

REQUIREMENTS FOR ENERGY SYSTEMS CONNECTED TO THE LV NETWORK VIA INVERTERS

HORIZON POWER

MAXIMUM GENERATION CAPACITY

- **10kVA Single Phase**
- **30kVA Three Phase**

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TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	Horizon Power / Customer Interface	1
1.2	Generation Capacity	1
1.3	Applicable Equipment	1
1.4	Metering Installation	2
2	SPECIFIC TECHNICAL CONDITIONS	2
2.1	Safety	2
2.1.1	Labelling of Switches	2
2.1.2	Security of Operational Settings	2
2.2	Circuit Arrangements	2
2.2.1	Schematic Diagrams	2
2.2.2	Required switches	2
2.2.3	Customer Main Switch (CMS)	4
2.2.4	Customer Paralleling Switch (CPS)	4
2.2.5	Generator Main Switch (GMS)	4
3	PROTECTION	4
3.1.1	Islanding Protection	4
3.1.2	Synchronising	4
3.1.3	Method of Resetting and Reconnection with Network	4
3.1.4	Over Current Protection	4
3.1.5	Voltage Limits	5
3.1.6	Frequency Limits	5
4	OPERATING PROCEDURES	5
5	CERTIFICATIONS AND APPROVALS	6
5.1	Application Procedure for a Proposed System	6
5.2.1	Submitting a Proposal	6
5.2.2	Horizon Power Assessment of the Proposal	6
5.2	Commissioning and Testing	6
6	GLOSSARY OF TERMS	7
7	APPENDIX A – SIGNAGE GUIDE	9
7.1	Main Switchboard and Distribution Board (s) Upstream of Distribution Board Where the Inverter Energy System Is Connected.	9
7.2	Main Switchboard Or Distribution Board Where The Inverter Energy System Is Connected.	9
7.3	Normal Supply Main Switch	9
7.4	Solar Generator Main Isolator	9
8	APPENDIX B CERTIFICATION OF COMMISSIONING	11

1 INTRODUCTION

This document outlines the requirements for Inverter Energy Systems connected to the Horizon Power low voltage network. (10kVA single phase and 30kVA three phase).

1.1 Horizon Power / Customer Interface

To expedite the approval process, it is recommended that the applicant appoint one person to carry out formal negotiations with Horizon Power on his or her behalf. The appointee's name and phone number (plus e-mail and fax number, if available) should be given to Horizon Power in writing. Normally, Horizon Power will nominate one representative. The appointee shall direct all proposals and queries to the Horizon Power representative.

1.2 Generation Capacity

The nominal network voltages and maximum generation capacities for which these requirements are valid are as follows:

<u>Nominal Voltage</u>	<u>Maximum Capacity</u>
240V single phase	10 kVA
415V three phase	30 kVA

To simplify site regulation, installation, maintenance and operational requirements, it is assumed that the full rated output power of the inverter system can be exported to the Network.

1.3 Applicable Equipment

Inverter systems must satisfy the requirements as published and revised by the ESAA: "Guidelines for grid connection of energy systems via inverters". A type-test report or type-test certificate from an independent and recognised certification body must be supplied to Horizon Power showing compliance with the ESAA document: "The Australian Guidelines for grid connection of energy systems via inverters".

Should any parameter of the equipment as installed and contracted be changed, Horizon Power must be notified for acceptance. Should the system capacity be expanded, for example with an additional inverter installed, Horizon Power must also be informed. In addition the Inverter Make, Inverter Model and the schematic drawing of the installation should be supplied to Horizon Power. Subsequently Horizon Power will determine whether a new application is required.

1.4 Metering Installation

An additional meter is required for export power metering. The Customer will meet the cost of installing an additional meter box or the relocation of fuses/circuit breakers within the existing meter box to accommodate two meters.

2 SPECIFIC TECHNICAL REQUIREMENTS

2.1 Safety

Installations must comply with the relevant Australian Standards and all statutory requirements including the WA Electrical Requirements.

2.1.1 Labelling of Switches

The customer's installation must display warning labels. These labels must be maintained in good order. Appendix A outlines a minimum set of labels to be installed. If the Generator is connected to a sub board all up-stream switches and switchboards must also be labeled.

2.1.2 Security of Operational Settings

Where the equipment has operational settings to be applied via a keypad or switches, adequate security must be employed to prevent any tampering or inadvertent/unauthorised changing of these settings. A suitable lock or password system shall be used. Any proposed setting changes must be approved by Horizon Power prior to implementation.

2.2 Circuit Arrangements

2.2.1 Schematic Diagrams

A single sided schematic-wiring diagram of the installation showing all equipment and switches should be left on site adjacent the inverter system.

2.2.2 Required switches

All switches shall be suitably rated for the work they are called upon to do. The diagram of Figure 1 outlines an example circuit for connecting Inverter energy systems to the network. The modes of operation are detailed in Table 1.

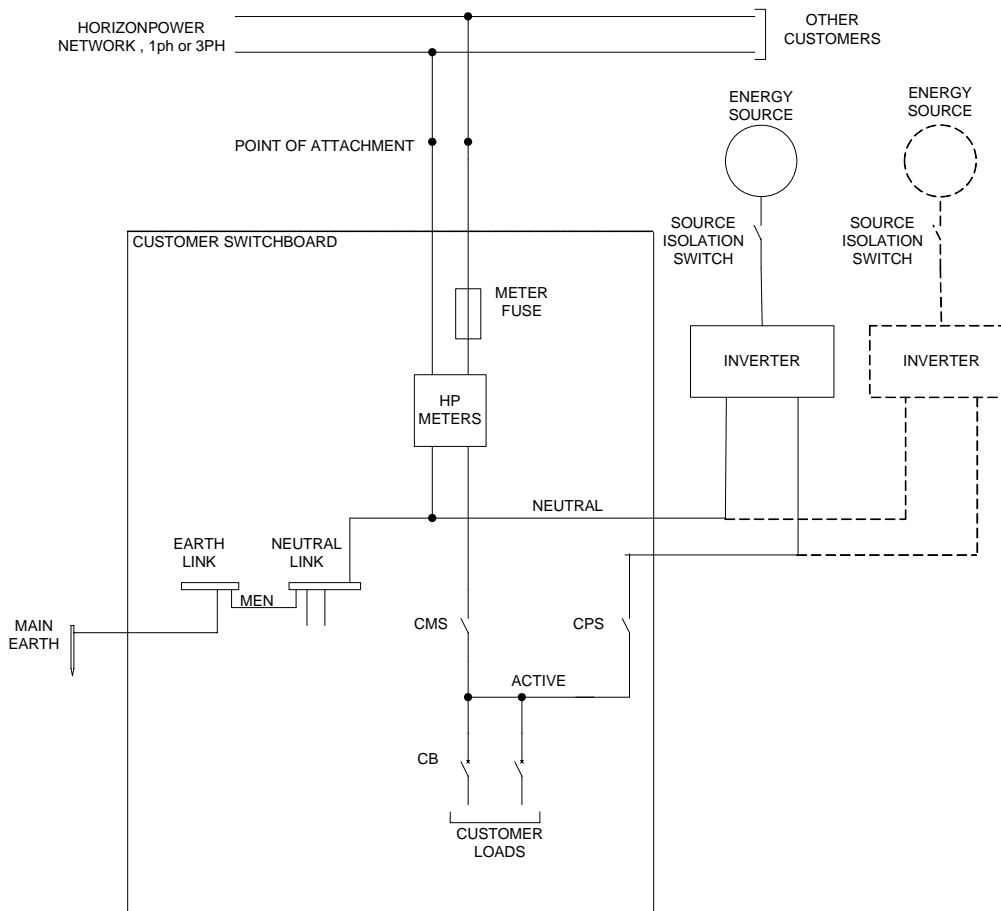


Figure 1. Schematic Diagram for the Network Connection of an Inverter System

Table 1. Inverter Energy System Connection Modes

Customer Main Switch	Customer Paralleling Switch	Operating Mode
OFF	OFF	All power off
OFF	ON	Supply to the consumer from the Inverter Only
ON	OFF	Inverter Isolated from the Horizon Power Network
ON	ON	Inverter Connected to the Grid

2.2.3 Customer Main Switch (CMS)

A suitably rated Customer Main Switch is required to isolate the entire installation from the network in accordance with Australian standards.

2.2.4 Customer Paralleling Switch (CPS)

A suitably rated Customer Paralleling Switch is required to isolate and protect the Inverter Energy System as shown in Figure 1. The Customer Paralleling Switch must be lockable in the OFF position.

It is preferable for the private generation source to be connected at the Main Switchboard. If this is not possible due to distance/cost considerations, the nearest sub board should be used, see Section 2.1.1.

2.2.5 Source Isolation Switch

Where required for safety, a Source Isolation Switch will be required to isolate the Energy source as shown in Figure 1. The Source Isolation Switch must be rated for DC operation.

3 PROTECTION

Grid connected inverter systems must satisfy the requirements as published and revised by the ESAA: “Guidelines for grid connection of energy systems via inverters”.

3.1.1 Islanding Protection

The islanding function shall be automatic and must physically remove the Inverter Energy System from the network. The Islanding protection shall detect loss of supply from the network and disconnect the Inverter Energy System from the network within 2 seconds.

3.1.2 Synchronising

Connection to the LV network must be automated and synchronised at all times. The protective apparatus shall confirm that the supply voltage and frequency is within limits for no less than 1-minute prior to synchronisation.

3.1.3 Method of Resetting and Reconnection with Network

Reconnection to the LV network must be automated and synchronised at all times. The protective apparatus shall confirm that the supply voltage and frequency is within limits for no less than 1-minute prior to synchronisation.

3.1.4 Over Current Protection

Over current protection shall be provided in accordance with the equipment rating.

3.1.5 Voltage Limits

The Inverter voltage limits shall be set according to the ESAA guidelines for grid connected inverters. The Horizon Power low voltage network has voltage ranges as shown in Table 2. The network voltage range is based on 5-minute averages of the RMS value.

Table 2. The Horizon Power Low Voltage Network Voltage Limits

Nominal Voltage	Lower Limit	Upper Limit
240V	226V	254V
415V	390V	440V

3.1.6 Frequency Limits

For the nominal system frequency of 50Hz, the under frequency limit shall be set no lower than 48Hz and the over frequency limit shall be set no higher than 52Hz.

4 OPERATING PROCEDURES

Operational and safety aspects of electrical installations/supply are detailed in the WA Electrical Requirements¹. The installation must comply with the relevant Australian standards including the WA Electrical Requirements (WAER) and other requirements of the Office of Energy.

All electrical installation, commissioning and maintenance work shall be carried out by a licensed Electrician/Electrical Contractor wherever required under the “Electricity (Licensing) Regulations”, 1991.

¹ For the latest version of the WAER see-www.energy.wa.gov.au

5 CERTIFICATIONS AND APPROVALS

5.1 Application Procedure for a Proposed System

5.1.1 Submitting a Proposal

The customer should submit a form entitled “Application To Network Connect Energy Systems to the LV Network via Inverters” to Horizon Power with all the required attachments as specified in the application. This application form is available from the Horizon Power Retail Branch.

The application shall address the technical issues and shall also include a combined power, protection and control schematic in accordance with Australian standards for the proposed electrical system. The contents of the Application must be certified by a Chartered Professional Engineer with NPER standing with the Institution of Engineers Australia, **unless proposed system is on the HP Approved Systems list (attached to application form).**

5.1.2 Horizon Power Assessment of the Proposal

Horizon Power will carry out an assessment of the proposed system and network connection. This assessment will include a check of the technical and safety aspects of the proposed system as it relates to the electricity network.

If any network reinforcement work or network studies are required the customer will meet the cost of these and will be provided with an estimate. On completion of the assessment the Customer will be notified of the outcome.

5.2 Commissioning and Testing

Commissioning shall only occur after the installation of metering equipment.

A Certification of Commissioning form is to be completed upon installation of the system. This Certificate will also require the Customer to agree to maintain and operate the system in accordance to the manufacturer’s recommendations. The Certification of Commissioning form is included in Appendix B.

6 GLOSSARY OF TERMS

Approved/ Approval

Approved or Approval means approved or approval by Western Power or the Office of Energy which shall not be unreasonably withheld

Certified

‘Certified’ means the NPER engineer warrants that the system meets these technical requirements.

Customer Main Switch (CMS)

The switch or circuit breaker that serves to connect the Customer’s Facilities to the Horizon Power Network.

Customer Paralleling Switch (CPS)

The circuit breaker between the CMSs and the GMSs used for paralleling.

Engineering Units

Hz	kA	kV	kVA	kVAr	kW
Hertz	kiloamps	kilovolts	kilovoltamperes	kVAreactive	kilowatts

Export

Delivery of electricity from the Facilities to the Horizon Power Network and “Exported” shall be interpreted accordingly.

Facilities

All the Customer’s buildings and enclosures, generating plant, electrical equipment, and all other equipment used to export or import electricity at the site.

Fail Safe

An arrangement whereby the failure of any system component renders the system in a state such that it is least likely to cause injury to personnel or damage to equipment.

Generator Main Switch (GMS)

A circuit breaker that connects each of the Customer’s generators to the Horizon Power Network via the CMS.

Healthy

Each of the three phases is energised and operating within the allowable limits of the nominal busbar voltage.

Import

Delivery of electricity from the Horizon Power Network to the Facilities and “Imported” shall be interpreted accordingly.

Internal Loads

Those loads on the Customer’s side of a Point of Connection.

Islanding

Islanding shall be understood to mean continued generation of power by the Facilities after disconnection from the main portion of the Horizon Power Network. Under such conditions the Facilities may sustain their own Internal Loads and the electrical load of the portion of the Horizon Power Network that remains connected to the Facilities



Inverter

A device that converts DC electrical power into AC electrical power and includes power conditioning functions.

Metering Equipment

The metering equipment installed at the Facilities and owned and maintained by Horizon Power.

Network

The interconnected system of works and undertakings to deliver electricity to Horizon Power's Customers from power stations and transmission and distribution systems.

Parallel

When two or more generators or groups of generators are connected together on an interconnected electricity supply system such that they all contribute power to the loads on the system.

Point of Connection

The point at which electricity is Exported to Horizon Power or Imported from Horizon Power.

Protection

Within this document, the word "Protection" shall be used to describe the concept of detecting, limiting and removing the effects of faults from electrical power systems. It shall also be used to refer to the Apparatus required to achieve this function. The words "Protection Scheme" shall be used to describe a set or collection of Apparatus required to achieve Protection. Where the plural "Protection Schemes" is used, this shall be taken to mean more than one such set or group of Apparatus.

7 APPENDIX A – SIGNAGE GUIDE

This is only a sample of appropriate signage. It is indicative of the type of appropriate signage required at the various locations specified.

Note: Words in *italic* would change to describe the type of generation (e.g. Photovoltaic, induction generator, synchronous generator, alternative, renewable, etc.)

Size specifications are minimum size.

7.1 Main Switchboard and Distribution Board (s) Upstream of Distribution Board Where the Inverter Energy System Is Connected.

Qty: 1
Lettering: 4mm, 8mm “WARNING”
Colour: Red, white letters
Size: **120 * 60 mm**

WARNING
SOLAR GENERATION PLANT
CONNECTED
ISOLATE SOLAR GENERATION
PLANT AT (appropriate distribution board)

7.2 Main Switchboard Or Distribution Board Where The Inverter Energy System Is Connected.

Qty: 1
Lettering: 4mm, 8mm “WARNING”
Colour: Red, white letters
Size: **120 * 60 mm**

WARNING
DUAL SUPPLY
ISOLATE BOTH NORMAL AND SOLAR SUPPLIES
BEFORE WORKING ON THIS SWITCHBOARD

7.3 Normal Supply Main Switch

Qty: 1
Lettering: 5mm
Colour: White, black letters
Size: **75 * 30 mm**

NORMAL SUPPLY MAIN SWITCH

7.4 Solar Generator Main Isolator

Qty: 1
Lettering: Title 5mm, words 4mm
Colour: White, black letters

SOLAR SUPPLY MAIN SWITCH
SOLAR GENERATOR LOCATED IN
(Location of solar generator)

Size: 75 * 30 mm



8 APPENDIX B CERTIFICATION OF COMMISSIONING

Including “Owner’s Declaration”

The system installed is that described in the approved Application for:

Customer’s Name:

Location:

Installer’s Certification

Icertify that the above Facilities have been installed and commissioned in accordance with Horizon Power’s “Requirements for Energy Systems Connected to the LV Network via Inverters”, all relevant standards and statutory requirements; and Good Engineering Practice and are ready for operation. In particular, the following have been verified:

- The approved schematic specified in Schedule C has been checked and accurately reflects the installed electrical system
- All required switches present and operate correctly as per the Approved Schematic
- Signage and Labelling complies with that specified in Schedule C
- Correct installation and fit for purpose of the installation
- Operational settings are secure as per Schedule C
- Operation of Islanding protection that removes the Generator from the Network within 2 seconds
- Reconnection time greater than 1minute after grid reconnection

Notes:

Signature:

Licence Number:

Date:

Owner’s Declaration:

I..... agree to operate and maintain this system in accordance with the manufacturers operating instructions and recommendations and Horizon Power’s “Requirements for Energy Systems Connected to the LV Network via Inverters”.

Signature:

Date:

Please return completed form to:

The Manager

Retail Systems
P.O. Box 79
CLOVERDALE WA 6985