Specification - Standalone Power System (SPS)

Standard Number: HPC-8DJ-12-0001-2022

11/05/2023

HORIZON POWER

Document Control			
Author	**Name:**	Joe Dines	Date: 2023.05.11 11:59:52 +08'00'
	Position:	Project Manager	
Reviewer	**Name:**	Robert Ivory	Robert Ivory Digitally signed by Robert Ivory Date: 2023.05.11 15:59:57 +08'00'
	Position:	Principal Project Engineer	
Endorsed By	**Name:**	Mark Montemayor	Mark Montemayor Digitally signed by Mark Montemayor Date: 2023.06.01 11:12:39 +08'00'
	Position:	Engineering Services Manager	
Approved By *	**Name:**	Victor Cheng	Digitally signed by Victor Cheng Date: 2023.06.01 14:51:52 +08'00'
	Position:	Snr Manager Engineer & Project Services	
Date Created/Last Updated	10 May 2023		
Review Frequency **	3 years		
Next Review Date **	28 February 2025		

** Shall be the Process Owner and is the person assigned authority and responsibility for managing the whole process, end-to-end, which may extend across more than one division and/or functions, to deliver agreed business results.*

*** Frequency period is dependent upon circumstances– maximum is 5 years from last issue, review, or revision whichever is the latest. If left blank, the default shall be 1 year unless otherwise specified.*

Revision Control		
Revision	**Date**	**Description**
4	10/05/2023	Update references and removed ambiguity regarding remote monitoring
3	22/03/2022	Update terminology to align with ESS Standard
2	1/03/2022	Standards and Performance Specification Update
1	14/09/2021	Update to remove MPS and diesel, and to reduce costs
0	16/01/2019	Original Document

STAKEHOLDERS *The following positions shall be consulted if an update or review is required:*	
Project Manager	Manager Asset Services
Manager Engineering and Project Services	Manager Capacity Management Support

Table of Contents

1 SCOPE 5

2 STANDARDS, CODES, REGULATIONS & Definitions 6

2.1 Priority of technical standards 6

2.2 Statutory requirements 6

2.3 Horizon Power standards 7

2.4 Australian and International standards 7

2.5 Mandatory Documents 8

2.6 Definitions and Abbreviations 8

2.6.1 Definitions 8

2.6.2 Abbreviations 9

3 General Requirements 10

4 SPS Operation 10

5 Equipment Requirements 11

5.1 Environmental Conditions 11

5.2 Disposable Strategy 11

5.3 Other Environmental Requirements 11

5.4 Design Life Requirements 11

5.5 Functional Requirements 12

5.6 SPS Fault Performance 12

5.7 Electrical Supply Requirements 13

5.8 Harmonics 13

5.9 Motor Starting 13

6 SPS Components 14

6.1 SPS General Requirements 14

6.2 Equipment Enclosures 14

6.3 Customer Main Switchboard 15

6.4 ESS 15

6.4.1 ESS PCE and ESS Controller 15

6.4.2 Energy Storage Medium 16

6.5 PV PCE 18

6.5.1 Required Attributes 18

6.6 PV Modules, Arrays and Mounting Structures 18
6.6.1 Required attributes – PV Modules 18
6.6.2 Required attributes – PV Array 18
6.6.3 Required attributes – PV Array Mounting and Structure 19
6.7 Alternative Generator 19
6.7.1 Required Attributes 19
6.8 Remote Monitoring and Communication System 20
6.8.1 Required Attributes 21

7 Auxiliary Equipment 22

7.1 Circuit Breakers, Fuses and RCDs 22
7.2 Cabling and Wiring 22
7.2.1 Terminals 22
7.2.2 Aerial Conductors 23
7.2.3 Direct Buried Conductors 23
7.2.4 Conduits 23
7.2.5 Cable Ladder and Trunking 23
7.2.6 Cable Glands 23
7.2.7 Cable Labelling 23
7.2.8 Cable Separation 23
7.2.9 Cable Penetrations 23
7.2.10 Secondary and Control Wiring 23
7.3 Three Position Switch 24
7.4 Consumer Mains Protection Device 24
7.5 Earthing 24
7.6 Signage and Labelling 24

8 Technical Specification Changes and Variations 25

8.1 Horizon Power Initiated Changes 25
8.2 Contractor Initiated Changes 25

9 Appendix A: REVISION INFORMATiON 26

10 Appendix B: Standards 27

1 SCOPE

This Technical Specification (Specification) covers Horizon Power's technical requirements for a stand-alone power system known as a Standalone Power System (SPS).

The SPS may consist of a combination of generating units incorporating engine driven, renewable and storage energy components. SPS are generally used either:

- on the fringe of the grid areas where SPS proves viable when compared to reinvesting in the traditional poles, wires, and transformers network; or
- in remote areas to provide power to a customer's installation which is not in an area serviced by a Horizon Power's distribution network; or
- where there is no cost-effective network access.

The Specification includes the requirements for the SPS equipment. This Specification shall be read in conjunction with the Scope of Work which contains the Contractor's scope for the design, supply, factory acceptance testing (FAT), installation, site acceptance testing (SAT), commissioning and documentation requirements for the SPS.

The SPS shall provide power to the customer from:

- A ground mounted photovoltaic (PV) array and PCE.
- An Energy Storage System (ESS) with PCE; and
- An alternative generator.

2 STANDARDS, CODES, REGULATIONS & DEFINITIONS

2.1 Priority of technical standards

The order of precedence of codes and standards shall be:

- the Laws of Western Australia.
- Australian Standard statutory requirements.
- Horizon Power Standards.
- Australian informative Codes and Standards.
- IEC Codes and Standards.
- ASME/ANSI/NFPA Codes and Standards; and
- Specific UL Codes and Practices for RFI Interference.
- other International Standards and Codes of Practice.

Where conflict exists between any of the statutory regulations, standards, reference documents, and/or the requirements on drawings, data sheets and this Specification, the most stringent requirement must apply.

2.2 Statutory requirements

Relevant Government (local, state, and federal) Laws shall include but will not necessarily be limited to the latest editions of the following:

- *Electricity Act 1945* (WA) and associated regulations, including:
  - Electricity (Licensing) Licensing Regulations 1991 (WA).
  - Electricity (Network Safety) Regulations 2015 (WA); and
  - WA Electrical Requirements 2014.
- Electrical Operators (Powers) Act 1979 (WA)
- Occupational Safety and Health Act 1984 (WA) and associated regulations.
- WA Office of Energy Safety Guidelines.
- *Dangerous Goods Safety Act 2004* (WA) and associated regulations.
- Australian Dangerous Goods (ADG) Code.
- The Storage and Handling of Workplace Dangerous Goods (National Standard).
- Dangerous Goods Safety (Storage and Handling of Non-explosives)

Regulations 2007 (WA).

- *Environmental Protection Act 1986* (WA) and associated regulations.
- Environmental Protection (Noise) Regulations 1997 (WA).
- Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (WA).
- Environmental Protection (Unauthorised Discharges) Regulations 2004 (WA).
- Occupational Safety and Health Regulations 1996 (WA); and
- the *Department* of Mines, Industry Regulation and Safety approved codes of practice and the WA Work Safe Commission for Occupational Safety and Health Codes of Practice and Guidelines, including:
    - managing noise at workplaces; and
    - prevention of falls from height at workplaces.

2.3 Horizon Power standards

Refer to https://www.horizonpower.com.au/contractors-installers/manuals-standards/ for a list of Horizon Power specifications and standards.

2.4 Australian and International standards

The Contractor, in relation to the SPS design and manufacturing, shall comply with the latest revision of the relevant Australian Standards, Codes of Practise and Guidelines or, in the absence of appropriate Australian Standards, with the relevant ISO, IEC, US, British or European (DIN or similar) Standards.

Where no Australian Standard applies, another standard may be adopted with the following precedence:

- International (ISO) Standards were referenced as the basis for current mandatory Australian Standards.
- International Electro-technical Commission (IEC).
- Standards referenced in Horizon Power Engineering Standards.
- British (BS).
- European (DIN or equivalent); and
- NFPA (USA).

Refer to *Appendix B: Standards* for a non-exhaustive list of specifications and standards applicable to the Works.

2.5 Mandatory Documents

Other documents that are mandatory to this Specification include:

- WA Metering Code 2005.
- WA Service and Installation Requirements 2021; and
- Horizon Power Technical Rules.

2.6 Definitions and Abbreviations

To this specification the following definitions apply:

2.6.1 Definitions

1) **Alternative Generator:** The equipment to generate electrical energy independent of the PV array. This includes the housing, fuel tank and controller

2) **Battery System:** The Battery System is a component of the ESS and is defined as the system within the ESS containing all cells, battery modules, battery racks, and battery management system (BMS)

3) **Energy Storage System (ESS):** An ESS is comprised of an Energy Storage Medium, a PCE, and a ESS Controller. The ESS Controller may be housed in an enclosure separate to the ESS

4) **ESS Controller:** The controller that controls the ESS, which may be comprised of one or more devices or as a part of PCE

5) **Energy Storage Medium (ESM):** The Battery System or any other medium of electrical energy storage in the ESS

6) **Power Conversion Equipment (PCE):** A device or circuitry that changes direct current (DC) to alternating current (AC) or vice versa; or transforms between voltage levels

7) **Standalone Power System:** A self-contained power generating unit or units providing the only source of electricity, independent of the Horizon Power network

8) **Nominal Battery Capacity:** The capacity of a battery in kWh when discharged from 100% to 0% state of charge

9) **PV array:** A photovoltaic array consists of PV modules and the frame

10) **Seamless transition:** No change in power quality to support the load when energy sources are changed, i.e., Bumpless

2.6.2 Abbreviations

1) **AS:** Australian Standard
2) **AS/ CA:** Australian Standard Communications Alliance
3) **AS/NZS**: Australian Standard/New Zealand Standard
4) **CEC:** Clean Energy Council
5) **CT:** Current Transformer
6) **FAT:** Factory Acceptance Test
7) **IEC:** International Electrotechnical Commission
8) **IP:** Internet Protocol
9) **IPXX:** International Protection where 'XX' represents the level of protection
10) **kVA:** Kilovolt-ampere (apparent power)
11) **kW:** Kilowatt (active power)
12) **kWh:** Kilowatt hour (electrical energy measurement)
13) **kWp:** Kilowatt peak (peak active power)
14) **L:** Litres
15) **MEN:** Multiple Earthed Neutral
16) **PV:** Photovoltaic
17) **RCD:** Residual Current Device
18) **SAT:** Site Acceptance Test
19) **SPS:** Standalone Power System
20) **SOW**: Scope of Work
21) **STC:** Standard Test Conditions
22) **TCP:** Transmission Control Protocol
23) **THD:** Total Harmonic Distortion
24) **UPS:** Uninterruptable Power Supply
25) **WAER:** Western Australian Electrical Requirements
26) **WASIR:** Western Australian Service and Installation Requirements

3 GENERAL REQUIREMENTS

The SPS voltage and frequency output limits to the customer Installation shall comply with the requirements given in Western Australian Service and Installation Requirements (WASIR) section 10.3.

4 SPS OPERATION

The SPS shall provide power from the three energy sources to the customer load, in the following order:

- PV array and PCE; then
- the energy storage system; then
- the alternative generator.

During the day when the customer load is less than the power output from the PV Array (see section 6.6), then the excess PV power shall charge the ESS (see section 6.4.2). When the ESS is fully charged the PV PCE (see section 6.5) will limit power output to only the customer load.

When there is insufficient power from the PV Array for the customer loads and for charging the ESS, and the battery state of charge has fallen to the percentage configured in the ESS Controller (see section 6.4.1), then the Alternative Generator (see section 6.7) will start and provide power to charge the ESS. When the battery state of charge has recovered to the defined set point the ESS Controller will send commands to stop the Alternative Generator.

When there is insufficient power from the PV Array for the customer load, then the ESS Controller will draw from the ESS to provide power to the customer load.

When there is insufficient power from the PV Array and insufficient power from the ESS then the ESS Controller will start the Alternative Generator to supply power to the customer load. The Alternative Generator shall be the primary power source for the customer load until the battery state of charge has risen to the percentage configured in the ESS Controller.

If the generator hasn’t run in the previous 14 days, the Alternative Generator will be run for thirty (30) minutes to confirm that the Alternative Generator will start when required.

5 EQUIPMENT REQUIREMENTS

This section describes the equipment requirements for a SPS.

5.1 Environmental Conditions

The equipment shall be suitable for use in the location it will be situated. Conditions to consider include solar radiation, pollution (salt bearing and industrial), humidity and wind velocities.

The equipment shall be suitable for continuous operation under the relevant environmental conditions stated in HPC-9EJ-01-0001-2013 Horizon Power Environmental Conditions for the duration of its design life.

5.2 Disposable Strategy

The Contractor shall provide details of its end-of life strategy for the Equipment or in part thereof. Horizon Power has preference for a recycling scheme offered by the Contractor. The recycling scheme shall have the following as a minimum:

- Point of collection
- Transport
- Buy back value (i.e., scrap value)

5.3 Other Environmental Requirements

The maximum SPS noise emitted shall be no greater than the allowable noise level prescribed by the Environmental Protection Act 1986 (re-print May 2018) and the Environmental Protection (Noise) Regulations 1997 (Table 1).

5.4 Design Life Requirements

Equipment must meet the design life requirements described in Table **1**.

Table 1: Design Life Requirements

Component	Design Life
Battery module	10 years
Battery PCE	10 years
PV module	25 years
PV PCE	20 years
PV Array structure	25 years
Alternative Generator set and frame	30 years
Cubicles or Enclosure	30 years
Cable and wiring	20 years

5.5 Functional Requirements

Each SPS shall have the following functional requirements:

- The same or higher level of reliability as a Horizon Power network connection.
- At least 20% spare capacity for battery storage.
- No damage to SPS equipment or customer equipment and loads due to an emergency shutdown of the SPS.
- Safe, simple, and easily accessible SPS components for maintenance, replacement, and refurbishment.
- Seamless transition between energy sources.
- Ability to remotely call the Alternative Generator and power the customer in the event of the ESS Controller failure.
- All components are to function without a direct connection to the internet.
- Be able to remotely operate a Stop operation effectively switching off components such as PCE and generators.
- Energy metering capability from PV, ESS, and Alternative Generation individually; and
- Provide customer metering and protection i.e., have a customer main switchboard installed as part of the SPS.

5.6 SPS Fault Performance

The SPS shall respond in the following manner to faults occurring within an SPS:

- Operate safely and fail to a safe state.
- Detecting a customer fault and safely disconnecting the customer without damaging the customer's equipment and loads.
- The protection equipment for each part of the SPS (PV, ESS, and Alternative Generator) shall be coordinated/graded with each other and the customer protection circuit breakers for protection of circuits rated less than 25 A. For a customer fault on circuits rated less than 25 A, the customer protection circuit breakers should trip before the Point of Supply circuit breaker or any SPS protection equipment trips.

NOTE: For systems less than 7.5 kVA the use of an engineered solution i.e., an undervoltage coil, can be utilised.

- The SPS Protection equipment shall include alarms for each protection device, that will be flagged and transmitted to the Horizon Power monitoring system; and
- The SPS protection equipment shall operate to ensure that the SPS is not damaged.

If there is a fault in the customer's installation or Consumer Mains and the SPS protection devices have tripped, the SPS shall not re-connect to supply to the customer installation until the fault has been cleared and an SPS restart/reset operation has been performed. This may require the attendance of Horizon Power maintenance staff.

5.7 Electrical Supply Requirements

The SPS output shall meet the supply requirements for:

- Voltage, Phases, Power factor, Nominal Frequency, and Unbalance of three phase systems as stated in the Horizon Power Technical Rules and the WASIR.
- Flicker and Voltage Transients as stated in the Horizon Power Technical Rules and AS/NZS 61000.3.11.

5.8 Harmonics

Each SPS must be capable of supporting harmonic loads with a maximum THD of 5% and be compliant to AS/NZS61000.3.6 harmonic voltage distortion.

5.9 Motor Starting

The SPS shall be able to start a motor with a capacity of 3 kW Direct Online without overloading or shutting down the SPS and without support from the Alternative Generator.

6 SPS COMPONENTS

This section describes and specifies the SPS Components.

6.1 SPS General Requirements

The safety, design, and installation of the SPS (including the PV modules and PV PCE, ESS and the Alternative Generator) shall comply with the requirements of AS/NZS 4509, Parts 1 and 2.

The finished colour of pipework, storage tanks and any fire service equipment shall comply with the colour standards given in AS 2700.

All equipment shall be compliant with AS/NZS & ISO 9001.

The SPS shall provide the required parameters as defined in Remote Monitoring System Data.

6.2 Equipment Enclosures

The enclosure(s) shall:

- be capable of being locked with a 13mm padlock.
- have an International Protection level determined by the equipment enclosed.
- be rated for the site ambient temperature and environmental conditions to ensure that equipment will operate within their manufacturer's limits.
- be designed for the site environmental conditions for temperature, humidity, rainfall, wind velocity and dust.
- enable access to the equipment.
- have barriers, shields or compartments to protect against accidental exposure to touch potentials by the installation of Acrylic Perspex Escutcheons where required.
- have an opening restraint to prevent the door being pushed open/closed by air movement. The opening restraint shall be removable if required.
- have an internal temperature sensor, monitored by the Remote Monitoring and Communication System (this only applies to enclosures housing equipment); and
- prevent any internal fire from exiting the enclosure and spreading to any external fuel; and
- have a manufacturing, defects, and materials warranty of a minimum of 1 year.

6.3 Customer Main Switchboard

The enclosure(s) shall:

- meet the requirements of section 11 of the WASIR.
- meet the requirements of the AS/NZS 3000.
- include preinstalled conduit complete with draw string and pit to allow customer to connect; and
- have a general-purpose power outlet.

6.4 ESS

The ESS shall be comprised of:

- an Energy Storage Medium;
- a PCE; and
- a ESS Controller.

6.4.1 ESS PCE and ESS Controller

The ESS PCE and ESS Controller may be either separate devices or combined.

6.4.1.1 Required attributes

The ESS PCE and ESS Controller combined shall have:

- proven operational performance under climate conditions like Western Australian conditions.
- a listing on the CEC Approved Inverter list (http://www.solaraccreditation.com.au/products/inverters/approved-inverters.html);
- compliance with:
  - AS/NZS 5603 (operations),
  - IEC 62109 (safety – design and operation),
  - IEE 1547:2020 Standard for Interconnecting Distributed Resources with Electric Power Systems,
  - UL 1741 Standard for Inverters, Converters, Controllers, and Interconnection System Equipment for Use with Distributed Energy Resources; and
  - FCC Part 15, Sub-Part B Unintentional Radiators for the Prevention of Electromagnetic interference, or radio-frequency interference, is created when an external source causes a disruption to an electrical circuit.

- a method of controlling the parallel supply of power from the PV PCE and the Alternative Generator in addition to the ESS.
- the ability to monitor the energy sources and connect/disconnect each source when necessary to maintain a reliable supply to the customer.
- protection for the Batteries against damage which includes, but is not limited to over voltage, over current and other mechanisms deemed necessary by the battery manufacture.
- have a physical ethernet port and use a protocol utilising message queue principles over Ethernet (e.g., MODBUS), to communicate with the Remote Monitoring and Communication System (refer to section 6.8) to transmit and receive data and commands.
- approval by the battery manufacturer for use with the battery management system.
- the package shall be capable of providing the minimum fault current contribution for all balanced and unbalanced fault types (includes phase to earth faults), regardless of pre-load conditions.
- an efficiency ≥92% from 25% to 100% rated load; and
- have a manufacturing, defects, and materials warranty of a minimum of 10 years.

6.4.2 Energy Storage Medium

The ESM shall be comprised of:

- a Battery System; and
- a BMS.

6.4.2.1 Battery System

6.4.2.1.1 Required attributes

The battery system shall:

- be on the CEC Approved storage list or eligible to be on the list (http://www.solaraccreditation.com.au/products/energy-storage-devices/battery-assurance-program.html)
- be sealed and not require the addition of any medium during their lifetime.
- have maintenance or housekeeping cycle of no more than once per year.
- be recyclable.
- have a physical ethernet port and use a protocol utilising message queue principles over Ethernet (e.g., MODBUS), to communicate with the Remote

Monitoring and Communication System (refer to section 6.8) to transmit and receive data and commands OR provide enough information to the ESS Controller to obtain the required parameters from the ESS Controller;

- be designed such that additional Batteries can be added to provide an additional 20% spare storage capacity.
- have a performance guarantee ≥70% of nominal capacity at 10 years; and
- have a manufacturing, defects, and materials warranty of a minimum of 5 years.
- compliance with:
    - UL 1642 Standard for lithium batteries:
    - AS 62282-3-100:2021 Stationary fuel cell power systems - Safety

6.4.2.2 Battery Management System

6.4.2.2.1 Required attributes

The battery management systems shall:

- have a physical ethernet port and use a protocol utilising message queue principles over Ethernet (e.g., MODBUS), with inverter and management system parameters available via the interface OR provide enough information to the ESS Controller to obtain the required parameters from the ESS Controller;
- be approved by the Battery PCE manufacturer for use with the Battery PCE.
- maintain correct balancing of battery cell voltage and cell cluster monitoring.
- provide protection to the Battery System against damage from over currents, over voltage, over temperature and any other abnormal operating conditions deemed necessary by the battery manufacturer.
- be able to detect and identify any faulty battery cells and premature battery cell degradation and transmit an alarm to the site Remote Monitoring and Communication System (Refer to section 6.8); and
- monitor and provide all key battery status parameters including, but not limited to battery voltage, battery cell state of charge, battery cells temperature.
- Be able to operate without a direct connection to the internet

6.5 PV PCE

6.5.1 Required Attributes

The PV Array PCE shall:

- have a physical ethernet port and use a protocol utilising message queue principles over Ethernet (e.g., MODBUS), to communicate with the Remote Monitoring and Communication System (refer to section 6.8) to transmit and receive data and commands.
- be listed on the CEC Approved Inverter list (http://www.solaraccreditation.com.au/products/inverters/approved-inverters.html).
- be compliant with:
  - AS/NZS 4777.2; and
  - IEC 62109 (Safety – design and operation)
- have an efficiency ≥92% of at rated output; and
- have a manufacturing, defects, and materials warranty of a minimum of 10 years.
- Be able to operate without a direct connection to the internet

6.6 PV Modules, Arrays and Mounting Structures

6.6.1 Required attributes – PV Modules

The PV modules shall:

- be listed on the CEC approved modules list (http://www.solaraccreditation.com.au/products/modules/building-approved-modules.html).
- comply with IEC 61215 and IEC 61730.
- have a panel efficiency of ≥ 17%.
- have a performance guarantee ≥80% of nominal output at 25 years; and
- have a manufacturing, defects, and materials warranty of a minimum of 10 years.

6.6.2 Required attributes – PV Array

The PV Array shall:

- have a maximum array voltage of 1000 V_{dc}; and
- have a minimum 10 degrees of tilt to enable self-cleaning.

6.6.3 Required attributes – PV Array Mounting and Structure

The PV Array mounting, and structure shall:

- have corrosion resistance using:
  - 316 Stainless Steel to AS 1449; or
  - 6005 Aluminium to AS/NZS 1866; or
  - Hot Dipped Galvanised Structural Steel to AS/NZS 4680 and AS/NZS 1214;
- have a manufacturing, defects, and materials warranty of a minimum of 10 years; and
- be certified by a Structural Engineer.

6.7 Alternative Generator

6.7.1 Required Attributes

The Alternative Generator, controller and fuel storage system shall:

- be serviceable in Australia (preferably Western Australia).
- contain a run hour meter.
- have a physical ethernet port and use a protocol utilising message queue principles over Ethernet (e.g., MODBUS), to communicate with the Remote Monitoring and Communication System (refer to section 6.8) to transmit and receive data and commands.
- be able to operate without a direct connection to the internet
- have a noise level of ≤ 80 dB(A) measured at 1 meter.
- be capable of operating in parallel or as the sole source of frequency control.
- be fitted with air filters to avoid dust ingress within the generator enclosure and into the air intake.
- comply with EPA and WorkSafe requirements for exposure to airborne contaminates.
- not permit the exhaust emissions from the Alternative Generator to fall onto or under the photovoltaic modules.
- include a spark arrestor where a combustion process occurs.
- have a pad lockable start battery isolator (i.e., ability to electrically isolate starter circuit).

- have a pad lockable fuel valve (i.e., ability to mechanical lock out the fuel source).
- have a pad lockable fuel cap (i.e., mechanism to prevent theft of fuel).
- for diesel:
    - have a fuel storage tank complaint with AS 1940, AS 1692, AS 1627.1 and AS/NZS 2312; and
- for ammonia:
    - comply with AS/NZS 2022; and
- for hydrogen:
    - be certified and independently inspected.

6.8 Remote Monitoring and Communication System

Each SPS shall be equipped with a Remote Monitoring and Communication System which will be hosted and monitored by Horizon Power. A portion of the Remote Monitoring and Communication System will be free issued by Horizon Power for installation on DIN rail(s) in the SPS cubicle or enclosure.

The Horizon Power free issued equipment comprises:

- a modem with NextG or Satellite configuration (currently a Series 2000 Cybertec Modem with the following characteristics):
    - Dimensions: H 50mm X W 103mm X D 120mm.
    - Fixing: DIN rail clip.
    - Coaxial connection: SMA Female Connector.
    - Power Input: 10-60 V (direct current).
    - Power Consumption (including antennae): 30 W.
- remote monitoring equipment (currently a Linux based device with the following characteristics):
    - Dimensions: H 51mm X W 96mm X D 120mm.
    - Weight: 200g.
    - Fixing: DIN rail clip.
    - Power Input: 12-24 V (direct current).
    - Power Consumption: 5 W.

6.8.1 Required Attributes

The Contractor shall provide the following:

- an external antenna, with requisite mountings and cabling to connect to the free issued modem. The antenna communications coaxial cable will be supplied with a lightning surge (AS/NZS 1786) suppressor Type 3 connected to the SPS main earth bar. The antenna shall support a 4G signal from Horizon Power's Telecommunication Provider and provide a minimum Signal Strength (RSCP) of -90 dBm and minimum Signal Quality (RSRQ) of -15 dB.

- un-managed Ethernet switch capable of connecting all required components including the free issued modem/router and remote monitoring equipment, DIN rail mounted with 10 – 60 V (direct current) power supply, and estimated 10W power consumption to AS/NZS 1768 and 4117.

- Cat 5e Ethernet cabling from the modem to a port on the Ethernet switch.

- Cabling for the remote monitoring system shall comply with AS/CA S008 and AS/CA S009.

The Contractor shall:

- provide a minimum of 60 minutes of uninterruptible power in the event of a failure of the SPS, to allow for remote trouble shooting and possible restart of one or more generating sources. This power supply needs to be able to be interrogated to determine the health of the supply. Power usage of this Remote Monitoring and Communication System configuration is estimated at 45 W.

- provide an uninterrupted power source separate to the main Battery System.

- provide an uninterrupted power source that shall have a physical ethernet port and use a protocol utilising message queue principles over Ethernet (e.g., MODBUS), to communicate with the Remote Monitoring and Communication System (refer to section 6.8) to transmit and receive data and commands OR provide enough information to the ESS Controller to obtain the required parameters from the ESS Controller.

- provide full details of the addressing, tag names and protocol of the monitored parameters for each device connected to the Remote Monitoring and Communication System.

- assist Horizon Power with all information required to integrate the hardware.

The final data template/map for each device, and IP addressing requirements shall be supplied by Horizon Power.

Configuration of the Horizon Power supplied remote monitoring equipment is out-of-scope.

The SPS shall monitor and transmit to the Remote Monitoring and

Communication System the data specified in the Horizon Power document Remote Monitoring System Data DM: 10806403.

7 AUXILIARY EQUIPMENT

7.1 Circuit Breakers, Fuses and RCDs

All low voltage circuit breakers used in the SPS shall comply with AS/NZS IEC 60947 and AS/NZS 3190.

All low voltage fuses used in the SPS shall comply with AS/NZS 60269. The Horizon Power preference is for circuit breakers unless the circuit fault level requires the use of fuses.

All RCDs shall be Type A to allow for detection with inverter sources.

7.2 Cabling and Wiring

The Contractor shall comply with HPC-9DJ-23-0002-2016 – Panel Wiring and Terminals.

Adequate space shall be allowed for the termination and connection of all incoming and outgoing cables as per the designer's cable circuit schedule.

All cables shall be connected directly to the associated switch / circuit breaker terminals, contactors, neutral and earth bar using screwed or bolted terminations. The following exceptions apply:

- RCDs not integrated with the associated circuit breaker shall have cables terminated on the RCDs. Internal wiring between RCD and circuit breaker shall be completed by the Contractor.
- Where circuits need to be routed via control relays, terminals shall be provided for outgoing cables with internal wiring between circuit breakers, relays and terminals being completed by the Contractor.
- Where oversized supply cables are specified, the Contractor shall install suitably sized terminals for the cable size. The Contractor shall wire between the terminals and the main isolator using adequately rated cables.

All cables and wiring shall have medium fire performance, flame retardant (self-extinguishing and shall not support combustion), low smoke, zero halogen, reduced acid gas and hazardous fume emissions sheath and insulation in accordance with AS/NZS 1660.5. The outer sheath of earth cables shall be coloured green/yellow along their entire length.

All cables ties used external to the equipment enclosures shall be stainless steel.

7.2.1 Terminals

Where necessary, rail mounted, tunnel type terminals shall be provided to terminate a minimum stranded copper conductor size of 2.5 mm². Larger

terminals shall be provided where cable sizes dictate.

7.2.2 Aerial Conductors

Aerial conductors are not permitted.

7.2.3 Direct Buried Conductors

Direct buried conductors are not permitted for the SPS. The exception will be the earth grading rings.

7.2.4 Conduits

Conduits shall comply with AS/NZS 2053.

7.2.5 Cable Ladder and Trunking

Cable ladder and trunking shall:

- be hot dip galvanised.
- have a lid installed to protect the cable outer sheath from UV damage.

7.2.6 Cable Glands

Non-parallel threaded glands are not permitted. Gland plates shall be made of non-ferrous material.

All gland plates shall be earthed.

7.2.7 Cable Labelling

Cables shall be labelled at each end with either strap-on imprinted stainless-steel type or UV resistant labelling ferrules. Cable labels shall be attached with stainless steel cable ties.

Individual core identification shall be with white background ferrules with engraved letters and numerals filled with non-deteriorating black text and shall correspond with the coding on approved drawings.

7.2.8 Cable Separation

Low voltage and communications cabling shall adhere to the separation requirements of Section 3.9.8.4 in AS/NZS 3000 and the requirements of AS/CA S009.

7.2.9 Cable Penetrations

All penetrations shall be as small as practicable and where going through metal shall be suitably bushed with the gap sealed with fire rated mastic.

7.2.10 Secondary and Control Wiring

Protection and control wiring shall not be less than seven stranded copper wire.

Ethernet cabling shall be Category 5e (minimum) screened cable rated to 250V minimum.

Metering and protection functions, where performed by different devices, are to be completely independent of each other. The sharing of cable wiring, test blocks, terminal strips, relays, and switches will not be permitted.

Where secondary wiring requires terminal connectors, they shall be compression type lugs. Bootlace type lugs shall be used on stranded cable cores less than 2.5mm^2 for equipment having recessed screen socket type connections (i.e., terminal blocks). The width of the bootlace shall closely match the width of the terminal tunnel recess and shall have minimum blade protrusion outside of the terminal. All other equipment shall be terminated on spade lugs (except CT terminals which shall be ring lugs).

All screened cables shall have the screen earthed at the signal source end to prevent circulating currents.

7.3 Three Position Switch

The SPS shall have an three position selector switch labelled:

Hybrid – Generator Only – OFF

In the Hybrid position the Alternative Generator will start and stop by commands from the ESS Controller with power flow controlled by the ESS Controller. The selector switch Generator Only position will allow Horizon Power maintenance personnel to start the Alternative engine on site and to bypass the ESS to power the Customer. The Off position isolates the SPS from the customer. The switch position shall be monitored and be controlled by the Remote Monitoring and Communication System via a physical ethernet port and use a protocol utilising message queue principles over Ethernet (e.g., MODBUS), to communicate with the Remote Monitoring and Communication System (refer to section 6.8) to transmit and receive data and commands.

7.4 Consumer Mains Protection Device

The SPS shall have a remote controllable motorised electronic circuit breaker protecting the outgoing cable from the SPS to the Customer Main Switchboard.

The Consumer Mains Protection Device shall be monitored and be controlled by the Remote Monitoring and Communication System via a physical ethernet port and use a protocol utilising message queue principles over Ethernet (e.g., MODBUS), to communicate with the Remote Monitoring and Communication System (refer to section 6.8) to transmit and receive data and commands.

7.5 Earthing

The SPS shall have an earthing system sized and designed in accordance with AS/NZS 3000, AS/NZS 3010, AS/NZS 4509.

7.6 Signage and Labelling

All signage and labelling shall be suitable to last the 30-year life of the SPS asset and securely fitted.

Equipment (not including external labelling outside enclosures) shall be clearly

identified with black on white labels engraved in minimum height 6 mm letters on traffolyte or equivalent. Labels shall be supplied and fixed in sufficient number, size, and details to enable rapid and positive identification of all SPS power generating equipment, power, control, and signal cables. Labels shall have equipment/component numbers and names.

The SPS Contractor shall supply and install all Safety signs for the SPS in accordance with AS/NZS 1319.

Labels for dangerous goods shall comply with AS/NZS 1216.

For external labelling of equipment and enclosures, the Contractor shall refer to the HPC-9AF-07-0001-2011 General Template Labelling Standard for Distribution Equipment standard and the labels shall be aligned with the SPS drawings.

In addition to these requirements, the following signs shall be supplied by the Contractor and fixed to the SPS enclosures:

- one sign with the text “Equipment is the Property of Horizon Power”.
- Electrical Hazard sign to prevent access to enclosure(s) by non-service personnel; and
- combustible liquid safety warning on the fuel tank.

The Contractor’s company name or logo shall not be applied to any part of any enclosures without prior written consent from Horizon Power and any Original Equipment Manufacturer details shall be removed where possible.

8 TECHNICAL SPECIFICATION CHANGES AND VARIATIONS

8.1 Horizon Power Initiated Changes

Horizon Power may decide at its discretion and will advise in writing either by letter or email, of any changes or variations to the Technical Specification.

8.2 Contractor Initiated Changes

Should the Contractor propose a change or variation from the Technical Specification it must be done in writing either by letter or email. The Contractor must give Horizon Power at least 10 business days to respond. No change can be made without Horizon Power approval.

9 APPENDIX A: REVISION INFORMATION

(Informative) Horizon Power has endeavoured to provide standards of the highest quality and would appreciate notification of errors or queries.

Each Standard makes use of its own comment sheet, which is maintained throughout the life of the standard, which lists all comments made by stakeholders regarding the standard.

A comment sheet found in DM: 11353115, can be used to record any errors or queries. This comment sheet will be referred to each time the standard is updated.

Rev No.	Date	Notes
4	10/05/2023	Update references and removed ambiguity regarding remote monitoring
3	22/03/2022	Update terminology to align with ESS Standard
2	1/03/2022	Standards and Performance Specification Update
1	14/09/2021	Update to remove MPS and diesel, and to reduce costs
0	16/01/2019	Initial Document Creation

As part of document quality control, revision information for initial document creation and subsequent revisions must be kept. Also, a comment sheet must be maintained in DM to document all comments and how those comments were addressed must also be documented.

10 APPENDIX B: STANDARDS

The Contractor shall comply with the following standards as a minimum:

STANDARD	TITLE
AS 1216	Class labels for dangerous goods
AS 1319	Safety signs for the occupational environment
AS 1449	Wrought alloy steels - Stainless and heat-resisting steel plate, sheet, and strip
AS 1627.1	Metal finishing - Preparation and pre-treatment of surfaces - Removal of oil, grease, and related contamination
AS 1692	Steel tanks for flammable and combustible liquids
AS 1768	Lightning Protection
AS 1940	The storage and handling of flammable and combustible liquids
AS 2700	Colour standards for general purposes
AS 4086	Secondary batteries for use with Stand-alone power systems
AS 60529	Degrees of protection provided by enclosures (IP Code)
AS 62282-3-100:2021	Stationary fuel cell power systems - Safety
AS/CA S008	Requirements for customer cabling products (Telecommunications)
AS/CA S009	Installation requirements for customer cabling (Wiring Rules) (Telecommunications)
AS IEC 62619	Secondary cells and batteries containing alkaline or other non-acid electrolytes – safety requirements for secondary lithium cells and batteries, for use in industrial applications
AS/NZS 1170.2	Structural design actions - Wind actions
AS/NZS 1214	Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series) (ISO 10684:2004, MOD)

STANDARD	TITLE
AS/NZS 1866	Aluminium and aluminium alloys - Extruded rod, bar, solid and hollow shapes
AS/NZS 2053	Conduits and fittings for electrical installations
AS/NZS 2312	Guide for protection of structural steel against atmospheric corrosion using protective coatings.
AS/NZS 3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3008.1	Electrical installations - Selection of cables - Cables for alternating voltages up to and including 0.6/1 kV
AS/NZS 3010	Electrical installations - Generating sets and associated standards
AS/NZS 3017	Electrical installations – Verification Guidelines
AS/NZS 3100	Approval and Test Specification – General Requirements for Electrical Equipment
AS/NZS 4509	Stand-alone power systems
AS/NZS 4680	Hot dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 4755	Demand Response capabilities and supporting technologies for electrical products.
AS/NZS 4777:2020	Grid connection of energy systems via inverters, with the default regional setting selection set to “Australia C”. For all other modes and operation that are not covered by a regional setting then default settings of AS/NZS 4777.2 2020 apply.
AS/NZS 5033	Installation and Safety Requirements for Photovoltaic (PV) Arrays
AS/NZS 5139	Electrical Installations Installation and safety requirements of battery storage systems
AS/NZS 5603	Stand-alone inverters – Performance requirements
AS/NZS & ISO 9001	Quality management systems – Requirements

STANDARD	TITLE
AS/NZS 14001	Environmental Management (known as NZS/AS in NZ)
AS/NZS 60269	Low voltage fuses
AS/NZS & IEC 60947	Low-voltage switchgear and control gear
AS/NZS 61000.3.11	Electromagnetic compatibility (EMC) – Limitation of voltage changes, voltage fluctuations and flicker in public low voltage supply systems – for currents up to and including 75A per phase.
AS/NZS 61439	Low-voltage switchgear and control gear assemblies' General rules
IEE 1547:2020	Standard for Interconnecting Distributed Resources with Electric Power Systems
IEC 61215	Terrestrial photovoltaic (PV) modules
IEC 61730	Photovoltaic (PV) module safety qualification
IEC 62109	Safety of power converters for use in photovoltaic systems
UL 1642	Standard for lithium batteries
UL 1741	Standard for Inverters, Converters, Controllers, and Interconnection System Equipment for Use with Distributed Energy Resources
FCC Part 15, Sub-Part B	Unintentional Radiators for the Prevention of Electromagnetic interference, or radio-frequency interference, is created when an external source causes a disruption to an electrical circuit.