National Distributed Energy Resources Grid Connection Guidelines

Technical Guidelines for Small IES EG Connections

ENA DOC 039-2022

Energy Networks Australia

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ISBN: 978-1-925871-15-9

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Key Information

Document Category	Guideline
Functional Domain	Connections
Designation	ENA DOC 039-2022
Version No	2.0
Title	National Distributed Energy Resources Grid Connection Guidelines – Technical Guidelines for Small IES EG Connections
Development Leader (Version 1)	CutlerMerz
Working Group (Version 1)	Zahra Jabiri, Laurie Curro, Dennis Stanley and other representatives.
Revision Working Group (Version 2)	Ausgrid -Nathan Laird; Energy Queensland - Jennifer Gannon; ENA - Monaaf Al-Falahi; Essential Energy - Alexei Watson and Tom Rueger; Evo Energy - Jessica Evers; Jemena - Ashandi Abeysinghe; United Energy - Darshana Paranagama; SA Power - Andrew Lim and Shivangi Patel; Western Power - Nigel Wilmot
Foundation Work	A 'Framework and Principles Guideline' was produced, to guide the development of this and other connection guidelines.
Filing Details	Energy Networks Australia (Website)
Review Period	One year after publication date

Documents of Energy Networks Australia

History of Energy Networks Australia

Energy Networks Australia is the peak national body representing Australia's gas distribution and electricity transmission and distribution companies. Established in its current form in 2004 it has a long history of industry representation, operating under different names over the years to reflect the sector transformation.

With more than 16 million customer connections across the nation, Australia's energy networks provide the final step in the safe, reliable delivery of gas and electricity to virtually every home, business and industry in the country.

Documents

Part of the role of Energy Networks Australia is the development and management of support material such as codes, specifications, guidelines and handbooks to support the energy industry and members of the public in the interpretation and application of legislation and standards. All documents are written in collaboration with the industry through working groups and general consultation with the Members of Energy Networks Australia.

It should be noted that legislation and standards may alter between editions of Energy Networks Australia documents, and they will always take precedence. As such, all document users must be aware of the current regulatory environment.

Definitions[1]

Small IES embedded generation connection	*A connection between a distribution network and a retail customer's premises for a micro embedded generating unit, for which a model standing offer is in place* or an equivalent model offer is in place in jurisdictions not subject to Chapter 5A of the National Electricity Rules
Backup load	*Any load to be supplied by an embedded generating unit during customer islanded mode.*
Customer Islanded Mode	*A generating unit capable of customer islanded mode will have the ability to supply electricity to a section of the customer's installation when disconnected from the distribution network*
Central protection	Central protection is the protection installed to perform the functions of: coordinating multiple generating units (inverter energy system and/or rotating machines) installations at one site, providing protection for the entire generation installation and islanding protection to the connected grid as well as preserving safety of grid personnel and the general public
Demand response enabling device (DRED)	A device that provides the functionalities and capabilities to achieve demand response
DER Technical Standards	Means the requirements for embedded generating units under Australian Standard AS4777.2:2020
Embedded generating unit	*A generating unit connected within a distribution network and not having direct access to the transmission network*
Embedded generating system	A system comprising of multiple embedded generating units
Export capacity	Combined power that all embedded generating units installed at the consumer's premises are capable of exporting to the network
Export limitation	Where the electricity exported from an IES to the distribution network is controlled so as to not exceed a specified limit
Distributed Energy Resources (DER)	Power generation or storage units that are connected directly to the distribution network
Energy storage system (ESS)	A system comprising one or more batteries that store electricity generated by distributed energy resources or directly from the grid, and that can discharge the electricity to loads
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*
Generator	*A person who owns, operates or controls a generating unit*

[1] Definitions in italics are consistent with the definitions under the National Electricity Rules

Generation limit	Where the electricity generated by an IES is controlled so as to not exceed a specified limit that is lower than the inverter nameplate rating
Inverter energy system (IES)	A system comprising one or more inverters that convert direct current to alternating current
Low voltage (LV)	The mains voltages as most commonly used in any given network by domestic and light industrial and commercial consumers (typically 230V)
Medium voltage (MV) / High voltage (HV)	Any voltage greater than 1kVAC
Micro embedded generation connection	*Means a connection between an embedded generating unit and a distribution network of the kind contemplated by Australian Standard AS 4777 (Grid connection of energy systems via inverters)* currently up to 200kVA
Market generating unit	*A generating unit whose generation is not purchased in its entirety by a retailer (and receives payment for generation through the National Electricity Market or Wholesale Electricity Market)*
Model standing offer	*A document approved by the Australian Energy Regulator as a model standing offer to provide small IES embedded generation connection services or standard connection services which contains (amongst other things) the safety and technical requirements to be complied with by the proponent.* This definition also applies to an equivalent model offer for jurisdictions not subject to Chapter 5A of the National Electricity Rules
Proponent	A person proposing to become a generator (the relevant owner, operator or controller of the generating unit (or their agent))
Registered generator	*A person who owns, operates or controls a generating unit that is connected to, or who otherwise supplies electricity to, a transmission or distribution system and who is registered by the Australian Energy Market Operator as a Generator under Chapter 2 of the National Electricity Rules*
Site generation limit	The generation threshold that the embedded generation system cannot exceed, measured downstream of the connection point
Small generation aggregator	*A person who has classified one or more small generating units as a market generating unit*
Small registered generator	*A generator who elects to register a generating unit with the Australian Energy Market Operator as a market generating unit who would otherwise be entitled to an exemption to register based on size*
Standard connection	*A connection service (other than a small IES embedded generation connection service) for a particular class (or sub-class) of connection applicant and for which an Australian Energy Regulator approved model standing offer is in place* or for which an equivalent model offer is in place in jurisdictions not subject to Chapter 5A of the National Electricity Rules
Single Wire Earth Return (SWER)	Parts of the electrical distribution network that use a single live conductor to supply single-phase or split-phase electric power with higher network impedances, and with distribution supplying low voltages to premises
Technical requirements document	The document produced by each Distribution Network Service Provider setting out their requirements for proponents to enable a grid connection, to which these guidelines apply

Abbreviations

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AS/NZS	A jointly developed Australian and New Zealand Standard
CBD	Central Business District
CEC	Clean Energy Council
DER	Distributed Energy Resources
DNSP	Distribution Network Service Provider
DRED	Demand response enabling device
EG	Embedded Generation or Embedded Generating
ESS	Energy Storage System
HV	High Voltage
IEC	International Electrotechnical Commission
IES	Inverter Energy System
LV	Low Voltage
MV	Medium Voltage
NEM	National Electricity Market
NER	National Electricity Rules
NMI	National Metering Identifier
SWER	Single Wire Earth Return
SWIS	South West Interconnected System

WEM	Wholesale Electricity Market servicing the SWIS

Foreword

The electricity industry in Australia is undergoing a transformation from a centralised system of generation transmission and distribution, dominated by relatively few participants, to a system of increasing decentralisation. The transformation is being largely driven by technological change in renewables and DER, enabling a broader range of stakeholders, including retail customers, to connect to and participate in existing and emerging energy markets.

As a result, network businesses are transforming from network service providers, facilitating one-way flow, to a customer connection provider, facilitating two-way flows between multiple distributed generating units and loads. The rate of transformation varies between networks due to the rate of uptake of DER and differing characteristics of network types.

Each network has responded to these challenges independently, resulting in a range of technical requirements and connection processes which, although consistent with regulatory requirements, result in some inconsistencies between networks and a lack of clarity for proponents. These issues have been identified as a major concern by stakeholders in numerous industry reports and reviews including the CSIRO/Energy Networks Australia's Energy Network Transformation Roadmap[2], and the Clean Energy Council's Future Proofing Australia's Distribution Networks[3]. These National DER Connection Guidelines have been developed in response to the needs identified in the abovementioned studies.

Energy Networks Australia, in partnership with the AEMO, is separately undertaking consultation on its '*Open Energy Networks*' project. Open Energy Networks proposes options for improving the electricity system to ensure household solar PV and ESS work in harmony and deliver the most value for all customers. The consultation has identified the need for common standards and protocols for active DER but is yet to develop specific technical requirements. It is envisaged that the outcomes of the Open Energy Networks consultation will be incorporated in future iterations of these National DER Connection Guidelines.

[2] http://www.energynetworks.com.au/electricity-network-transformation-roadmap
[3] http://fpdi.cleanenergycouncil.org.au/reports/grid-connection-standards-scoping-study.html

About the National DER Connection Guidelines

The National DER Connection Guidelines set out the framework, principles, approach and technical settings for Australian DNSPs to adopt in the development and application of their technical requirements for grid connection of DER. The ultimate aim of the guidelines is to facilitate the efficient integration of DER into the grid from the perspective of networks, renewable energy proponents and Australia's electricity system more generally.

In preparing these guidelines, Energy Networks Australia has consulted broadly with industry including: the AEMO, the AEMC, state and federal governments and the Clean Energy Council as well as each of the fourteen DNSPs across Australia, who are our member organisations.

Objectives of the Guidelines

The objectives of the guidelines are to:

1. Give rise to clear, complete and accessible technical requirements for grid connection for each DNSP
2. Provide for a level of consistency between DNSPs' technical requirements for grid connection in terms of both structure of presentation and the requirements themselves
3. Ensure that DNSPs' technical requirements give regard to the long-term interest of consumers by appropriately balancing the economic benefits, costs and risks that the requirements impose upon their network, proponents and Australia's electricity system more generally; consistent with the National Electricity Objective to:

   "Promote efficient investment in, and efficient operation and use of, electricity services for the long-term interests of consumers of electricity with respect to: price, quality, safety and reliability and security of supply of electricity and; the reliability, safety and security of the national electricity system"
4. Establish a platform for DNSPs to develop common standards and protocols for future management of active DER.

Structure of Guidelines

The guidelines are separated into four distinct documents:

1. **Framework and Principles guideline** – Specifies the number, scope and structure of the technical requirements documents which all DNSPs shall develop as well as the principles DNSPs shall adopt in setting technical requirements
2. **Small IES EG connection technical guidelines (this document)** – Specifies how DNSPs shall develop and apply technical requirements for the connection of a small EG unit with a total system capacity less than or equal to 10 kVA for single-phase IES, and less than or equal to a total system capacity of 30 kVA for three-phase IES to an LV distribution network
3. **LV EG connection technical guidelines** – Specifies how DNSPs shall develop and apply technical requirements for the connection of an EG unit (which is not a small IES EG unit) to a LV distribution network
4. **MV/HV EG connection technical guidelines** – Specifies how DNSPs shall develop and apply technical requirements for the connection of an EG unit (which is not a small IES EG unit or an LV

EG unit) to a MV/HV distribution network, for which the generator is not required to be registered in the NEM (≤5MVA) or WEM (≤10MVA) or is within other jurisdictions and is ≤5MVA[4].

How to Comply with the Guidelines

Compliance to the Energy Networks Australia DER Connection Guidelines is not legally required by DNSPs, however, all DNSPs have communicated an intention to adopt the requirements of the guidelines. To be deemed to comply with the guidelines, DNSPs shall:

- Structure their technical requirements documents consistent with the framework and principles set out in the Framework and Principles guideline
- Develop and apply technical requirements set out in the technical guidelines as relevant.

Where DNSPs choose to adopt an alternative setting, structure or approach, they shall still be deemed to comply so long as the deviation is set out and justified.

Justification shall include:

- That the alternative setting is required to respond to a jurisdictional legislative or regulatory requirement and/or
- That the alternative setting promotes improved benefits to Australia's electricity system (in terms of both network and proponent benefits, risks and costs).

Each deviation shall be listed in a table within the appendix of the DNSPs' technical requirements document, consistent with the format provided in Appendix A: Deviations from the National DER Connection Guidelines. The full justification shall be published separately on the DNSP's website and hyperlinked from the deviation table where appropriate.

Terminology

In these guidelines the following terminology is used:

- The word *shall* indicates that adopting the setting or approach is mandatory in order for DNSPs to be deemed to comply with these guidelines
- The word *may* indicates an optional setting or approach that DNSPs shall consider. DNSPs will still be deemed to comply with the guidelines if they do not adopt that setting.

Relationship to Other Documents

The guidelines are intended to be consistent with and to complement existing legislation and regulations.

To the extent that the application of these guidelines results in any inconsistency between existing legislation and regulations and DNSPs' technical requirements, existing legislation and regulations shall prevail. The implications of any inconsistency on DNSP's ability to comply with these guidelines shall be set out within a table of deviations as per Appendix A: Deviations from the National DER Connection Guidelines.

These guidelines are also intended to be consistent with relevant Australian/International Standards and Industry Codes. In some cases, these guidelines require DNSPs to apply additional requirements or additional specificity beyond Australian/International Standards and Industry Codes. Any inconsistency shall be interpreted as deliberate and shall not be used as justification for a deviation.

[4] Note that the guidelines still apply to generators who elect to register with AEMO as either a small registered generator or a small generation aggregator operating individual generating units of less than 5MW.

Preparing Small IES EG Connection Technical Requirements

DNSPs shall produce a technical requirements document for small IES EG connections that shall follow the structure and content detailed in these guidelines. The DNSP shall include the terms "Small IES EG Connection Technical Requirements" in their key search terminology for their technical requirements document. The DNSP document title shall include the terms "*Small IES EG Connection Technical Requirements*". The document may include other terms, where required for consistency with the DNSP's document classification system.

1 Introduction

This section shall include an introduction to the DNSP's technical requirements document that provides proponents with an overview of the technical requirements for the equipment and installation of small IES EG connections to the DNSP's LV network.

The introduction shall include:

1. The definition of a small IES EG connection, consistent with the definition provided within the Framework and Principles guideline being:
   "a small EG system with a total system capacity less than or equal to 10 kVA for a single-phase IES network connection, and a total system capacity less than or equal to 30 kVA for a three-phase IES network connection that is:
   a. *intended to be connected to and capable of operating in parallel with any part of the LV distribution network*
   b. *involving minimal or no augmentation of the distribution network*
   c. *meeting all other technical requirements set out in this document"*
2. The purpose of the DNSP's technical requirements document being:
   "*to provide proponents of small IES EG connections information about their obligations for connection to and interfacing with the LV distribution network"*
3. An outline of the scope of connections to which the technical requirements document applies, being new connections of small IES EG systems or modifications to existing small IES EG systems, where the small IES EG system consists of IES, ESS or a combination of both
4. An outline of the scope of systems to which the technical requirements document does NOT apply, being:
   a. EG units covered by the DNSP's LV EG Connection Technical Requirements
   b. EG units covered by the DNSP's MV/HV EG Connection Technical Requirements
   c. Electric vehicles, unless the Electric Vehicle Supply Equipment (EVSE) are capable of exporting to the LV network (in which case the requirements shall apply)
   d. DER systems that do not generate electricity, including demand response/demand management systems, unless they impact on the ability of the small IES EG system to meet the technical requirements
5. The general obligations of proponents, including:

a. The obligation to comply with the technical requirements as well as relevant national standards, industry codes, legislation and regulations. In the event of inconsistency, an indication of which instrument shall prevail, being legislation and regulations, followed by the technical requirements, followed by national standards and industry codes

b. The obligation to not connect additional inverters, make modifications or install additional small EG units, including ESS, without prior written agreement from the DNSP

c. The obligation to comply with the DNSP's model standing offer

d. The obligation to meet the requirements in the design, installation and operation of the small IES EG system

6. A statement of acknowledgement from the DNSP of their obligations to ensure the safe and reliable operation of the distribution system for operating personnel, customers and the general public

7. A statement that the technical requirements comply with the National DER Connection Guidelines for Small IES EG Connections, with the exception of the deviations presented in Appendix A: Deviations from the National DER Connection Guidelines.

2 Definitions and Abbreviations

2.1 Definitions

This section shall provide a tabulated list of definitions for any technical or industry terms used throughout the technical requirements document. The definitions shall be consistent with the definitions provided within the National DER Connections Guidelines (including these technical guidelines and the Framework and Principles guideline) as relevant.

2.2 Abbreviations

This section shall provide a tabulated list of all abbreviations used throughout the technical requirements document. The abbreviations shall be consistent with the abbreviations provided within the National DER Connections Guidelines (including these technical guidelines and the Framework and Principles guideline) as relevant.

2.3 Terminology

DNSPs shall outline how instructional terms are to be interpreted, being:

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.

2.3.1 Subcategories

DNSPs shall advise proponents of the subcategories for which different technical settings may apply, being:

1. Single-phase small IES EG connection – Any small IES EG system with a system capacity less than or equal to 10 kVA for a single-phase IES network connection meeting all technical requirements for small IES EG connections set out in the DNSP's technical requirements document
2. Two-phase small IES EG connection - Any small IES EG system with a system capacity less than or equal to 20 kVA (10 kVA per phase) for a two-phase IES network connection meeting all technical requirements for small IES EG connections set out in the DNSP's technical requirements document
3. Three-phase small IES EG connection – Any small IES EG system with a system capacity less than or equal to 30 kVA for a three-phase IES network connection meeting all technical requirements for small IES EG connections set out in the DNSP's technical requirements document
4. Non-standard small IES EG connection – Any small IES EG system connecting to a non-standard part of the network including (but not limited to) SWER networks, isolated networks, and CBD networks.

This section shall also provide a hyperlink or website reference to a map, list of postcodes, or equivalent, which allows proponents to geographically identify whether their connection is to a non-standard network.

This section shall also provide contact details in case there is any doubt as to which subcategory applies.

This section shall specify that the technical requirements set out in these guidelines should be interpreted as applying to all subcategories of small IES EG connections unless otherwise specified.

3 Relevant Rules, Regulations, Standards and Codes

3.1 Standards and Codes

This section shall provide a list of all the Australian and international standards and industry codes which shall apply to the design, manufacture, installation, testing and commissioning, and operation and maintenance of all plant and equipment for small IES EG connections to the distribution network.

This section shall be consistent with the standards provided within the Framework and Principles guideline and shall only include those relevant to the DNSP's jurisdiction.

This section shall also state that in the event of any inconsistency between Australian and international standards and industry codes and the DNSP technical requirements, the DNSP technical requirements shall prevail.

3.2 Legislation and Regulation

This section shall provide a list of all the relevant legislation and regulations which shall apply to the design, manufacture, installation, testing and commissioning, and operations and maintenance of all plant and equipment for small IES EG connections to the distribution network.

This section shall be consistent with the legislation and regulation provided within the Framework and Principles guideline and shall only include those relevant to the DNSP's jurisdiction.

This section shall also state that in the event of any inconsistency between legislation and regulations and the DNSP technical requirements, the legislation and regulation shall prevail.

4 Technical Requirements

4.1 General

This section specifies the detailed technical requirements for small EG connection. The technical requirements set out in this document shall apply to all subcategories of small IES EG system connections. All equipment shall be designed, manufactured, installed and tested in accordance with the requirements of all relevant Statutory Authorities and Acts and the latest relevant Standards and Codes of Practices.

4.2 Maximum System Capacity

This section shall specify the maximum system capacity of small IES EG connections for each subcategory consistent with the below:

1. Single-phase small IES EG connection – For single-phase small IES EG connections of IES, the maximum system capacity shall be set to less than or equal to 10 kVA
2. Three-phase small IES EG connection – For three-phase small IES EG connections of IES , the maximum system capacity at the same connection point shall be set to less than or equal to 10 kVA per phase
3. Non-standard small IES EG connection – For each type of non-standard network small IES EG connections, a lower maximum system capacity may be specified. The lower maximum system capacity which applies to each type of non-standard network shall then be specified in this section.

This section shall also specify how the system capacity for small IES EG connections on different strata titles, but at the same network connection point (e.g. retirement villages), are to be treated. That is, whether they are to be treated as individual small IES EG connections or whether the connection type is to be defined by the capacity at the connection point.

Where the DNSP reduces the maximum system capacity setting from their current setting for any of the subcategories, they shall include this as a deviation in Appendix A and provide a justification accordingly.

4.3 Generation Control

This section shall specify that small IES EG connections require generation control.

4.3.1 Export Limits at Connection Point

This section shall specify the export limits of small IES EG connections for each subcategory consistent with the below:

1. Single-phase small IES EG connection – For single-phase small IES EG connections of IES , the export limit shall be set to equal 5 kVA at the connection point. For some regions, particularly rural areas, the export limit may be set to less than 5 KVA
2. Three-phase small IES EG connection – For three-phase small IES EG connections of IES , the export limit shall be set to equal 5 kVA per phase with a balanced output with respect to its rating and a tolerance of no more than 5 kVA unbalance between any phases as per AS/NZS 4777.1 at the connection point
3. Non-standard small IES EG connection – For non-standard small IES EG connections, a lower export limit or an option that avoids network augmentation may be specified. The lower export limit which applies to each type of non-standard network shall then be specified in this section. This section may also specify additional generation control requirements.

The export limit is to be interpreted as “soft”, consistent with the definition of soft export limits within AS/NZS 4777.1.

This section shall specify that the export limit is to be interpreted by the proponent as a maximum. The ability of the proponent’s small IES EG system to export at the export limit is not guaranteed, but rather, it will depend upon network characteristics which change over time. This section shall describe those scenarios where output may need to be constrained including, but not limited to inverter power output where power quality response modes are in operation.

4.3.2 Site Generation Limit Downstream of Connection Point

Where the DNSP adopts a site generation limit, this section shall specify the site generation limits of the small IES EG connections for each subcategory consistent with the below:

1. Single-phase small IES EG connection – For single-phase small IES EG connections of IES , the site generation limit shall be set to equal 5 kVA downstream of the connection point
2. Three-phase small IES EG connection – For three-phase small IES EG connections of IES , the site generation limit shall be set to equal 5 kVA per phase with a balanced output with respect to its rating and a tolerance of no more than 5 kVA unbalance between any phases as per AS/NZS 4777.1 downstream of the connection point
3. Non-standard small IES EG connection – For non-standard small IES EG connections, a lower site generation limit downstream of the connection point or an option that avoids network augmentation may be specified. The lower site generation limit which applies to each type of non-standard network shall then be specified in this section. This section may also specify additional generation control requirements.

Where the DNSP does not have any site generation limit requirements for small IES EG connections, this section shall be retained, but noted as intentionally blank.

4.4 Inverter Energy System

This section shall state the requirements that apply to IES, including that:

1. IES shall be tested by an authorised testing laboratory and be certified as being compliant with AS/NZS 4777.2 with an accreditation number
2. IES shall comprise of inverters that are registered with CEC as approved grid connect or multiple mode inverters
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 as per AS/NZS4777.2
4. IES shall comprise of inverters installed in compliance with AS/NZS 4777.1

4.5 Network Connection and Isolation

This section shall specify that network connection and isolation requirements shall be as per AS/NZS 4777.1.

In addition, this section may provide further specificity, including, but not limited to:

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

Any requirements that are additional to AS/NZS 4777.1 and AS/NZS 3000 shall be clearly stated as such.

4.6 Earthing

This section shall specify that the earthing requirements shall include:

1. For IES, earthing requirements shall be as per AS/NZS 4777.1 and AS/NZS 3000
2. For ESS, earthing requirements shall be as per AS 3011.

4.7 Protection

This section shall specify that protection requirements shall be as per AS/NZS 4777.2.

4.7.1 Inverter Integrated Protection

This section shall specify that inverter integrated protection requirements shall be as per AS/NZS 4777.1 and AS/NZS 4777.2 for small IES EG connections.

This section shall further specify the passive anti-islanding requirements using voltage and frequency limits as per AS/NZS 4777.2 and shall reproduce Table 4.1 and 4.2 of AS/NZS 4777.2 and specify the regional settings. DNSPs may depart from the set point values included in Table 4.1 and 4.2 of AS/NZS 4777.2 but should clearly nominate where this is the case.

This section shall also specify active anti-islanding protection and its requirements as per AS/NZS 4777.2.

4.7.2 Central Protection

This section may be not required for small IES EG connection. Where central protection is required, this section shall include set points for voltage and frequency parameters in conformance with AS/NZS 4777.1.

4.7.3 Interlocking

This section shall specify that where multiple single-phase inverters are connected to more than one phase, either of the following requirements will apply:

1. Single-phase inverters are to be interlocked and configured to operate as an integrated multi-phase inverter providing a balanced output that is no more than 5 kVA between any phases as per AS/NZS 4777.1

   OR

2. 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 Operating Voltage and Frequency

This section shall specify that the operating voltage and frequency requirements can be found within the DNSP's technical requirements document in the section containing the Inverter Integrated Protection requirements.

This section shall specify the nominated maximum voltage set point, V_{nom_max} as per AS/NZS 4777.2.

This section shall also specify the voltage rise requirement as per Appendix F.2 (i) of AS/NZS 4777.1 and any jurisdictional requirements for voltage rise calculation.

4.9 Metering

This section shall not include any requirements for metering and shall be retained but noted as intentionally blank for DNSPs in jurisdictions subject to Chapter 7 of the NER.

This section may include requirements for jurisdictional metering for DNSPs in jurisdictions which are not subject to Chapter 7 of the NER.

4.10 Power Quality

4.10.1 IES Power Quality Response Modes

This section specifies where power quality response modes required as per AS/NZS 4777.2.

This section shall state the regional settings according to AS/NZS 4777.2 region A,B and C. If there are any variations, volt-var and volt-watt response shall be set according to DNSP requirement.

This section may specify that where an additional small IES EG unit is being added to a site with an existing small IES EG connection that has legacy power quality settings, the DNSP may provide site-specific voltage response mode settings.

This section shall specify whether there are ramping requirements of the IES as per AS/NZS 4777.2, where a site generation limit is applied for generation control.

4.11 Communications Systems

Where DNSPs have communications systems requirements for small IES EG connections, this section shall specify the communications systems requirements that proponents should adopt for small IES EG connections with reference to other requirements. That is, communications systems requirements may be recommended, but not imposed by the DNSP for small IES EG connections.

This section may specify communications systems requirements for non-standard small IES EG connections.

Where the DNSP does not yet have any communications systems requirements for small IES EG connections, this section shall be retained, but noted as intentionally blank.

4.12 Data and Information

4.12.1 Static Data and Information

This section shall specify the static data and information that is required to be provided by the proponent to the DNSP as per Appendix D: Static Data and Information.

This section may specify the format and method for transmitting static data but shall not impose any additional communications systems requirements.

4.12.2 Dynamic Data and Information

This section may specify the requirements for transmitting dynamic data and information to the DNSP and any other bodies, which proponents shall adopt where communications systems are in place.

Where the DNSP does not yet have any communications systems requirements for small IES EG connections, this section shall be retained, but noted as intentionally blank.

4.13 Cybersecurity

Where DNSPs have communications systems requirements for small IES EG connections, this section shall specify the cybersecurity requirements including but not limited to:

1. Ensuring monitoring and communications devices are in 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.

This section may specify the relevant standards and documents relating to cybersecurity.

Where the DNSP does not yet have any communications systems requirements for small IES EG connections, this section shall be retained, but noted as intentionally blank.

4.14 Technical Studies

This section shall state that no technical studies are required to be carried out by the proponent or at the proponent's expense to enable connection to the distribution network.

This section may state that technical studies may be performed by the DNSP at the DNSP's cost, but that the outcomes of the technical studies shall not result in any change to the technical requirements for small IES EG connections.

5 Fees and Charges

This section shall specify fees and charges applicable to proponents and any jurisdictional requirements including, but not limited to:

1. The types of connection fees that shall be applied
2. Any ongoing charges applicable regarding the installation and operation of the generating unit while maintaining the connection to the distribution network and how these are determined
3. The fees payable and/or how the fees are determined
4. How the fees are to be paid by the proponent.

This section may provide hyperlinked website addresses with short descriptions where information is published separately on the DNSP's website.

6 Testing and Commissioning

This section shall state that testing and commissioning shall be undertaken in accordance with AS/NZS 4777.1, AS/NZS 3000 and AS/NZS 5033 (where applicable), the equipment manufacturer's specifications, and the DNSP's technical requirements to demonstrate that the small IES EG system meets the requirements of the connection agreement.

This section shall specify that the tests shall be installation tests not type tests.

7 Operations and Maintenance

This section shall state that small IES EG systems should be operated and maintained to ensure compliance with their connection agreement and all legislation, codes, and/or other regulatory instruments at all times.

This section shall state that the DNSP may inspect small IES EG systems at any time at the DNSP's expense.

This section may also describe the general expectations for operating and maintaining small IES EG systems including, but not limited to:

1. Maintaining the electrical installation at the supply address in a safe condition
2. Ensuring that any changes to the electrical installation at the supply address are performed by an electrician lawfully permitted to do the work and that the customer holds a Certificate of Compliance issued in respect of any of the changes
3. Seeking DNSP approval prior to altering the connection in terms of an addition, upgrade, extension, expansion, augmentation or any other kind of alteration, including changing inverter settings
4. How the DNSP proposes to respond to non-complying small IES EG systems
5. Inverter replacement requirements.

Appendix A: Deviations from the National DER Connection Guidelines

This appendix shall include a register of all deviations from this technical guideline in the format provided in Table 1.

Table 1 Table of Deviations from National DER Connection Guidelines

Section	Description of deviation	Type of deviation	Justification
{Section of this technical guideline document to which the deviation applies}	*{High level description of the deviation}*	*{Nominates whether the deviation is to meet a jurisdictional requirement or is to promote improved benefits to Australia's electricity system}*	*Justification {Either N/A where the deviation is to meet a jurisdictional requirement or provides link to justification documentation}*

Appendix B: Connection Arrangement Requirements

This appendix shall include:

1. Single line diagrams of the DNSP's preferred connection arrangements, and a range of other possible connection arrangements for integration of small IES EG connection, showing:
    a) the connection point
    b) the point of common coupling
    c) the EG unit(s)
    d) load(s)
    e) meter(s)
    f) isolation device.
2. A sample schematic diagram of the protection system and control system relevant to the connection of a small IES EG unit to the distribution network, showing the protection system and control system, and including:
    a) All relevant current circuits
    b) Relay potential circuits
    c) Alarm and monitoring circuits
    d) Back-up systems
    e) Parameters of protection and control system elements.

Appendix C: Model Standing Offer

In jurisdictions subject to Chapter 5A of the NER, this section shall include the AER approved model standing offer for small IES EG connections.

In jurisdictions not subject to Chapter 5A of the NER, this section shall include an equivalent model offer used as the basis to form a connection agreement with proponents of small IES EG connections.

The model standing offer (or equivalent) shall be entirely consistent with the technical requirements document.

This section may provide hyperlinked website addresses with short descriptions where information is published separately on the DNSP's website.

Appendix D: Static Data and Information

This appendix shall include the static data and information that is required to be provided by the proponent to the DNSP, including as a minimum:

1. NMI meter numbers (10 digit)
2. DER Devices
    a) Fuel source – primary {renewable/biomass/waste; fossil; hydro; geothermal; solar; wave; wind; tidal; storage}
    b) Fuel source – descriptor {as per appendix 8 of the NEM Generator registration guide}
    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 registered for ancillary service provision (Y/N)
    h) Whether the device is part of an aggregated control (Y/N)
    i) Whether the device is remotely controllable (Y/N)
    j) Compliance with Australian Standards
3. Inverter
    a) Make, model and manufacture
    b) Whether the installer has changed the inverter default manufacturer settings (Y/N)
    c) Maximum capacity (kW and kVA)
    d) Date of installation
    e) Compliance with Australian Standards
4. Inverter enabled modes of operation
    a) Demand response modes enabled and enablement method
    b) Power quality modes {power response (frequency control); voltage response (voltage-watt or voltage-var); Q (reactive power), PF (power factor); standalone}
5. Trip settings
    a) Frequency trip settings {none, over-frequency, under frequency}
    b) Voltage trip settings {none, over-voltage, under-voltage}

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