and installation of metering equipment shall be borne by the Proponent in accordance with the Consumer's Buyback Contract. This includes the cost of upgrading of enclosures and switchboard if required.

4.10 Power Quality

4.10.1 IES Power Quality Response Modes

4.10.1.1 *Security of operational settings*

The settings of the demand response or power quality response modes of the inverter shall be secured against inadvertent or unauthorised change. Changes to the settings shall require the use of a tool and special instructions not provided to unauthorised personnel.

4.10.1.2 *Inverter Demand Response Modes*

The Basic EG connection shall have Demand Response Mode DRM 0 as a mandatory demand response. DRM Mode 1 through DRM Mode 8 are to be disabled unless instructed otherwise by Horizon Power.

4.10.1.3 *Volt-Watt Response Mode*

The Volt-Watt Response Mode shall be **enabled by default** and settings shall be as per Table 3.6 in AS/NZS 4777.2 for region "Australia C".

For multiple mode inverter operation with energy storage the Volt-Watt Response Mode shall be **enabled by default** when charging and settings shall be as per Table 3.8 in AS/NZS 4777.2 for region "Australia C".

Horizon Power may at any time direct the enabling or disabling of Volt-Watt Response Mode or a change to the region "Australia C" settings.

4.10.1.4 *Volt-Var Response Mode*

The Volt-Var Response Mode shall be **enabled by default** and settings shall be as per Table 3.7 in AS/NZS 4777.2 for region "Australia C". Horizon Power may at any time direct the enabling or disabling of Volt-Var Response Mode or a change to the region "Australia C" settings.

4.10.1.5 *Voltage Balance Mode*

Where an IES has Voltage Balance Mode it shall be **disabled by default**. Horizon Power may at any time direct the enabling or disabling of Voltage Balance Mode if the IES has this feature, or a change to the Voltage Balance Mode settings.

4.10.1.6 Fixed Power Factor Mode

Fixed Power Factor Mode shall be **disabled by default**. Horizon Power may at any time direct the enabling or disabling of Fixed Power Factor Mode or a change to the Fixed Power Factor Mode settings.

4.10.1.7 Reactive Power Mode

Reactive Power Mode shall be **disabled by default**. Horizon Power may at any time direct the enabling or disabling of Reactive Power Mode or a change to the Reactive Power Mode settings.

4.10.1.8 Power Rate Limit Mode

All inverters are required to have a Soft Ramp Up after Connect or Reconnect mode as per AS/NZS 4777.2 Section 3.3.4.3.2. Horizon Power only requires for soft ramp up to be applied to reconnection (i.e. ramp up / soft start). The ramp up power rate limit shall be set to $W_{Gra+}=16.67\%$ of nameplate rating (per minute).

4.10.1.9 Frequency Response Mode (Hz-Watt)

Frequency Response Mode (Hz-Watt) shall be **enabled by default** and settings shall be as per Table 4.5 to 4.7 in AS/NZS 4777.2 for region “Australia C”. Table 4.5 in AS/NZS 4777.2 also contains settings for multiple mode inverters.

4.10.2 ESS Power Quality Response Modes

An ESS inverter is a multiple mode inverter as per AS/NZS 4777.2. The required voltage response is dependent on the energy storage level and required mode (e.g. fully charged status battery can discharge and generate but won’t be able to charge to act as a load).

For an ESS inverter the Volt-Watt mode shall be enabled for charging and discharging through the grid-interactive port of a multiple mode Inverter in conformance to AS/NZS 4777.2.

The requirements of Section 4.10.1.4 for Volt-Var Response Mode shall apply to the charging mode of ESS inverters.

4.11 Communications Systems

Communication systems are required for Basic EG connections to provide Horizon Power direct control of the Basic EG connection (including ESS). Information on the requirements to interface with DERMS are contained Section 4.3.4 and Appendix F.

4.12 Data and Information

4.12.1 Static Data and Information

The Proponent is to provide the following information to Horizon Power as part of the connection application.

1. **Completed Application Form.**
2. **Compliance Checklist (Not Mandatory).** This is a checklist comprising the key elements that need to be satisfied to comply with this document (refer to Schedule 1 of this document).
3. **System Diagram.** A diagram that illustrates the functional relationships between key electrical and communication subsystems. The Proponent’s System Diagram shall be in accordance with Appendix B of this document. An example is also provided as Schedule 2.
4. **Circuit Diagrams.** One or more diagrams detailing the electrical connections from the connection point through to the Basic EG connection energy source. Refer to Schedule 3 of this

document for an example. The Proponent's Circuit Diagram shall be in accordance with the Standards in Section 3 and other relevant requirements of this document. The Circuit Diagram shall include:

- a. Electrical connections for all phases.
 - b. Neutral and earth connections (AC & DC).
 - c. Switchboard electrical connections (depiction of Proponent final loads not required).
 - d. Electrical interconnection of all electrical elements of the EG including inverters, energy storage devices, chargers, renewable energy sources, DC and AC protection devices etc.
5. **Cable Data.** Data associated with power cables connecting the Proponent's Basic EG connection to Horizon Power's Electricity System. This includes the consumer mains cable. Refer to Schedule 4 of this document for an example. Cable data to be provided includes:
- a. Location of cable in installation.
 - b. Number of cores.
 - c. Cross sectional area and insulation type.
 - d. Cable Length.
 - e. Method of installation (e.g. underground in conduit).
6. **System Parameters (Not Mandatory).** The Proponent is to document the parameters (including power quality response modes and protective functions) that will be applied to the Basic EG connection. Any departures from the default region "Australia C" shall be clearly identified. Refer to Schedule 5 of this document for the system parameters list).
7. **Static Data and Information** (refer Appendix C).

4.12.2 Dynamic Data and Information

Dynamic data and information requirements apply for Basic EG connections for the purposes of Energy Management in accordance with Section 4.3.4 and Section 4.11.

4.12.3 Information To Be Provided After Commissioning

Please refer to Section 6.3.

4.13 Cybersecurity

Where communications are required, Horizon Power shall notify the Proponent of any cybersecurity requirements, which may include:

1. Monitoring and communications devices shall be in screw sealed or lockable enclosures.
2. Protection and control from the network systems (firewalls).
3. Privilege settings and password protection.
4. Limiting access to only that which is required to monitor the generating unit.
5. Communications shall be over secured channels or Modbus TCP.
6. No unauthorised changes to the SGD.

4.14 Technical Studies

System Impact Studies (SIS) are generally not required for Basic EG connections although Horizon Power may perform a SIS for various reasons, including circumstances where there are known power system issues. Where a SIS is required, this will be undertaken at Horizon Power's cost.

In some cases, the technical studies may identify additional technical requirements for the Proponent's Basic EG connection (for example alternative export limits or specific energy management requirements), or the requirement for generation or network augmentation.

Any additional requirements for the Proponent's Basic EG connection or generation or network augmentation identified in technical studies will be at the Consumer's cost.

5 Fees and Charges

5.1 Application and assessment

There are no fees to apply to install a Basic EG connection or to participate in Horizon Power's buyback offer for standard applications.

Horizon Power does not charge a fee for a standard assessment of a Basic EG connection, including a Network Impact Assessment, but may charge a fee if a System Impact Study is required.

Horizon Power may charge a fee in circumstances where a Network Impact Assessment identifies the requirement for network augmentation or other requirements necessary to facilitate the Basic EG connection.

5.2 Metering equipment

A meter re-configuration fee may apply once the Basic EG connection is installed, depending on the metering arrangements at the time of the application.

5.3 Energy Management

All Basic EG connections require Energy Management (please refer to Section 4.3.4). With regard to Energy Management:

- the SGD shall be supplied by Horizon Power at no cost to the Proponent; and
- the Proponent is responsible for all costs associated with installation and commission of the SGD.
- The Proponent is responsible for all costs associated with providing power and an ongoing active internet connection to the SGD.

Please refer to Section 4.3.4 and Appendix F for more information on Energy Management.

5.4 Further information

Please refer to Horizon Power's website for further information on fees and charges.

<https://www.horizonpower.com.au/utilities/pricing/>

6 Testing and Commissioning

Testing and commissioning shall be undertaken in accordance with AS/NZS 4777.1, AS/NZS 3000, AS/NZS 3017, AS/NZS 5033 (where applicable), the equipment manufacturer's specifications, this document and Section 3.5.8 of the Horizon Power Technical Rules to demonstrate that the Basic EG connection meets the requirements of the Connection Agreement.

All electrical installation, commissioning and maintenance work, wherever required, shall be carried out by an electrical contractor licensed under the Electricity (Licensing) Regulations, (1991).

Commissioning and testing shall include (but not limited to):

- Confirmation that the export limiting device(s) prevents export limits at the connection point being exceeded;
- Confirmation that the site generation limiting device(s) prevents site generation limits being exceeded;
- Confirmation that phase balancing control requirements are met as per the requirements of Section 4.3.7;
- Confirmation that the maximum voltage rise on any phase within the premises complies with AS/NZS 4777.1;
- Confirmation that Soft Ramp Up after Connect or Reconnect mode complies with AS/NZS 4777.2 Section 3.3.4.3.2. The ramp up power rate limit shall be set to $W_{Gra+}=16.67\%$ of nameplate rating (per minute); and
- Testing of the Energy Management communication and control facilities in cooperation with Horizon Power, where relevant.

6.1 Commissioning procedures

If requested by Horizon Power, the Proponent shall provide to Horizon Power a list of step-by-step energizing and commissioning procedures prior to commissioning the Basic EG connection. Horizon Power reserves the right to witness commissioning or request evidence of commissioning results. The tests shall be installation tests and functional tests, not type tests.

6.2 Verification Tests

During commissioning of a new or modified Basic EG connection, a verification test shall be performed as recommended by the equipment manufacturer and required by the relevant standards.

Testing of new or modified Basic EG connections shall include procedures to functionally test all power quality response modes (refer Section 4.10.1) and protective functions (refer Section 4.7.1) elements including verification of inverter trip settings.

6.3 Information to be provided to Horizon Power

The Proponent shall ensure the following information is provided to Horizon Power on completion of the testing and commissioning requirements (including verification tests) and retain copies:

1. photographs of the installation clearly showing evidence that installation of the Basic EG connection has been performed in accordance with:
 - a. all relevant requirements documented in Table 4;
 - b. the requirements in this document including:

- i. labelling and signage;
 - ii. communications systems including Energy Management facilities, where relevant;
 - iii. System Diagrams, Circuit Diagrams and Cable Data in Schedule 2 to Schedule 4;
 - iv. main switch compatibility; and
 - v. changeover switch requirements (evidence that an appropriate changeover switch is installed).
2. photographs or other such evidence that the IES (and ESS if relevant) has been configured with regional "Australia C" settings.
3. photographs or other such evidence that the inverter connecting ESS has been configured to meet the requirements of Operating Envelopes for Energy Storage Systems.

The Proponent shall be responsible for ensuring that the maximum voltage rise on any phase within the Premises complies with AS/NZS 4777.1 and shall submit evidence for Horizon Power's record keeping in the form of Schedule 4 Cable Data on completion of commissioning.

The information above shall be submitted to Horizon Power by email to the following email address: Renewables@horizonpower.com.au.

6.4 Labelling

Please refer to Section 4.1.

6.5 Distributed Energy Resources Management System (DERMS)

Horizon Power will require the Proponent to commission the SGD on site in accordance with Appendix F.

7 Operations and Maintenance

Basic EG connections shall be operated and maintained to ensure compliance with the Connection Agreement, including compliance with all relevant legislation, codes, and/or other regulatory instruments, including Horizon Power's Technical Rules, always.

The Proponent shall continue to meet the Proponent Obligations in Section 1.4.

Operations and maintenance requirements for Basic EG connections stems shall include, but not be limited to:

1. Maintaining the electrical installation at the premises in a safe condition.
2. All electrical installation, commissioning and maintenance work, wherever required, shall be carried out by an electrical contractor licensed under the Electricity (Licensing) Regulations, (1991). The persons performing the electrical installation, commissioning and maintenance work shall hold a valid Certificate of Compliance issued in respect of any of the changes.
3. The Basic EG connection shall be operated and maintained to ensure compliance with the Connection Agreement and all legislation, codes, and/or other regulatory instruments at all times
4. Ensuring that settings of the demand response, power quality response modes, Operating Envelopes (ESS only), and protection functions of the inverter are secured against inadvertent or unauthorised change. Changes to the settings shall require the use of a tool and special instructions not provided to unauthorised personnel.

7.1 Inspection

Horizon Power may inspect the Proponent's Basic EG connection at any time. This inspection will be at Horizon Power's cost.

Should Horizon Power wish to inspect a Proponent's Basic EG connection:

1. Horizon Power will make arrangements with the Proponent for the inspection;
2. The Proponent shall have the appropriate tools and passwords necessary for Horizon Power to confirm all settings have been applied correctly; and
3. If requested by Horizon Power, the Proponent shall arrange for historical data to be exported from the Basic EG connection records and provided to Horizon Power, if the functionality is available.

7.2 Compliance Audits (Health Checks)

Horizon Power may undertake audits of the Basic EG connection for compliance with the requirements in this document.

Note that compliance audits of existing Basic EG connection connected prior to this version of the technical requirements may also be undertaken; these systems shall be assessed against the version of the technical requirements at the time the connection was approved to connect to the grid, accounting for any changes in settings Horizon Power may have directed since that time.

Horizon Power may perform desktop audits on a Basic EG connection using:

- Information provided with the connection application and post commissioning including photographs and other such evidence that the installation has been carried out in accordance with the requirements in this document;

- Querying information accessible via DERMS;
- Inverter manufacturer portals and settings databases; and
- Advanced Meter Data.

In some cases, Horizon Power may determine a site audit is necessary. Where this is required, Horizon Power will contact the Proponent to arrange for an audit of the Basic EG connection at the Premises. The Proponent shall provide full unrestricted access to the Basic EG connection to the Horizon Power personnel or authorised Horizon Power contractor undertaking the audit. Please also refer to inspection requirements in Section 7.1.

The results of the audit will be recorded on Horizon Power's system for future reference.

7.3 Non-Compliance Process

Should a non-compliance of any kind be identified, the Proponent shall be given a period of 21 business days to rectify the non-compliance.

In cases where a non-compliance remains unresolved, or a non-compliance is identified which poses a safety or system reliability risk, a Fault Note will be placed on the installation and the Basic EG connection will be disconnected from Horizon Power's Electricity System. The Basic EG connection will not be reconnected to Horizon Power's Electricity System until Horizon Power is satisfied that the non-compliance has been resolved.

Rectification of non-compliance issues shall be at the Proponent's cost.

Horizon Power will generally audit a premises no more than once annually, but more frequent audits may be carried out if a Basic EG connection has previously been non-compliant or Horizon Power has reason to believe a Basic EG connection is non-compliant.

APPENDIX A. DER CONNECTION GUIDELINES DEVIATIONS

The National Distributed Energy Resources Grid Connection Guidelines - Technical Guidelines for Basic EG Connections (ENA DOC 039-2019) require Horizon Power to document each deviation from these guidelines and the reasoning. Table 9 provide a list of the deviations and refers to these guidelines as “Guidelines”.

Table 9: Table of Deviations from National DER Connection Guidelines

Section of ENA Technical Guideline	Description of Deviation	Type of Deviation	Justification
Multiple	Change of nomenclature of Basic Micro EG System to Basic EG connection.	Jurisdictional.	In a non NEM context Micro EG has no meaning for Proponents. In WA micro is associated with type of inverters. Renaming eliminates unnecessary word and potential confusion.
1 Introduction	Scope changes	Consistency with Australian Standard practice.	Changed comply to conform as no ENA guideline is a legal requirement. This usage aligns with Australian Standards practice.
2.3.1 Non-standard basic micro EG connection	Horizon Power does not have a non-standard subcategory for Basic EG connections. All connections are categorised as single-phase or three-phase Basic EG connections.	Jurisdictional.	Region “Australia C” settings apply to all areas of the Horizon Power Electricity System. This document is intended to provide sufficient flexibility for alternative settings and different technical requirements to apply to all types of systems in these categories based on network type and Hosting Capacity.
2.4 Subcategories	Removed sub-categories and included in Section 1.		Simplifies document and flow of information.
4.2 Maximum System Capacity	Increased single-phase definition to be less than or equal to 10 kVA capacity.	Promote improved benefit to Australia’s electricity system.	Increasing capacity acknowledges Horizon Power’s commitment to enable more DER connections.
4.2 Maximum System Capacity	Separate capacity requirements for AC and DC coupled ESS systems	Equity among technology types.	To provide equity between these different system types AC coupled ESS systems require generation limiting to the same capacity as DC coupled systems.

Section of ENA Technical Guideline	Description of Deviation	Type of Deviation	Justification
4.3.1 Export Limits at Connection Point	Export limits at the connection point expressed in kW rather than kVA and balancing requirements separated to site generation limits coupled with Central Protection.	Jurisdictional.	To provide more flexibility for volt-var control functions to control voltage when active power limits are binding. AS/NZS 4777.2 requires three-phase inverters shall inject three-phase balanced currents (Section 2.11) and as a result such installations have limited capacity to control unbalance at the connection point.
4.3.2 Site Generation Limit Downstream of Connection Point	Slight reordering of clauses to incorporate additional export limits and Energy Management requirements. Now 4.3.6.	Jurisdictional	Required to introduce additional requirements at appropriate places in the document.
4.7.2 Central Protection	Where required, phase balance protection is set to greater than 12.5 amps (3 kVA at 240 V) between phases instead of 21.7 amps (5 kVA at 230 V) as specified in AS/NZS 4777.1	Jurisdictional	N/A
4.11 Communications Systems	Horizon Power mandates all Basic EG connection have Consumer facilities necessary to interface to its Distributed Energy Resource Management System (DERMS).	Promote improved benefit to Australia's electricity system.	This option is provided to the Proponent to enable a connection in circumstances where Horizon Power cannot otherwise connect due to a threat to power system security, safety, power quality or damage to equipment.
Appendix Model Standing Offer	Note required.		Horizon Power does not have an MSO requirement.
Multiple	Inclusion of ESS requirements throughout multiple sections		Horizon Power considers ESS systems as a type or part of a Basic EG connection

APPENDIX B. CONNECTION ARRANGEMENT REQUIREMENTS

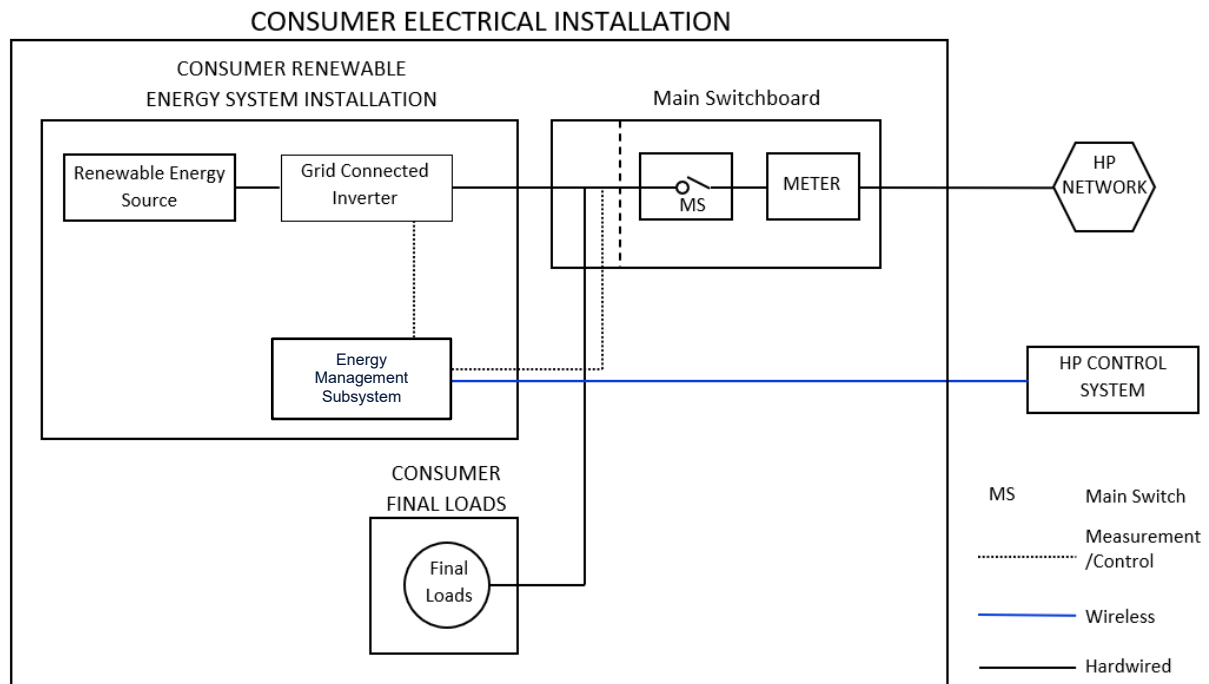
A system diagram illustrates the functional relationships between key subsystems using solid lines. The lines do not represent wiring, rather energy flows between subsystems. Details such as intermediary protection devices, chargers, internal device connections, switches and links are not displayed on the provided system diagrams. The Proponent's Electrical Installation shall be in accordance System Diagram E (Basic EG connection with **communications**) shown in Figure 1.³ Note that Energy Management is required in all circumstances.

Common elements to the system diagrams include, but are not limited to:

1. A single connection point between the Proponent's Electrical Installation and Horizon Power's Electricity System.
2. Splitting of the Proponent's Electrical Installation into the following elements:
 - a) EG
 - b) Proponent Final Loads
 - c) One or more switchboards
 - d) Tariff Meter and sub meters
3. The EG may include, but is not limited to the following devices:
 - a) Renewable Energy Sources (e.g. photovoltaic cells, wind turbine)
 - b) Grid Connected Inverter
 - c) Other Inverters (if required)
 - d) Chargers
 - e) Grid Protection Devices
 - f) Energy Storage Devices (e.g. battery bank)
 - g) Feed-in Management Devices
 - h) Associated control, monitoring, protection and auxiliary equipment (e.g. gateway devices)
4. Final Proponent Loads
 - a) Final Proponent Loads requiring energy
 - b) Associated control, monitoring, protection and auxiliary equipment

³ Note that System Diagrams B, C and D are not applicable and have been removed from this document.

System Diagram E: Basic EG Connections with Communications



NOTE: Indicative layout only. To be read in conjunction with AS/NZS 3000, AS/NZS 4777.1 and WASIR

Figure 1: System Diagram E – Basic EG Connections with Communications

Key elements of System Diagram E are:

1. Use of Communications (DERMS, refer Section 4.3.4).
2. The energy storage device is not a mandatory requirement subject to the requirements in Section 4.3.4. It may be added by the Proponent as long as the export limit requirements in Section 4.3.1 and any other relevant technical requirements are met.
3. No direct connection is permitted between the Proponent's EG Installation and Proponent Final Loads. Connection shall be made via the switchboard.

APPENDIX C. STATIC DATA AND INFORMATION

This appendix includes the static data and information that is required to be provided by the Proponent to Horizon Power as part of a connection application. The minimum information required includes:

1. Basic EG connection or Off Grid application
2. NMI meter numbers (10 digit)
3. DER Devices
 - a) Fuel source – primary (renewable/biomass/waste; fossil; hydro; geothermal; solar; wave; wind; tidal; storage)
 - b) Fuel source – descriptor
 - c) Make, model and manufacturer
 - d) Maximum capacity (kW or MW)
 - e) Storage capacity (kWh/MWh of available storage)
 - f) Installer
 - g) Whether the device is remotely controllable (Y/N)
 - h) Compliance with Australian Standards
4. Inverter
 - a) Make, model and manufacturer
 - b) Confirmation that the region “Australia C” setting has been applied
 - c) Confirmation that the settings detailed in Appendix E have been applied. Any departures shall be advised including details of any changes
 - d) For inverters connecting ESS, confirmation that the Operating Envelope requirements have been met (refer Section 4.3.5)
 - e) Nameplate rating (kVA) and maximum active power capability (kW)
 - f) Date of installation
 - g) Confirmation of Compliance with Australian Standards
5. Main switch rating
6. Changeover switch – type and settings, where relevant.
7. Central Protection - Advise if Central Protection is required to comply with the technical requirements.

Horizon Power will retain this information along with post commissioning and testing information provided to it in accordance with Section 6.3.

APPENDIX D. LIST OF AMENDMENTS TO PREVIOUS VERSION

Table 10 documents amendments made to this document since the previous version. The table is provided as an overview only and is not an exhaustive list of all changes made to this document.

Table 10: Table of Amendments since the previous version

Section	Amendment(s)
1.4 Proponent Obligations	Included the obligation for Proponents to ensure Operating Envelopes requirements are met for Basic EG connections with ESS.
1.7 Modifications or Upgrades to Existing Basic EG Connections	Updated requirements for existing Basic EG connections to comply with Energy Management requirements, AS4777.2 Region C settings and other requirements of Table 6 including Maximum Aggregate System Capacity, Site Generation Limits, Operational Envelopes, Export Limits and Phase Balance requirements when an additional Basic EG connection is being added.
2.1 Definitions	Two new terms have been defined: • Coordination • Operating Envelope
4.2 Maximum System Capacity	Updated maximum system sizing. Updated Table 6 to include technical requirements for Operating Envelopes, Updated maximum system sizing and Site Generation Limits.
4.3.4 Energy Management	Main body text shifted down to sub-section 4.3.4.1 titled “General”.
4.3.5 Energy Management Requirements for Energy Storage Systems	Changed to sub-section 4.3.4.2 and retitled to “Energy Storage Systems”. The requirements for connection of ESS has been consolidated, and are now identical for DC coupled and AC coupled inverters connecting ESS. Updated to include guidance on the process for adding new inverters to the compatible inverter list.
4.3.5 Operating Envelopes for Energy Storage Systems	New section. Defines the Operating Envelope requirements for Basic EG connections with ESS.
4.3.6 Site Generation Limits	Site Generation Limits added.
4.3.8 Charging of ESS from the Electricity System	Significant changes made to simplify this section and update requirements for charging of ESS from the Electricity System.
4.4.2 Energy Storage System (ESS)	Updated to note that Grid Connected ESS must adhere to Operating Envelope requirements.

4.5 Network Connection and Isolation	Noted that in accordance with Section 6.1 of the WAER, the connection service and service apparatus must comply with the WAER and WASIR at the time of installation. Clarification of the requirements for the installation of a circuit breaker as a main switch. Includes clarity on circuit breaker ratings and requirements, and on consideration of connection service capacity in designing systems.
4.6 Earthing	Updated earthing standard reference for energy storage systems to AS5139.
6.3 Information to be provided to Horizon Power	Updated to include a requirement for evidence to be provided to Horizon Power after commissioning, which confirms the installed ESS inverter has been configured to meet the requirements of Operating Envelopes for Energy Storage Systems.
7 Operations and Maintenance	Amended point #4 to explicitly include the Proponent's obligation to ensure Operating Envelope settings are secured against inadvertent or unauthorised change.
Appendix C. Static Data and Information	Added a requirement under point #4 for the provided information to include confirmation that the Operating Envelopes requirements for inverters connecting ESS have been met.
Appendix D. List of amendments to previous version	Updated with latest amendments to the document.
Appendix F. Energy Management	Updated to provide guidance on connection requirements for installations with two inverters, and more than two inverters.
Schedule 1. Proponent Compliance Checklist (NOT MANDATORY)	Updated proponent compliance checklist to include a compliance check of Operating Envelopes. This checklist remains optional and is not a mandatory deliverable, this is intended to assist Installers with quality control.

APPENDIX E. SUMMARY OF INVERTER SETTINGS

Table 11 summarises the settings required for IES connected to Horizon Power’s Electricity System. The settings are in accordance with AS/NZS 4777.2.

When configuring the IES the Proponent shall set the region to “Australia C”.

Table 11: Summary of Required Inverter Settings

AS/NZS 4777.2 Clause	Description	AS/NZS 4777.2 Default setting	Horizon Power required settings
Various	Region	NA	Region “ Australia C ” shall be selected.
3.2	Inverter demand response modes	DRM 0 Disconnect - required. DRM 1 to DRM 8 - optional.	DRM 0 shall be enabled . DRM 1 to DRM 8 shall be disabled .
3.3.2.2	Volt-watt response mode	Default - enabled	Volt-watt response shall be enabled and Australia C settings apply in accordance with Table 3.8 of AS/NZS 4777.2.
3.3.2.3	Volt-var response mode	Default - enabled	Volt-var response shall be enabled and Australia C settings apply in accordance with Table 3.7 of AS/NZS 4777.2.
3.3.2.4	Voltage balance mode	Default - disabled	Voltage balance mode shall be disabled
3.3.3	Fixed power factor mode and reactive power mode	Default - disabled	Voltage balance mode shall be disabled
3.3.4.2 3.3.4.3.1	Gradient of power rate limit (Ramp Rate) Modes: (a) Soft Ramp Up after connect or reconnect <u>Note:</u> This will be applied to reconnection (i.e. ramp /soft start)	Required.	Required , with ramp limit: W_{Gra+} = 16.67% of rated power per minute (6 min ramp up rate) For multiple mode inverters with energy storage when charging W_{Gra-} = 8.33% of rated power per minute (12 min ramp down rate)
4.3	Active anti-islanding protection	Required.	Test method to IEC 62116 is required
4.4	Voltage and frequency limits (passive anti-islanding protection)	Required – Australia C	Required – Australia C settings apply in accordance with Table 4.2 of AS/NZS 4777.2.
4.5.2	Sustained operation for voltage variations	Required.	Required – Australia C settings apply.

AS/NZS 4777.2 Clause	Description	AS/NZS 4777.2 Default setting	Horizon Power required settings
4.5.3.1	Sustained operation for frequency variations – Response to frequency variations and hysteresis	Required.	Required – Australia C settings apply in accordance with Table 4.5 and 4.7 of AS/NZS 4777.2.
4.6	Disconnection by external signal.	Required.	Required – Implemented as directed by Horizon Power for individual connections.
4.7	Connection and reconnection procedure	Required.	Required. The upper connect and reconnect frequency for Horizon Power shall be set to 50.5Hz in accordance with Australia C settings.

APPENDIX F. ENERGY MANAGEMENT

All Basic EG connections shall provide the necessary facilities for Energy Management at the time of connection. This requires the Proponent to provide an enclosure which houses a 240 V AC general purpose outlet and sufficient additional room for all DERMS related communication facilities, including a Secure Gateway Device (SGD).

More detail on the SGD, enclosure, GPO requirements and connection of the SGD are provided below.

The Proponent shall allow Horizon Power to remotely monitor and control the Basic EG connection in accordance with the requirements outlined in this document.

What is SGD?

SGD stands for 'Secure Gateway Device'. It is a requirement to install a SGD for all Basic EG connections. The SGD acts as a gateway device between Horizon Power's DERMS and a Consumer's Basic EG connection. The SGD polls the DERMS for operational limits to ensure the Electricity System remains balanced and secure. Where operational limits are necessary the SGD issues commands to the Basic EG connection accordingly.

The SGD is provisioned and supplied by Horizon Power. The SGD will remain Horizon Power's property over the lifetime of the asset.

The Proponent shall install the SGD and cooperate with Horizon Power to test and commission the SGD.

The Proponent shall also provide Horizon Power with remote access permission to connect to the inverter via internet.

The SGD is a device dedicated to communications between Horizon Power and the Basic EG connection. It shall not be used for any other purpose.

Horizon Power's chosen SGD is supplied by SwitchDin. Key technical specifications of the SGD are available at www.horizonpower.com.au/contractors-installers/connect-solar-battery-ev/.

Figure 2 and Figure 3 shows the Horizon Power SGD and overview of ports. Figure 4 shows an overview of a typical Secure Gateway Device configuration.



Figure 2: Horizon Power's SGD hardware and port overview 1



Figure 3: Horizon Power's SGD hardware and port overview 2

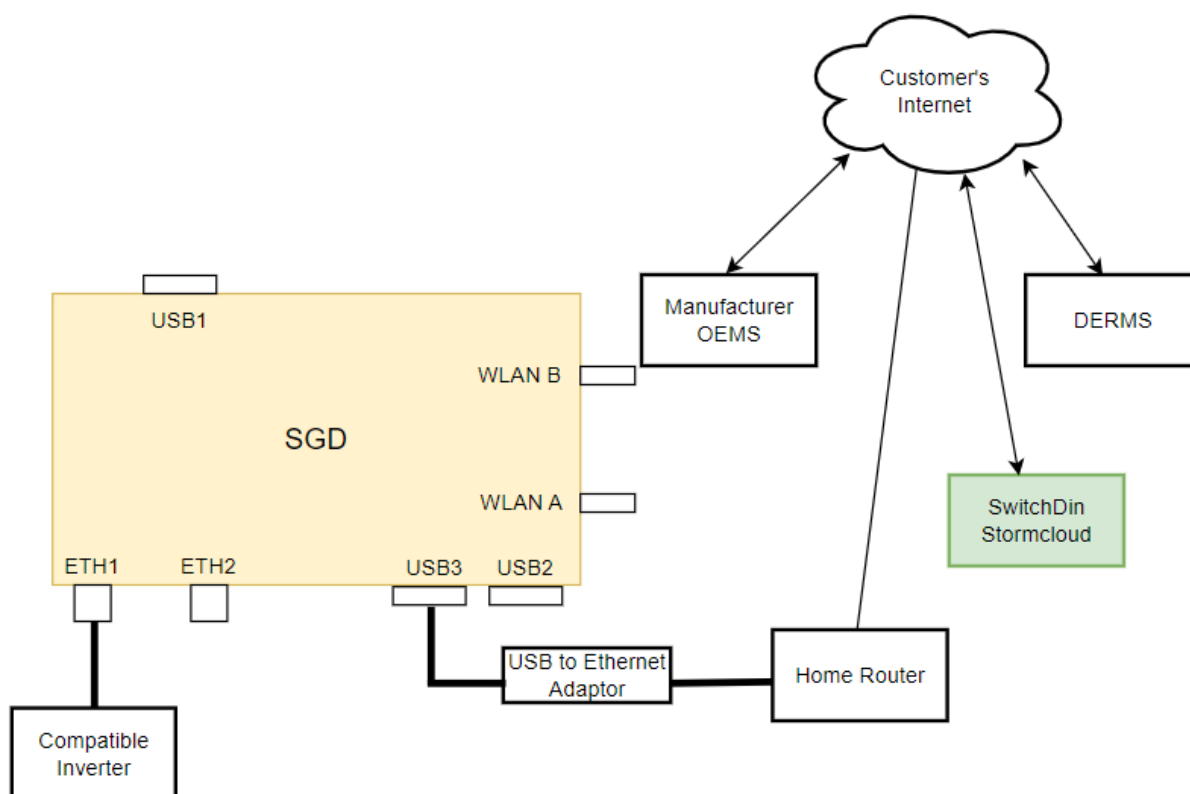


Figure 4: Overview of typical Secure Gateway Device Network Connections

SGD Enclosure

The Proponent shall install a communications enclosure to house the GPO and Secure Gateway Device (SGD) to facilitate communications between Horizon Power and the Basic EG connection.

The enclosure shall comply with the following requirements:

- Approximate minimum dimensions of (W) 300 mm x (H) 200 mm x (D) 150 mm, sufficient to house the SGD, GPO and powerpack supply to the SGD. There shall be at least 30 mm spacing on all sides (and front) of the equipment installed within the enclosure.
- The enclosure shall allow for the use of a DIN rail for connection of the SGD and surface mounting of the GPO.

- IP rated to suit local conditions to adequately protect against weather and dust particles, suitably UV rated and non-transparent.
- Mounting of the enclosure shall be:
 - within 1000 mm of the inverter;
 - a minimum height of 1500 mm from the finished ground or floor level and maximum height of 2100 mm from the finished ground or floor level;
 - easily accessible, with a 750 mm x 750 mm ground level clearance around the SGD enclosure (a 750 mm x 750 mm cleared area at ground level below the SGD enclosure);
 - out of direct sunlight; and
 - not mounted above the inverter.
- The enclosure shall be screw sealed or hinged lockable.
- The enclosure shall be labelled 'Inverter Communications'.
- The enclosure shall permit cable entry from the bottom of the enclosure.
- The enclosure provided shall be in accordance with AS/NZS 3000 and must be able to be accessible to non-electrical workers for the purposes of installation and ongoing maintenance.

In rare circumstances, Horizon Power may require provision for an external antenna to be installed with the SGD enclosure. In these circumstances Horizon Power will notify proponents during the application assessment and before final approval of the Basic EG connection.

Proponents connecting two inverters shall connect both inverters to the SGD.

Proponents connecting more than two inverters should contact renewables@horizonpower.com.au for connection requirements.

General Purpose Outlet (GPO) with External Weatherproof Switch

The Proponent shall install a 240V general purpose outlet (GPO) and an external weatherproof isolator switch to supply power to the SGD via the supplied SGD power supply. The GPO and external weatherproof isolator switch shall comply with the following requirements:

- The GPO shall be installed inside the SGD enclosure (refer to section on SGD Enclosure above) which is adjacent to the Basic EG connection and switched from outside the SGD enclosure via a weatherproof isolation switch. The GPO shall be surface mounted inside the enclosure.
- The GPO shall be rated at 10A (minimum) and supplied from a shared or dedicated circuit from the Consumer's distribution board.
- The external weatherproof isolator switch shall be:
 - Wired in series with the GPO and meeting relevant wiring standards;
 - Mounted external to the SGD enclosure and within 500mm of the SGD enclosure;
 - A 240V, 2-pole switch rated at 10A (minimum);
 - Weatherproof with IP66 rating; and
 - Labelled 'SGD Power'.

Figure 5 provides an example installation of a SGD enclosure with the required isolators.

Figure 6 provides an internal view of an approved installation of the GPO, SGD and connections.



Figure 5: Example SGD installation



Figure 6: Example SGD installation open

Figure 7 provides an indicative diagram for the SGD enclosure:

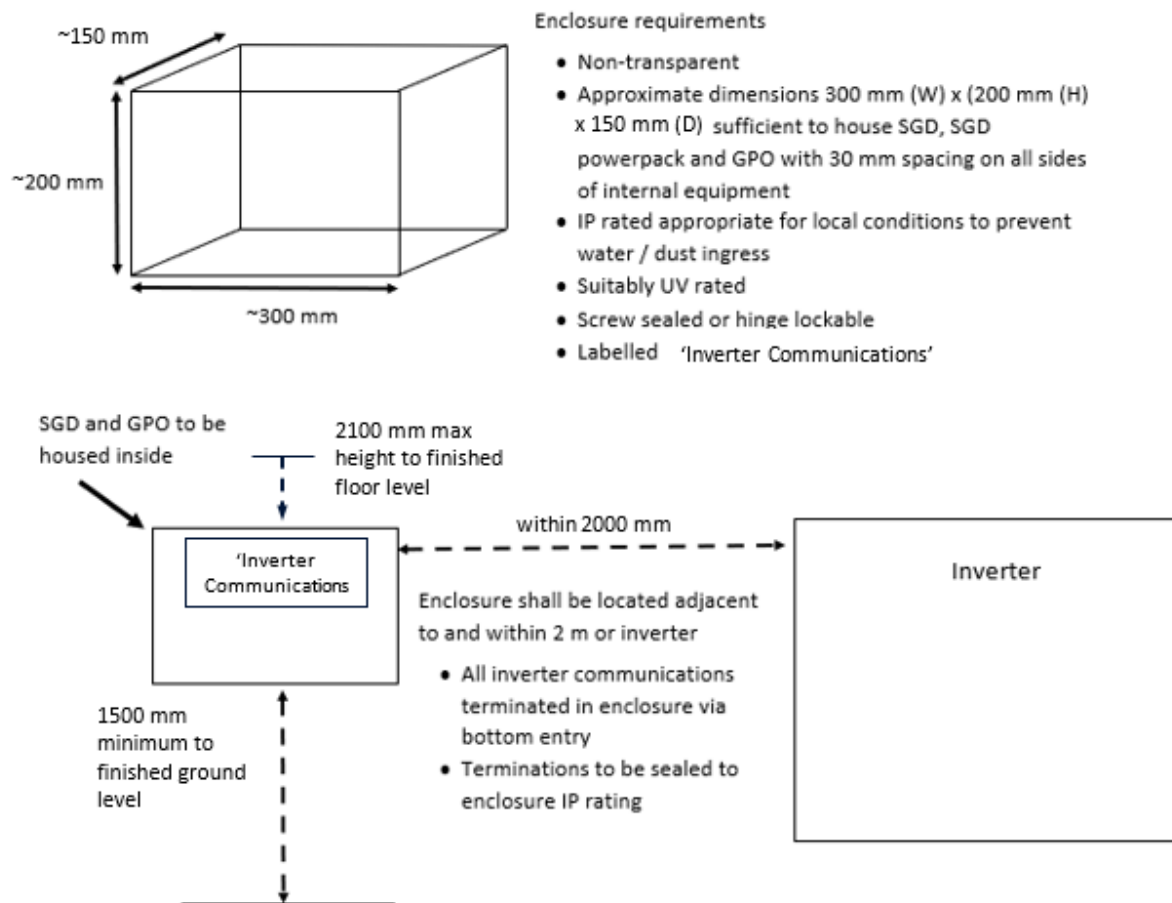


Figure 7: SGD Enclosure Installation Diagram (Indicative)

Figure 8 provides an overview of the SGD power and network connections:

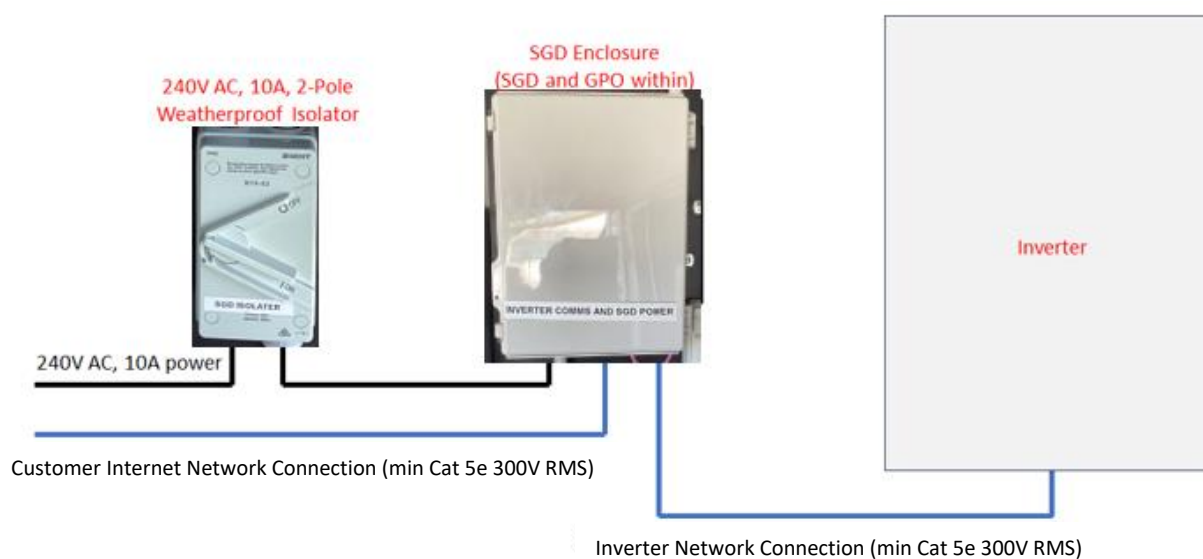


Figure 8: SGD Power and Network Connections (Indicative)

Internet Connection

All Basic EG connections shall have a hard-wired active internet connection to the SGD at all times. The SGD shall also be connected via a hard-wired ethernet connection to the inverter. In addition to providing a connection to Horizon Power's DER Management System, the ethernet connection shall also connect the inverter to the internet for the purposes of remote management of the inverter via the inverter manufacturers portal.

Horizon Power will accept alternative approaches to achieving the hard-wired internet connection (e.g. LAN connection direct to home router, power line carrier devices, WI-FI range extenders) but the final connection to the SGD must be a hard-wired minimum Cat 5e cable with internet available. The ethernet cable is to have an insulation rating that meets a minimum of 300V RMS and is marked as such from the manufacturer.

In circumstances where an inverter does not have a hard-wired ethernet port (e.g. with a serial connection) the internet connection to the SGD must be hard-wired, however a wireless connection to the inverter is also required for the purposes of connection to the inverter manufacturers portal.

The Proponent shall provide Horizon Power with remote access permission to connect to the inverter via internet.

Compatible Inverters

The Proponent shall select inverters which are compatible with the SGD. The list of compatible inverters is subject to change from time to time.

For the latest list of compatible inverters or enquiries in relation to compatible inverters please refer to Horizon Power's website at www.horizonpower.com.au/contractors-installers/connect-solar-battery-ev/ or contact renewables@horizonpower.com.au.

SGD installation and commissioning process

The following outlines the steps of the installation and commissioning process. Detailed instructions for the commissioning and registration of the SGD are available at www.horizonpower.com.au/contractors-installers/connect-solar-battery-ev/ or www.SwitchDin.com.

Step 1 - Horizon Power to issue SGD

Horizon Power will provision and supply the SGD according to the Proponents inverter model, which must be compatible with the SGD.

Step 2 - SGD Installation

The Installer shall complete the SwitchDin SGD training course and be accredited with SwitchDin for installation of the SGD.

The Installer shall install the SGD in the SGD enclosure and ensure the SGD is powered by the GPO inside the enclosure.

All cable entries into the enclosure shall be from the bottom of the enclosure only. The cable entry points shall be sealed with appropriate glands. The use of an adhesive to seal the cable entry points is prohibited.

All communications from the inverter(s) shall be terminated inside the enclosure. The primary inverter Ethernet connection shall be connected to a terminated socket inside the enclosure.

Where the Installer installs multiple inverters, all communications from each inverter shall be brought back and terminated within a single enclosure, or multiple enclosures if the inverters are more than 2m apart.

Step 3 - SGD test and commissioning

The Installer shall configure the SGD and DER via SwitchDin's support application.

Detailed instructions for the commissioning and registration of the SGD are available at www.horizonpower.com.au/contractors-installers/connect-solar-battery-ev/ or www.SwitchDin.com.

Operations and Maintenance Requirements

The following operational and maintenance requirements shall apply to the SGD:

- SGD shall remain installed at the premise as part of the Basic EG connection.
- The Proponent shall not tamper with the SGD including disconnection or de-powering the device.
- The Proponent shall allow Horizon Power to access the premise, with reasonable notice, to inspect, maintain, troubleshoot, or replace the SGD.

APPENDIX G. SCHEDULES

The following Schedules shall be submitted to Horizon Power by the Proponent as part of their application:

1. Schedule 1 Proponent Compliance Checklist *(Not Mandatory)*
2. Schedule 2 System Diagram Example
3. Schedule 3 Circuit Diagram Example
4. Schedule 4 Cable Data Example
5. Schedule 5 System Parameters Template *(Not Mandatory)*

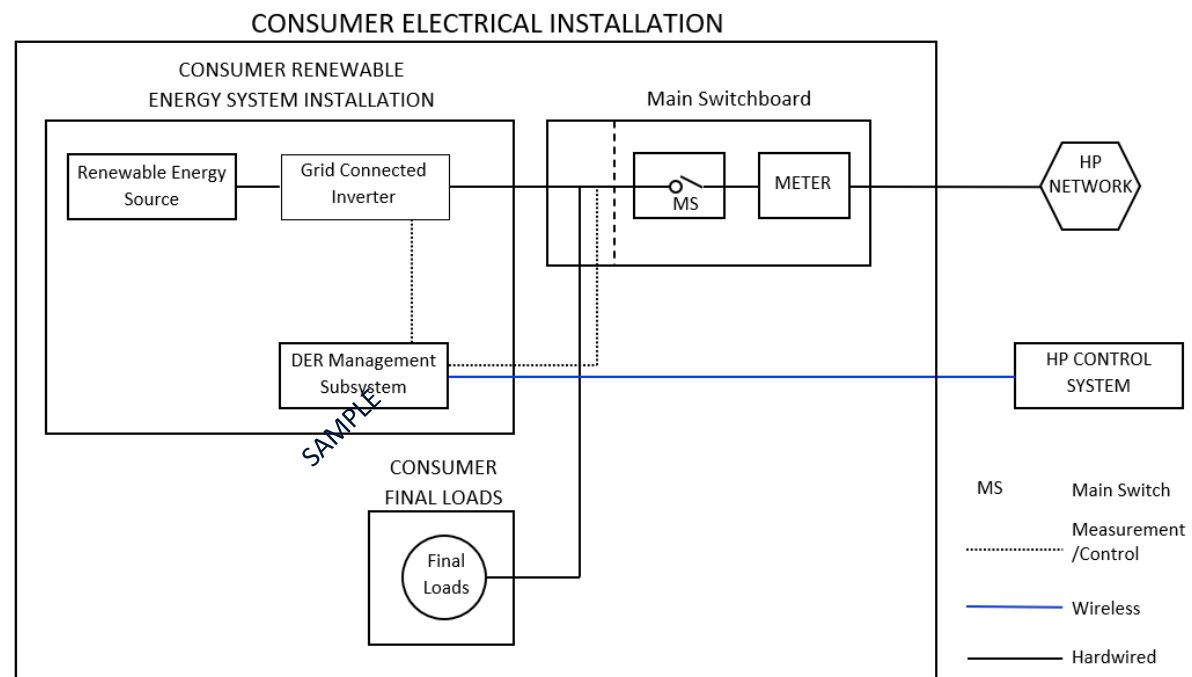
SCHEDULE 1. PROPONENT COMPLIANCE CHECKLIST (NOT MANDATORY⁴)

Description	Clause	Complies (Yes / No)	Comments
Proponent Obligations	1.4		
Labelling and Signage	4.1		
Maximum System Capacity	4.2		
Export Limit	4.3.1		
Main Switch Compatibility	4.3.3		
Phase Balancing Requirements	4.3.7		
Energy Management	4.3.4		
Operating Envelopes requirements (IES with ESS only)	4.3.5		
Region "Australia C" configuration	Multiple		
Inverter Energy System	4.4		
Network Connection and Isolation	4.5		
Changeover switches	4.5.2		
Earthing	4.6		
Protection Requirement	4.7		
Horizon Power Meter at Property	4.9		
Communications Systems	4.11		
Data and Information	4.12		
Cybersecurity	4.13		
Testing and commissioning	6		
Information to be provided to Horizon Power	6.3		
Operations and Maintenance	7		
Schedule 1			
Schedule 2			
Schedule 3			
Schedule 4			
Schedule 5			

⁴ Schedule 1 – Proponent Compliance checklist is no longer a mandatory schedule to be submitted.

SCHEDULE 2. SYSTEM DIAGRAM

*****SAMPLE ONLY*****

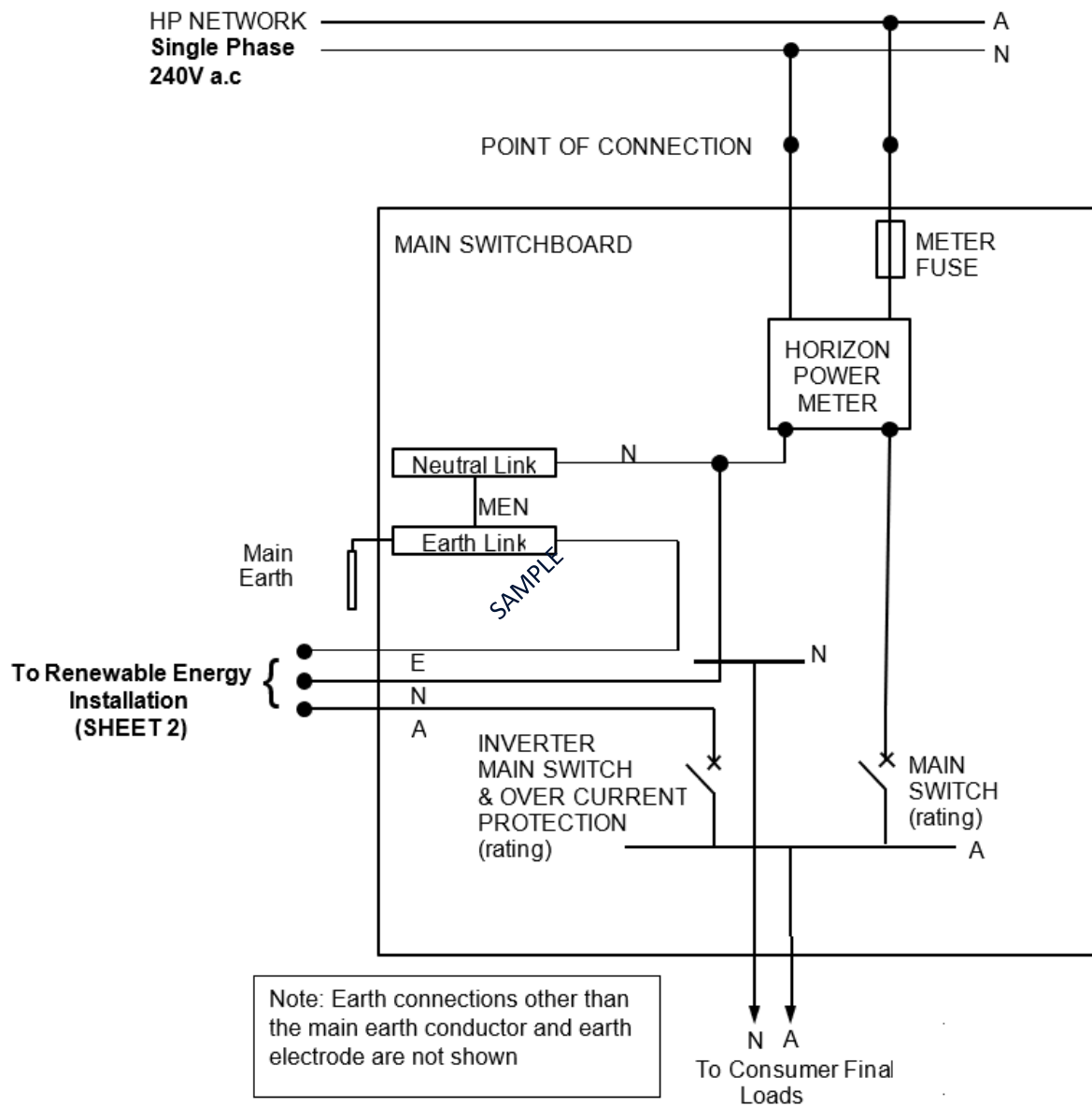


NOTE: Indicative layout only. To be read in conjunction with AS/NZS 3000, AS/NZS 4777.1 and WASIR

SCHEDULE 3. CIRCUIT DIAGRAM

*****SAMPLE ONLY*****

SHEET 1



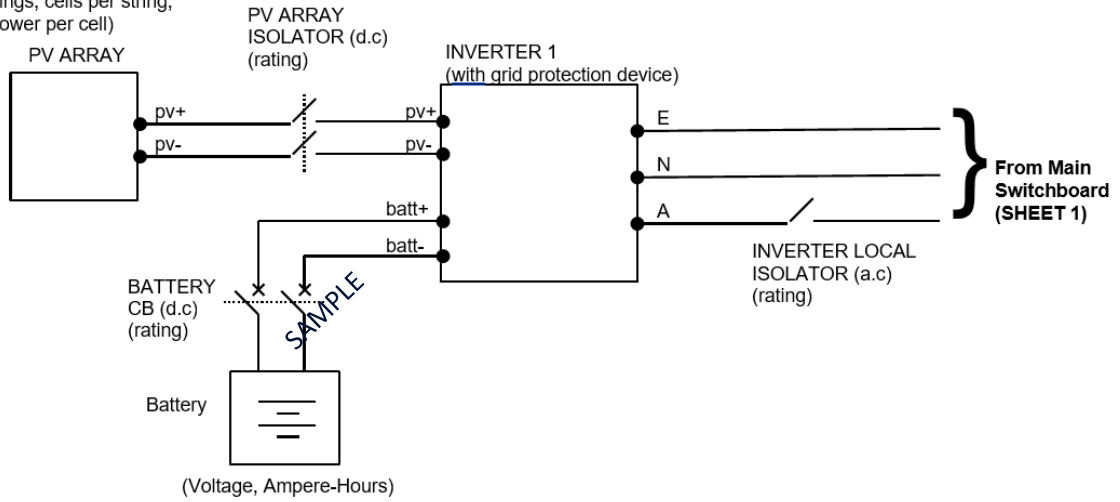
Note: For indicative purposes only - the Proponent shall rely on the other requirements of this document together with AS/NZS 4777.1, AS/NZS 3000, AS/NZS 5033 (PV only) and other applicable documents to connect the internal components of the Basic EG connection correctly.

(Schedule 3 continued)

*****SAMPLE ONLY*****

SHEET 2

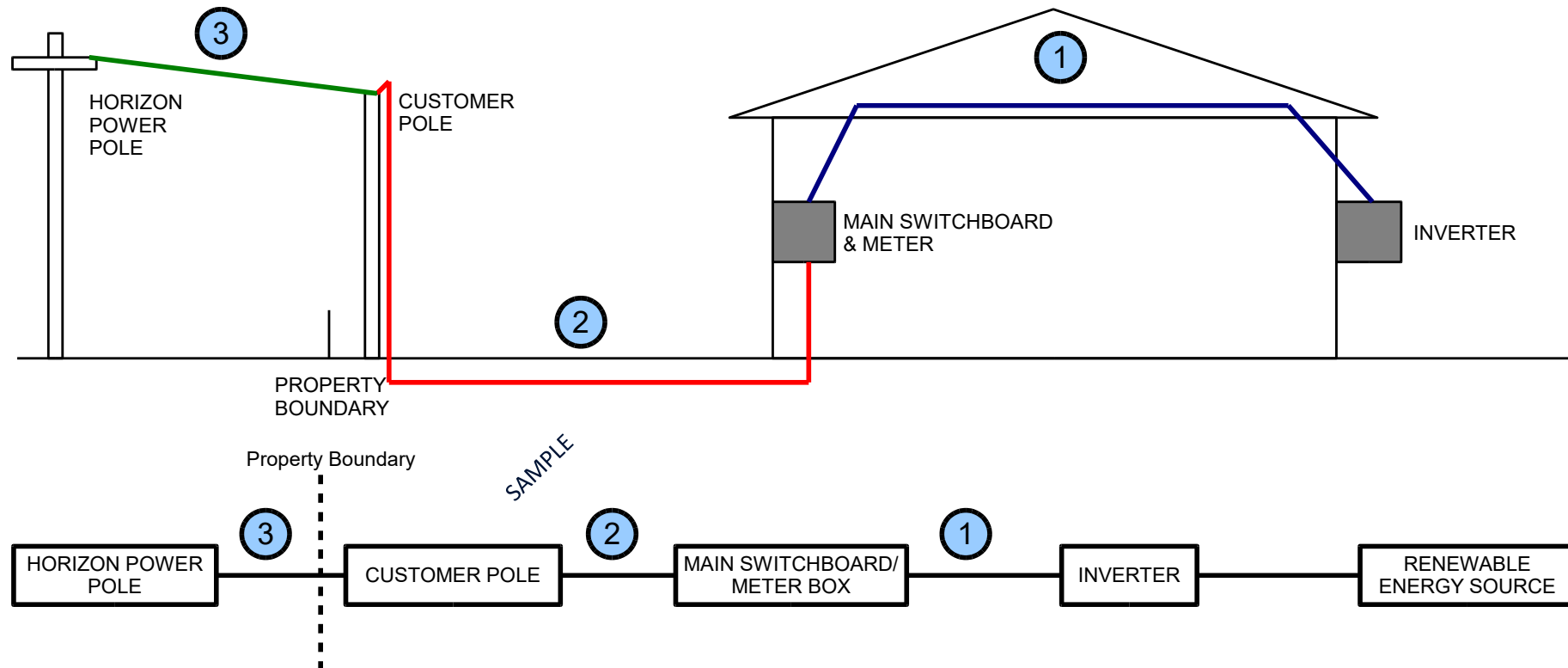
(no of strings, cells per string,
Power per cell)



SCHEDULE 4. CABLE DATA

*****SAMPLE ONLY*****

Concept Drawings (Sample):



(Schedule 4 continued)

*****NOTE: Include cable information for all power cables between Inverter and Point of Supply*****

Concept Drawing Item	Cable Length	Cable Type	Installation type
1	10m	6mm ² , 2 Core + Earth, PVC/PVC, Copper	In Roof Space
2	20m	6mm ² , 2 Core, PVC/PVC, Copper	Underground
3	30m	6mm ² , 2 Core Bare, Copper	Overhead

SCHEDULE 5. SYSTEM PARAMETERS (*NOT MANDATORY*⁵)

Total site export limit to Horizon Power Grid		kW
Region "Australia C" configuration		Yes or N/A ?
Document departures from Region "Australia C" settings where relevant (refer to Appendix E)		
Notes		

⁵ Schedule 5 – System Parameters is no longer a mandatory schedule to be submitted.