

Embedded generation commissioning sheet

Technical data and certification for low voltage connection of embedded generation systems.

This form is to be completed by a licensed and Clean Energy Council (CEC) accredited electrician on behalf of a customer requesting an embedded generation connection to the Power and Water network. Once the installation has been completed, please submit this form along with the Certificate of Compliance (CoC) to the Power Services Connections Office via PowerConnections.PWC@powerwater.com.au. If at any point there is not enough space provided in this form please use the 'additional notes' section on page 5.

Section 1: Installer and site details

Applicant name	Accredited installer's company name

Site address

Lot No.	Unit No.	Street No.	Street name

Suburb

Section 2: System details

Embedded Generator system details

PV panel make / model*	Rating (kW)*	Quantity	Total array rating (kW)

Inverter A make / model*	Rating (kVA)*	Quantity	Total inverter rating (kVA)

Inverter B make / model*	Rating (kVA)*	Quantity	Total inverter rating (kVA)

Inverter C make / model*	Rating (kVA)*	Quantity	Total inverter rating (kVA)

Inverter D make / model*	Rating (kVA)*	Quantity	Total inverter rating (kVA)

Export limiting device make / model	Device-limited inverter(s)	Combined rating of all inverters (kVA)

Energy Storage System (ESS) details

Battery pack make / model	Rating (kWh)	Quantity	Total battery pack rating (kWh)

Battery control system make / model*	Maximum discharge rate (kW)	Maximum charge rate (kW)

ESS inverter set-up: AC-coupled Hybrid Other (please specify)

*Enter **specific model details** as on the CEC approved lists¹
Any additional inverters must be listed in "additional details" if there is not enough room above

Section 3: System details for generating systems greater than 2000kW

Technology and number of additional generators (e.g. 2x diesel genset)	Generating unit make and model	Maximum generation capacity of additional units (kVA)	Additional generation operation configuration
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Contribution to fault levels (kA)	Relevant transformer voltages (e.g. 11/0.4kV)	Rating of relevant transformers (kVA)	
<input type="text"/>	<input type="text"/>	<input type="text"/>	
Protection system and communications systems	Voltage control and reactive power capability		
<input type="text"/>	<input type="text"/>		

- Additional System Control requirements are imposed on this connection.
- System is an island-capable microgrid, which meets all requirements under 3.4 of the NTC.

Section 4: Export limits at connection point

Table: Export limits

Connection Type	Description	
Single-phase basic micro EG connection	For single-phase basic micro EG connections of IES with & without ESS, the export limit shall be 5 kW at the connection point	<input type="checkbox"/>
Three-phase basic micro EG connection	For three-phase basic micro EG connections of IES with & without ESS, the export limit shall be 7 kW with a balanced output with respect to its rating	<input type="checkbox"/>
Non-standard basic micro EG connection	For non-standard basic micro EG connections, the export limit shall be determined at the time of application and may apply a zero export limit	<input type="checkbox"/>
Negotiated or Large EG connection	For systems >30 kVA and ≤2MVA (DKIS) or ≤10% of minimum demand, the export limit is determined per application and shall be as recorded in the Negotiated Connection Agreement	<input type="checkbox"/>

Section 5: Inverter integrated protection

Inverter active anti-islanding protection settings are as per AS/NZS 4777.2:2020 Region Australia A without deviation in the Table below.

Table: Inverter integrated active anti-islanding protection settings

Parameter	Required Setting	Installer Setting	Required Trip Delay Time	Installer Trip Delay Time	Required Max Disconnection Time	Installer Max Disconnection Time
Undervoltage 2 (V<<)	70 V		1 s		2 s	
Undervoltage 1 (V<)	180 V		10 s		11 s	
Overtoltage 1 (V>)	265 V		1 s		2 s	
Overtoltage 2 (V>>)	275 V		-		0.2 s	
Under-frequency (F<)	47 Hz		1 s		2 s	
Over-frequency (F>)	52 Hz		-		0.2 s	

Section 6: Central protection settings

Central protection in the form of a Generator Protection Relay is required for Embedded Generating systems above 30kVA total inverter AC nameplate rating. Central protection settings are a backup for inverter passive anti-islanding protection as per the Tables below.

Table: Voltage and frequency settings

Parameter	Required Setting	Installer Setting	Required Trip Delay Time	Installer Trip Delay Time	Required Max Disconnection Time	Installer Max Disconnection Time
Undervoltage 2 (V<<)	70 V		1.5 s		2 s	
Undervoltage 1 (V<)	180 V		10.5 s		11 s	
Overtoltage 1 (V>)	265 V		1.5 s		2 s	
Overtoltage 2 (V>>)	275 V		0.1 s		0.2 s	
Under-frequency	47 Hz		1.5 s		2 s	
Over-frequency	52 Hz		0.1 s		0.2 s	

Table: Rate of Change of Frequency (ROCOF)

Parameter	Required Setting	Installer Setting
ROCOF	± 4 Hz/s for a duration of 0.5 s	

Section 7: Frequency

For a grid disturbance that causes an increase in grid frequency (above the upper limit of continuous operation), the inverter(s) shall respond as per AS/NZS 4777.2 default settings as set in Table below.

Table: Limits for sustained operation for frequency variations (increase in grid frequency), applicable to all inverter

Inverter Response	Settings	Installer Settings
Lower limit of continuous operation for supplying rated power	49.75 Hz	
Upper limit of continuous operation for supplying rated power (above which power output is reduced linearly with an increase in frequency until f_{stop} is reached)	50.25 Hz	
Increase in frequency response upper limit Hz	52 Hz	
Decrease in frequency response Lower limit Hz	47 Hz	
Minimum elapsed time	60 s	

For a grid disturbance that causes a decrease in grid frequency (below the lower limit of continuous operation), the inverter(s) with energy storage shall respond as per AS/NZS 4777.2 default settings as set out in Table below.

Table: Limits for sustained operation for frequency variations (decrease in grid frequency), applicable to inverters with energy storage

Inverter response	Settings	Installer Settings
Frequency where power output level is maximum (f_{Pmax})	48 Hz	
Frequency where Power level is minimum (f_{Pmin})	52 Hz	
$f_{stop-CH}$ (below which power input for charging of energy storage is 0 W)	49 Hz	
Frequency where discharging power level is zero ($f_{transition}$)	50.75 Hz	
Minimum elapsed time	60 s	

Section 8: Voltage

For sustained operation for voltage variations, the maximum voltage set point shall be set as per the AS/NZS 4777.2 default setting, with no variation to AS/NZS 4777.2 in the Table below. The inverter shall operate the automatic disconnection device within 3 s when the average voltage for a 10 minute period exceeds the $V_{nom-max}$.

Table: Limits for sustained operation for voltage variations

Parameter	Required Setting	Installer Setting
Sustained operation over-voltage limit ($V_{nom-max}$)	258 V	

Section 9: IES Power quality response modes

AS/NZS 4777.2:2020 Region Australia A settings shall be applied for Volt_VAr response mode.

Table: Volt_VAr response mode settings

Parameter	Required Setting	Installer Setting	Required Setting	Installer Setting
Volt_VAr 1 (V_{V1})	207 V		44 % Supplying	
Volt_VAr 2 (V_{V2})	220 V		0 %	
Volt_VAr 3 (V_{V3})	240 V		0 %	
Volt_VAr 4 (V_{V4})	258 V		60 % Absorbing	

AS/NZS 4777.2:2020 Region Australia A settings shall be applied for Volt_Watt response mode.

Table: Volt_Watt response mode settings

Parameter	Required Setting	Installer Setting	Required P	Installer P
Volt_Watt 1 (V _{W1})	253 V		100% of S _{rated}	
Volt_Watt 2 (V _{W2})	260 V		20 % of S _{rated}	

Note: P is the output power of the inverter and S_{rated} is the rated output power of the inverter.

Section 10: Ramping requirements

Ramping is required for all inverters when reconnecting to the network. Additional ramping is required for inverters with ESS in remote networks or systems at or above 1MVA AC with ramping requirements to maintain system stability.

For inverters that have fewer decimal places, round the ramp rate down (e.g. 16.67% => 16%).

Table: Ramping settings for inverters capable of use with energy storage in remote networks or ≥1MVA total AC capacity

Parameter	Required Setting	Nominal Ramp time	Installer Setting
Rate limit for an increase in power (W _{GRA+})	16.67 % per minute	6 minutes	
Rate limit for an decrease in power (W _{GRA-})	16.67 % per minute	6 minutes	

I, the accredited installer named in Section 1, certify that the above detailed embedded generation (PV and/or battery) system installed at the address in section 1 has been installed and commissioned in accordance with Power and Water Corporation’s relevant Technical Specification documents, Network Technical Code, all Power and Water Corporation approval letters and agreements as well as all relevant standards and statutory requirements. I further certify that the embedded generation unit has been installed in accordance with good electricity industry practice and is ready for operation. In particular the following have been verified:

- The embedded generation unit is within Power and Water’s approved size limits
- The schematic diagram has been submitted and accurately reflects the installed electrical system
- All required switches and protection devices are present and operate correctly
- Signage and labelling complies with Power and Water’s ‘Basic Micro Embedded Generation Technical Specifications (30kVA)’, ‘Negotiated Embedded Generation Technical Specifications (30kVA – 2000kVA)’ (whichever is relevant) and AS4777.1
- The embedded generation has been installed correctly and is fit for purpose
- All protection settings are within requirements

Installer’s signature

Installer’s name

Date

Electrical contractor license number

CEC accreditation number

Additional notes

This page is for additional information if there is not enough room on a previous page (e.g. multiple inverter types).

Send to us

Email connect.me@powerwater.com.au
Postal PO Box 37471, Winnellie, NT 0821
Phone 1800 245 092