

# Low Voltage Embedded Generation Technical Requirements

Record Number: R0002006770

Version Number: 1.2

Date: June 2025



# Contents

<b>Disclaimer</b>	<b>4</b>
<b>1 Introduction</b>	<b>5</b>
1.1 Scope	6
1.2 Proponent Responsibilities	6
1.3 TasNetworks' Responsibilities	7
1.4 Responsibilities of Designers, Consultants and Installers	7
<b>2 Definitions and abbreviations</b>	<b>8</b>
2.1 Definitions	8
2.2 Abbreviations	10
2.3 Terminology	11
2.3.1 Subcategories	11
<b>3 Relevant rules, regulations, standards and codes</b>	<b>13</b>
3.1 TasNetworks' standards	13
3.2 Standards and codes	13
3.3 Legislation and regulation	14
3.4 Operating limits	14
3.4.1 Standard Operating Voltages	15
<b>4 Technical Requirements</b>	<b>16</b>
4.1 Labelling and Signage	16
4.2 Maximum System Capacity	16
4.3 Generation Control	17
4.3.1 Export Limits at Connection Point	17
4.3.2 Site Generation Limit Downstream of Connection Point	17
4.4 Inverter Energy System	18
4.5 Network Connection and Isolation	18
4.6 Earthing	19
4.7 Protection	20
4.7.1 Inverter Integrated Protection	20

4.7.2	Central Protection	21
4.7.3	Interlocking	24
4.7.4	Power Factor Control	25
4.7.5	Synchronisation	25
4.7.6	Additional Requirements for LV EG Non-IES	25
4.8	Operating Voltage and Frequency	25
4.9	Metering	26
4.10	Power Quality	27
4.10.1	Quality of Supply	27
4.10.2	LV EG IES Power Quality Response Mode	27
4.10.3	LV EG Non-IES Synchronous Power Quality Response	28
4.11	Communications Systems	28
4.11.1	LV EG IES Excluding ESS <200 kVA Communications Systems.	28
4.11.2	LV EG IES Excluding ESS >200 kVA Communications Systems	28
4.11.3	LV EG Non-IES Communications Systems	29
4.12	Data and Information	29
4.12.1	Static Data and Information	29
4.12.2	Dynamic Data and Information	29
4.13	TasNetworks' network isolation device	30
4.13.1	Live line work and operational switching	30
4.14	Cybersecurity	30
4.15	Technical Studies	31
<b>5</b>	<b>Fees and Charges</b>	<b>32</b>
<b>6</b>	<b>Testing and Commissioning</b>	<b>33</b>
6.1	General requirements	35
6.2	Testing and commissioning for IES EG systems	36
6.3	Testing and commissioning for non-IES EG systems	36
6.4	Non-compliance	36
<b>7</b>	<b>Operations and maintenance</b>	<b>36</b>
<b>Appendix A – Deviations from the National DER Connection Guidelines</b>		<b>38</b>
<b>Appendix B – Connection arrangement requirements</b>		<b>39</b>

<b>Appendix C – Model connection agreement</b>	<b>40</b>
<b>Appendix D – Static data and information</b>	<b>41</b>
<b>Appendix F – Asset Acceptance and Permission to Synchronise Certificate</b>	<b>42</b>
<b>Appendix G – Commissioning Certificate</b>	<b>44</b>

## Disclaimer

While we make every effort to ensure that this information and material is current and accurate, the information and material is provided to you on the understanding that:

1. This document has been prepared for the sole purpose of advising TasNetworks' access standards for embedded generation systems connecting to the Tasmanian distribution system, as required under Rules 5.3, 5.3A, 5.3AA and Chapter 5A of the National Electricity Rules.
2. Customers will seek verification and/or professional advice from an independent source before relying on or acting upon any of this information and material; and
3. We are not liable or responsible in any way for any actions taken by a proponent based on this document which are not within the purpose described above.

Please note that approval from us to connect a *generating system* to our distribution network is only an acknowledgement that the embedded *generating system* is suitable to be connected to our distribution network at the location requested at the time of your application. Our approval does not in any way indicate, guarantee, or approve that customers are or will be eligible to receive payments, credits or other forms of entitlements from any government or retailer sponsored energy feed-in rebate schemes. Customer eligibility should be determined with the relevant agencies responsible for the payment or provision of such entitlements.

## Revisions

Version	Comment
1.0	Original issue following ENA Connection Guideline format
1.1	Central protection updated for directional power protection requirements
1.2	Fixed reference in Section 4.15

We may amend and expand these requirements from time to time where it may be necessary to meet the requirements of the applicable regulations and to suit the needs of our distribution network.

# 1 Introduction

Tasmanian Networks Pty Ltd ABN 24 167 357 299 (TasNetworks) is a state government owned network service provider.

The purpose of this technical requirements document is to provide TasNetworks' customers and the designers, consultants and installers of Low Voltage (**LV**) Embedded Generation (**EG**) systems information about their obligations for connection to and interfacing with the distribution network.

An LV EG connection is a network connection for which the EG system is:

1. A network connection that typically has a system capacity of less than 500 kW,
2. Connected to, and capable of operating in parallel with, any part of the LV distribution network
3. Meeting all other technical requirements set out in this document
4. Is not a Basic Micro Low Voltage EG system as defined in the Basic Micro EG Technical Requirements<sup>1</sup>
5. Is not a MV EG system as defined in the MV EG Technical Requirements

As the licensed Distribution Network Service Provider (**DNSP**) and Transmission Network Service Provider (**TNSP**) in Tasmania, TasNetworks must meet a number of legal and regulatory obligations in relation to the safety, reliability and quality of power supply made available to Network Users.

As part of its obligations, TasNetworks must ensure that the connection of embedded generation within the distribution network does not have an adverse impact on existing Customers or on operation of the network more generally.

To achieve this, TasNetworks requires that embedded generating systems proposing to connect to the distribution network, satisfy certain technical design and performance criteria. The technical requirements to be met by generating systems are called Access Standards. Access standards are provided for a range of technical issues that impact TasNetworks' obligations as a DNSP.

---

<sup>1</sup> TasNetworks Basic Micro EG Connection Technical Requirements and MV EG Connection Technical Requirements can be found on [TasNetworks' website](#).

## 1.1 Scope

This technical requirements document applies to:

1. New connections of LV EG systems or modifications to existing LV EG systems, where the LV EG connection consists of Inverter Energy System (**IES**), synchronous rotating generator systems, asynchronous rotating generator systems, Energy Storage System (**ESS**) or any combination of these to TasNetworks' LV distribution network, and
2. Temporary connected LV EG systems

This technical requirements document does NOT apply to:

1. EG units covered by TasNetworks' Basic Micro EG Connection Technical Requirements,
2. EG units covered by TasNetworks' MV EG Connection Technical Requirements,
3. Electric vehicles, unless the on-board battery storage system is capable of exporting to the LV network (in which case the requirements shall apply).
4. DER systems that do not generate electricity including demand response / demand management systems, unless they impact on the ability of the LV EG system to meet these technical requirements
5. EG units that are registered within the NEM
6. EG units directly connected to the transmission network

## 1.2 Proponent Responsibilities

Proponents of EG systems are obliged to:

1. Comply with these technical requirements as well as relevant national standards, industry codes, legislation and regulations. In the event of inconsistency, legislation and regulations shall prevail, followed by the technical requirements, followed by national standards and industry codes. Any apparent conflict between the requirements of this standard and the law, mandatory requirements, industry standards, project specifications, non-statutory standards or guidelines, and any other associated documents should be brought to the immediate attention of TasNetworks, in writing, for resolution.
2. Not to connect additional inverters, make modifications or install additional LV EG units, including ESS, without prior written agreement from TasNetworks.
3. Comply with the TasNetworks' connection agreement (Electricity Supply Contract).
4. To meet the requirements in the design, installation and operation of the LV EG system.
5. To meet the connection, commissioning, operations and maintenance requirements to the LV distribution network
6. Provide written evidence illustrating compliance with these requirements in accordance with Sections 4.15 and 6 of this document.



### 1.3 TasNetworks' Responsibilities

TasNetworks acknowledges its obligation to ensure the safe and reliable operation of the distribution system for operating personnel, customers and the general public.

As the licenced entity under the *Electricity Supply Industry Act 1995* TasNetworks is responsible for ensuring that generators connected to its distribution system meet the requirements placed upon generators in the Tasmanian Electrify Code (TEC) and the NER.

TasNetworks has established procedures in place to process requests for generating unit connections to its distribution network. TasNetworks reserves the right to disconnect any generating system if it is causing a negative impact on other network customers or does not comply with the requirements outlines in these technical requirements.

These technical requirements comply with the National DER Connection Guidelines for LV EG Connections<sup>2</sup>, with the exception of the deviations presented in Appendix A: Deviations from the National Distributed Energy Resources (DER) Connection Guidelines.

### 1.4 Responsibilities of Designers, Consultants and Installers

As stated above, the content of this document is also relevant to the designers, consultants and installers of LV EG systems. It is expected that many Proponents will engage designers, consultants and installers to assist them to install LV EG systems, which includes meeting the technical requirements set out in this document.

TasNetworks also notes that designers, consultants and installers of LV EG systems, as people who work on electrical installations, may have other obligations and licensing requirements that they must meet under law in relation to electrical works. This document only sets out TasNetworks' technical requirements for the LV EG system – it is not a comprehensive guide to all legal and technical requirements for electrical work in respect of the system.

---

<sup>2</sup> The National DER Connection Guidelines for LV EG Connections can be viewed on the [Energy Networks Australia website](#).

## 2 Definitions and abbreviations

### 2.1 Definitions

Access Standard	Has the same meaning given it by the NER.
Basic micro 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.
Central protection	Central protection is the protection contemplated by AS/NZS 4777 (grid connection of energy systems via inverters) installed to perform the functions of: coordinating multiple inverter energy system installations at one site, providing protection for the entire inverter energy system installation and islanding protection to the connected grid as well as preserving safety of grid personnel and the general public.
Connection point (this may also sometimes be referred to as the "Point of Supply")	Has the same meaning given it by the NER. The connection point is the agreed point of supply between TasNetworks' distribution network and an electrical installation.
Distributed Energy Resources ( <b>DER</b> )	Power generation or storage units that are connected directly to the distribution network.
Embedded generating unit	A <i>generating unit</i> connected within a distribution network and not having direct access to the transmission network.
Embedded generating system	A <i>generating system</i> that is connected to the distribution network referred to in this document also as "EG System".
Energy storage system ( <b>ESS</b> )	A system comprising one or more batteries that store electricity generated by distributed energy resources or directly from the network, and that can discharge the electricity to loads.
Generating System	A system comprising of one or more <i>generating units</i> . A <i>generating system</i> includes auxiliary or reactive plant that is located on the <i>generator's</i> side of the <i>Connection Point</i> which may be necessary for the <i>generating system</i> to meet its registered performance standards and/or any other technical requirements included in the <i>Generator's Connection agreement</i>
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.
High Voltage	Voltages within the range of 66 kV to 220 kV
Inverter Energy System ( <b>IES</b> )	A system comprising one or more inverters that convert direct current to alternating current.
Low voltage	The mains voltages as most commonly used in any given network by domestic and light industrial and commercial consumers (230 V line-neutral or 400 V line-line).
Medium voltage	Voltages within the range of 1 kV to 66 kV.

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).
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 basic micro 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.
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 Australian Energy Market Operator ( <b>AEMO</b> ) as a Generator under Chapter 2 of the National Electricity Rules.
Registered generator connection	A connection of a generating unit by a registered generator.
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.
Standard connection	A connection of embedded generating unit which is not basic and for which a model standing offer is in place.
TasNetworks	Reference to TasNetworks, us, we or our in these requirements is a reference to TasNetworks in its capacity as the owner and operator of the regulated distribution network in Tasmania, unless an alternative meaning is explicitly given in the text.

## 2.2 Abbreviations

<b>AEMO</b>	Australian Energy Market Operator
<b>AS/NZS</b>	A jointly developed Australian and New Zealand Standard
<b>CEC</b>	Clean Energy Council
<b>DER</b>	Distributed Energy Resources
<b>EG</b>	Embedded Generation or Embedded Generating
<b>EMT</b>	Electromagnetic Transient (simulation model)
<b>ESS</b>	Energy Storage System
<b>HV</b>	High Voltage
<b>IEC</b>	International Electro-technical Commission
<b>IES</b>	Inverter Energy System
<b>JOP</b>	Joint Operating Procedure
<b>LV</b>	Low Voltage
<b>MV</b>	Medium Voltage
<b>NEM</b>	National Electricity Market
<b>NER</b>	National Electricity Rules
<b>NMI</b>	National Metering Identifier
<b>PPC</b>	Power Park Controller
<b>PV</b>	Photovoltaic

## 2.3 Terminology

The following instructional terms are to be interpreted as follows:

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

### 2.3.1 Subcategories

The following subcategories apply for LV EG connections:

1. **LV EG IES (excluding ESS) connection  $\leq 200$  kVA** – Any LV EG system, that is not a basic micro EG system, with a total system capacity less than or equal to 200 kVA for a single-phase or three-phase IES (excluding ESS) network connection, meeting all relevant technical requirements for LV EG connections set out in this technical requirements document. Further subcategorised by:
  - a. Exporting, or
  - b. Non-exporting.
2. **LV EG IES (excluding ESS) connection  $> 200$  kVA** – Any LV EG system, with a total system capacity greater than 200 kVA and less than or equal to 500 kVA<sup>3</sup> for a three-phase IES (excluding ESS) network connection, meeting all relevant technical requirements for LV EG connections set out in this technical requirements document. Further subcategorised by:
  - a. Exporting, or
  - b. Non-exporting
3. **LV EG non-IES connection** – Any LV EG system, that is synchronous or asynchronous, with a total system capacity greater than 0 kVA and less than or equal to {500 kVA<sup>3</sup>} for a single phase or three-phase network connection, meeting all relevant technical ENA DOC 040-2019 15 requirements for LV EG connections set out in this document. Further subcategorised by:
  - a. Exporting, or
  - b. Non-exporting.

---

<sup>3</sup> The maximum LV system capacity allowed for connection to the LV network is an indicative value above which a Proponent is likely to require a connection to the MV / HV network. Proponents wishing to connect a system between 500 kVA and 2000 kVA should contact TasNetworks to determine whether an LV EG connection is appropriate.

Where:

1. The Exporting systems shall be considered to be LV EG systems operating in parallel with the LV distribution network and exporting electricity either via partial-export or full-export into the LV distribution network, where:
  - a. Partial-export LV EG systems limit the amount of export into the LV distribution network to an agreed export threshold defined in the connection agreement, and
  - b. Full-export LV EG systems can export into the LV distribution network to the full LV EG nameplate capacity (full AC rating).
2. Non-exporting systems shall be considered to be LV EG systems operating in parallel with the LV distribution network that are not approved to and limited to ensure they cannot export electricity into the LV distribution network.

The technical requirements set out in these guidelines should be interpreted as applying to all subcategories of LV EG connections unless otherwise specified.

For all enquiries relating to network connections please contact:

[newsupply.applications@tasnetworks.com.au](mailto:newsupply.applications@tasnetworks.com.au)

Further information is available on the [Embedded Generation](#) page of the TasNetworks website.

## 3 Relevant rules, regulations, standards and codes

### 3.1 TasNetworks' standards

R0001177235	Embedded Generation Anti-Islanding Standard <sup>4</sup>
R000864164	Distribution Surge Diverters
R000522696	Surge Arrester Standard

### 3.2 Standards and codes

The following Australian and international standards and industry codes shall apply to the design, manufacture, installation, testing and commissioning, and operation and maintenance of all plant and equipment for LV EG connections to TasNetworks' distribution network:

AS/NZS 4777.1	Grid connection of energy systems via inverters Part 1: Installation requirements
AS/NZS 4777.2	Grid connection of energy systems via inverters Part 2: Inverter requirements
AS/NZS 3000	Electrical Installations (Wiring Rules)
AS/NZS 5139	Electrical Installations – Safety of battery systems for use with power conversion equipment
AS/NZS 5033	Installation and safety requirements for photovoltaic ( <b>PV</b> ) arrays
AS/NZS 61000	Electromagnetic Compatibility
AS/NZS 2373	Electric Cables
AS/NZS 3010	Electrical Installations – Generating sets
AS/NZS 3008	Electrical installations - Selection of cables - Cables for alternating voltages up to and including 0.6/1 kV
AS 60038	Standard Voltages
AS 2067	Substations and high voltage installations exceeding 1 kV
AS 2184	Low voltage switchgear and control gear
AS 2374	Power Transformers

---

<sup>4</sup> Available online at <https://www.tasnetworks.com.au/config/getattachment/1306d7f9-2a6d-4a83-9bae-7eb075e1b0c5/Embedded-Generation-Anti-Islanding-Standard.pdf>

AS 60034.1	Rotating electrical machines, Part 1: Rating and performance
AS 60034.22	Rotating electrical machines, Part 22: AC generators for reciprocating internal combustion ( <b>RIC</b> ) engine driven generating sets
AS 60044	Instrument transformers (multiple parts)
IEC 60255-12	Electrical relays - Part 12: Directional relays and power relays with two input energizing quantities
IEC 60255-26	Electrical relays - Part 26: Electromagnetic compatibility requirements
IEC 60255-27	Electrical relays - Part 27: Product safety requirements
IEC 60255-127	Measuring relays and protection equipment - Part 127: Functional requirements for over/under voltage protection
IEC 62109	Safety of power converters for use in photovoltaic power systems
IEC 62116	Utility-interconnected photovoltaic inverters – Test procedure of islanding prevention measures
AS 1359	General Requirements for Rotating Electrical Machines
AS 2006	Diesel Generators/internal combustion engines
AS 4509	Stand-alone power systems, Parts 1,2,3

### 3.3 Legislation and regulation

The following legislation and regulations shall apply to the technical requirements for design, manufacture, installation, testing and commissioning, and operations and maintenance of all plant and equipment for LV EG connections to the distribution network:

- National Electricity Rules
- National Electricity (Tasmania) Law
- Electricity Supply Industry Act 1995
- Tasmanian Electricity Code

Other legislation also applies in relation to licensing and performance of electrical work, such as the Occupational Licensing Act 2005 (Tas) and regulations. This document deals only with the technical requirements of the LV EG System itself.

### 3.4 Operating limits

Specific operating limits applicable to the Tasmanian power system that proponents of LV EG Systems should be aware of include the standard operating voltage ranges for LV (and MV) connections as shown in Table 1. **Error! Reference source not found.**



### 3.4.1 Standard Operating Voltages

Table 1: Standard operating voltage ranges for Tasmania as defined by the TEC

Voltage level (kV)	Voltage range for time periods		
	Steady state (average over 10 minute period)	Less than 1 minute	Less than 10 seconds
< 1.0	Refer to: AS 61000.3.100 Section 5.1	$\pm 10 \%$	Phase to earth 0 % - 150 %  Phase to phase 0 % - 130 %
1-6.6  11  22	AS 61000.3.100 Section 5.2	$\pm 10 \%$	Phase to earth 0 % - 180 %  Phase to phase 0 % - 130 %
33  44  66	AS 61000.3.100 Section 5.2	$\pm 15 \%$	Phase to earth 0 % - 150 %  Phase to phase 0 % - 130 %

For the latest version please check the following link:

<http://www.economicregulator.tas.gov.au/electricity/regulatory-framework/codes/tasmanian-electricity-code-downloads>

#### 3.4.1.1 Lighting Protection and Surge Arrestors

The LV EG System shall have appropriate mitigation measures installed to protect their *generating system* and *plant*. The proponent shall install appropriate lightning protection and surge arrestors to prevent damage and/or failure as a result of any system disturbances, as per TasNetworks' requirements established in the relevant standards.

Sr. No.	Parameter	Unit	Value					
1	Nominal system voltage ( $V_n$ )	kV	6.6	11	22	33	110	220
2	Rated voltage	kV	7.2	12	24	36	123	240
3	Power frequency withstand voltage	kV <sub>rms</sub>	20	28	50	70	230	460
4	Lightning impulse withstand voltage	kV <sub>peak</sub>	60	75	125	170	550	1050
5	Normal voltage variation (criteria for equipment design)	% $V_n$	$\pm 10$					

## 4 Technical Requirements

### 4.1 Labelling and Signage

The labels and signs on the installation, including cables, shall be as per AS/NZS 4777.1, AS/NZS 3000 and AS/NZS 5033.

### 4.2 Maximum System Capacity

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

1. LV EG IES (excluding ESS) connection  $\leq 200$  kVA – For LV EG connections of IES (excluding ESS), the maximum system capacity at the same connection point shall be set to less than or equal to 200 kVA
2. LV EG IES (excluding ESS) connection  $> 200$  kVA – For LV EG connections of IES (excluding ESS), the maximum system capacity at the same connection point shall be determined at the time of application but shall typically be greater than 200 kVA and less than or equal to 500 kVA.
3. LV EG non-IES connection – For LV EG connections of non-IES, the maximum system capacity shall be determined at the time of application but shall typically be greater than 0 kVA and less than or equal to 500 kVA.

## 4.3 Generation Control

LV EG connections require generation control.

### 4.3.1 Export Limits at Connection Point

The necessity of export limits for LV EG connections will be assessed on a case by case basis. Where an export limit is required or requested by the proponent, it shall be determined by TasNetworks at the time of the connection application.

The factors that will be considered when determining an export limit include, but is not limited to:

1. Existing asset ratings,
2. Existing power quality at the relevant network location, and
3. Existing and forecast DER penetration at the relevant network location.

Any export limit is to be interpreted as “soft”, a limit that will cause the IES or non-IES to reduce its output, preventing ongoing export greater than the limit.

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

TasNetworks will accept that an export limit is effectively established where the system capacity of a generating system (including ESS) is less than the required export limit.

### 4.3.2 Site Generation Limit Downstream of Connection Point

This section is intentionally blank – TasNetworks does not consider site generation limits downstream of a connection point.

## 4.4 Inverter Energy System

Where an LV EG connection incorporates an IES, the following requirements apply:

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. The following version of AS/NZS 4777.2 shall be used:
  - a. If the inverter is commissioned on or after 18 December 2021 it must comply with AS/NZS 4777.2: 2020.
  - b. If the inverter is commissioned prior to 18 December 2021 it must comply with either AS/NZS 4777.2: 2015 or AS/NZS 4777.2: 2020.
2. IES shall comprise of inverters that are registered with CEC as approved grid connect 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.
5. IES shall comprise of inverters that have both volt-var and volt-watt response modes available.

## 4.5 Network Connection and Isolation

The following connection and isolation requirements apply to all LV EG subcategories:

1. Network connection and isolation requirements shall be as per AS/NZS 4777.1<sup>5</sup> and AS/NZS 3000;
2. TasNetworks will install an isolation device upstream of the connection point to allow the generating system to be separated from the shared network without need to enter the generators premises
3. As a minimum, the proponent must install a mechanical isolation device as per AS/NZS 3000 in that the isolator must always be readily accessible. The device must be made accessible by TasNetworks upon request.
4. Any means of isolation (where lockable) shall be able to be locked in the open position only. This requirement is in addition to the requirements of AS/NZS 4777.2 and AS/NZS 3000.

---

<sup>5</sup> The isolation requirements in AS/NZS 4777.1 shall apply to LV EG IES connections greater than 200 kVA and non-IES connections even though AS/NZS 4777.1 currently only applies to IES systems less than or equal to 200 kVA.

5. The requirements for multimode IES shall be determined by TasNetworks at the time of the connect application
6. The network connection and isolation requirements for non-IES connections shall be determined by TasNetworks at the time of the connection application stage.

## 4.6 Earthing

The following earthing requirements apply:

1. IES less than or equal to 200 kVA have earthing requirements as per AS/NZS 4777.1 and AS/NZS 3000.
2. IES greater than 200 kVA have earthing requirements as per AS/NZS 4777.1 and AS/NZS 3000 (although AS/NZS 4777.1 currently only applies to IES systems less than or equal to 200 kVA).
3. Non-IES shall be earthed as per AS/NZS 3000 and AS/NZS 3010.
4. ESS shall have earthing requirements as per AS 3011.
5. For PV systems, earthing requirements shall be as per AS/NZS 5033.

TasNetworks permits the LV EG system to provide a path for zero sequence currents. Depending on the size and type of generating system, this may require fault levels and earth grid designs in proximity to the proposed connection point to be reviewed as part of the connection process.

Where a generating system can be operated within an electrical island separated from the distribution network, the generating system must be installed with an earthing system that can provide adequate earthing independent of that normally provided by the distribution network.

## 4.7 Protection

To ensure safe and reliable operation of the distribution network, appropriate protection must be fitted by embedded generating systems.

In the design of protection schemes, consideration must be given to the requirements of the generating system, the network in the vicinity of the connection point, and the protection schemes that are already in place within the broader distribution network.

Communication and negotiation with TasNetworks will almost certainly be required to develop protection schemes that grade appropriately and provide adequate coverage (especially in the case of backup protection). It is important that the generating system's protection is able to identify and isolate all internal faults, and network faults beyond the connection point, as agreed with TasNetworks.

Although all embedded generating systems must meet certain minimum protection requirements, the level of protection required will depend on the specific nature of the embedded generation.

This section aims to provide clarification on the specific protection requirements for generating systems of different technologies and sizes.

### 4.7.1 Inverter Integrated Protection

Inverter integrated protection requirements shall be as per AS/NZS 4777.1 and AS/NZS 4777.2 for basic micro EG connections. Active anti-islanding protection is required as per AS/NZS 4777.2.

Passive anti-islanding functions shall be set according to the settings in 2 below, corresponding to the 'Australia Region C' settings of AS4777.2:2020 standard.

Table 2: Mandatory passive anti-islanding settings.

Protective function	Protective function limit	Trip delay time	Maximum disconnection time
Under-voltage 2 ( $V_{<<}$ )	70 $V_{rms}$	1 s	2 s
Under-voltage 1 ( $V_{<}$ )	180 $V_{rms}$	10 s	11 s
Over-voltage 1 ( $V_{>}$ )	265 $V_{rms}$	1 s	2 s
Over-voltage 2 ( $V_{>>}$ )	275 $V_{rms}$	-	0.2 s
Under-frequency ( $f_{<}$ )	45.0 Hz	5 s	6 s
Over-frequency ( $f_{>}$ )	55.0 Hz	-	0.2 s

## 4.7.2 Central Protection

Central protection requirements that apply will be as per AS/NZS 4777.1 for all sized LV EG generators and non-IES generators, even though AS/NZS 4777.1 currently only applies to IES systems less than or equal to 200 kVA.

The central protection functions that apply to each subcategory of LV EG system are listed in Table 3 below. Further specification of each element is provided in the subsequent sections.

Table 3: Requirements for central protection in LV EG installations

Protection Requirements	LV EG IES				LV EG Non-IES	
	≤ 200 kVA		> 200 kVA			
	Exporting	Non-Exporting	Exporting	Non-Exporting	Exporting	Non-Exporting
Directional power (32R)	-	-	-	-	✓	-
Generator circuit						
Phase balance protection (46/47)	-	-	-	-	✓	✓
Overcurrent facility fault, grid fault and earth fault protection (50/51)	✓	✓	✓	✓	✓	✓
Passive anti-islanding protection (27U/O, 59U/O, 81U/O, 81R)	✓	✓	✓	✓	✓	✓
Inter-tripping	x	x	-	-	-	-

Where the following symbols are used to denote protection requirements in Table 3 above:

- ✓ Represents that the protection shall be required
- Represents that the protection may be required
- x Represents that the protection shall not be required

#### 4.7.2.1 Directional Power Protection

Where rotating machines lose their supply of mechanical power, they will naturally transition into motoring mode and begin drawing active power from the network. It is recommended that rotating machines be installed with reverse power flow protection to disconnect under such conditions.

For all non-exporting LV EG Systems, forward power flow protection at the point of connection to trip non-exporting machines if they begin to export shall be required to be installed.

The directional power protection requirements are:

1. Directional power protection shall be set as low as practicable with consideration of auxiliary loading, protection relay accuracy, CT accuracy and generating system synchronisation characteristics; and
2. Design of control systems for non-IES shall minimise reverse power flow immediately following synchronisation.

The specific settings for directional power flow protection shall be determined via a connection specific technical assessment.

#### 4.7.2.2 Phase Balance Protection

All multi-phase IES systems shall have phase balance protection in place where not inverter integrated.

All Non-IES systems shall have both current unbalance and voltage unbalance protection.

#### 4.7.2.3 Current Unbalance Protection

Current unbalance protection at the connection point is required where not inverter integrated in an IES.

The following requirements apply to the current unbalance protection:

Table 4: Current unbalance protection requirements

Parameter	Setting
<b>Threshold of current unbalance</b> Maximum difference between any of the phase currents and the average value of phase currents (%)	5 %
<b>Minimum current limit</b> Minimum limit of measured current as a percentage of nominal current, from which the current unbalance protection is enabled (%)	10%
<b>Time delay</b> Delay of current unbalance protection (sec).	2 s



#### 4.7.2.4 Voltage Unbalance Protection

Voltage unbalance protection at the connection point is required for non-IES systems.

The specific settings for voltage unbalance protection will be determined via a connection-specific technical assessment.

#### 4.7.2.5 Overcurrent Facility Fault, Overcurrent Grid Fault and Earth Fault Protection

The requirements for overcurrent facility fault, overcurrent grid fault and earth fault protection shall be determined via a connection-specific technical assessment.

TasNetworks requires that any fault internal to the embedded *generating system* is identified and isolated from the distribution network as fast as is practical. This is to ensure that distribution protection does not operate unnecessarily, resulting in loss of supply to other *network users*. To detect internal faults, any reliable techniques may be used. These may include, but are not limited to:

1. Differential protection
2. Overcurrent protection
3. Earth fault protection (including sensitive earth fault (SEF))

LV EG Systems must attempt to grade the *generating system* protection with upstream protection with a clearance margin of 250 ms.

The generator must be capable of identifying and clearing high impedance phase to ground faults, internal to the *generating system*. Where the generator is connected to the network through a step-up transformer, protection of the generator side windings may be achieved through conventional earth fault protection methods and technologies. Discussion on protection of the network side of the transformer (or if the generator is connected directly to the distribution network) is discussed further below.

For synchronous and asynchronous rotating generators, the settings for the detection of faults external to the generating system will be determined by negotiation with TasNetworks. For IES connections, TasNetworks has no requirements for the detection of faults external to the generating system.

#### 4.7.2.6 Passive Anti-islanding Protection

Passive anti-islanding shall be implemented for LV EG connections using voltage and frequency limits set out in Table 5 below. Note that parameters marked (with \*) have deviated from the default value in Table 2 of AS/NZS 4777.1.

Table 5: Passive anti-islanding settings for LV EG IES connections > 30 kVA and LV EG Non-IES connections.

Protective function	Protection set point	Disconnection time
Sustained over voltage (V>) (based on average value over a period of 10 min)	255 V	15 s
Over-voltage (V>)	260 V <sub>rms</sub>	2 s
Under-voltage (V<)	180 V <sub>rms</sub>	2 s
Under-frequency(f<)	47.0 Hz	2 s
Over-frequency (f>)	53.0 Hz*	2 s

#### 4.7.2.7 Inter-tripping

Electrical islanding (in the distribution network) is the process where a sub-section of the network is disconnected from other sources of generation (through fault or other network switching events), but remains energised via embedded generating system(s) connected in the local area.

Two fundamental conditions must exist if a viable electrical island is to form:

1. The embedded generating system(s) can continue to operate as a voltage source without the normal network supply being present.
2. The load and generation in the islanded section of the network can achieve equilibrium such that load demand is balanced by generation capability.

For LV EG connections the requirements for inter-tripping will be determined on the outcomes of technical studies as per Table 3.

Please refer to TasNetworks' Embedded Generation Anti-Islanding Standard (see Section 3.1) for anti-islanding protection requirements.

### 4.7.3 Interlocking

Where multiple single-phase inverters are connected to more than one phase, 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 kW between any phases as per AS/NZS 4777.1.

#### 4.7.4 Power Factor Control

Power factor control may be required in some instances, and will be determined by TasNetworks through technical studies.

Non-IES LV EG utilising induction generators may be required to limit their reactive power consumption within a range determined during TasNetworks' technical studies.

#### 4.7.5 Synchronisation

Specific advice regarding connection and disconnection processes will be provided by TasNetworks following the outcome of the technical studies.

The connection and disconnection process for embedded generating systems should be performed, as far as practicable, in a way that minimises the impact on other network users.

The following automatic synchronising and synchronisation check requirements shall be required where it is intended that operation of any EG unit will occur:

1. LV EG IES connections shall comprise inverters with internal synchronisation facilities
2. LV EG rotating synchronous generators shall implement a synchronism check at the generator circuit breaker.
3. LV EG rotating asynchronous generators do not require synchronization facilities.

#### 4.7.6 Additional Requirements for LV EG Non-IES

Pole slip protection shall be required to be installed for synchronous LV EG Systems to disconnect the generating system upon detection of a loss of synchronism.

TasNetworks does not have any additional protection requirements for LV EG Non-IES connections.

### 4.8 Operating Voltage and Frequency

The operating voltage and frequency requirements can be found within section 4.7.1 Inverter Integrated Protection.

The long-term over voltage trip setting  $V_{nom\_max}$  shall be set as per the region "Australia C" of AS/NZS 4777.2:2020.

The voltage rise between the connection point and the IES terminals must be considered and limited as per Section 3.3.3 of AS/NZS 4777.1.

All LV IES EG systems must provide a response to an increase in grid frequency and ESS must provide a response to a decrease in frequency as per section 4.5.3 of AS/NZS 4777.2 region “Australia C”. The settings for these responses are listed in Table 6.

Table 6: Frequency variation withstand limits

Reference	Setting
Decrease in frequency response Lower limit	45 Hz
Lower limit of continuous operation range ( $f_{LLCO}$ )	49.5 Hz
Upper limit of continuous operation range ( $f_{ULCO}$ )	50.5 Hz
Increase in frequency response Upper limit	55 Hz

Table 7: Frequency response limits

Reference	Setting
Frequency where power output level is maximum ( $f_{Pmax}$ )	47 Hz
Frequency where charging power level is zero ( $f_{stop-ch}$ )	48.25 Hz
Frequency where discharging power level is zero ( $f_{transition}$ )	51.75 Hz
Frequency where power level is minimum ( $f_{Pmin}$ )	53 Hz
Frequency response commencement time	1 s
Frequency response completion time	10 s
Frequency response hysteresis margin ( $f_{hyst}$ )	0.05 Hz

## 4.9 Metering

TasNetworks no longer offers metering services for distribution connections. Refer to your Metering Coordinator for specific metering requirements.

For general metering requirements and NEM specific requirements, please refer to Chapter 7 of the NER.

## 4.10 Power Quality

### 4.10.1 Quality of Supply

LV EG connections shall comply with the applicable power quality requirements of the AS/NZS 61000 series as well as TasNetworks site specific requirements, The Tasmanian Electricity Code and licence conditions, including but not limited to:

1. Network voltage control
2. Voltage fluctuations and flicker
3. Harmonics
4. Voltage balance

### 4.10.2 LV EG IES Power Quality Response Mode

The power quality mode setting as specified in AS/NZS 4777.2:2020 for region “Australia C” are required to be implemented in all inverters of a LV EG system. These settings must not be changed without written approval from TasNetworks.

The following power quality response mode settings must be enabled in all new and replacement LV EG systems:

1. Volt-watt response (as per AS4777.2)
2. Volt-var response (as per AS4777.2)

The settings for these response modes in Table 8, Table 9, Table 10 and must be used:

Table 8: Mandatory volt-var response mode settings

Reference	Voltage (V)	Inverter reactive power level (Q) % of $S_{rated}$	direction
$V_{V1}$	215	44%	supplying vars
$V_{V2}$	230	0%	-
$V_{V3}$	240	0%	-
$V_{V4}$	255	60%	absorbing vars

Table 9: Mandatory volt-watt response mode settings

Reference	Voltage (V)	Inverter maximum active power output level (P) % of $S_{rated}$
$V_{W1}$	253	100%
$V_{W2}$	260	20%

Table 10: Mandatory volt-watt response mode settings for multi-mode inverters with energy storage when charging

Reference	Voltage (V)	$P_{\text{charge}} / P_{\text{rated-ch}}$
$V_{W1\text{-ch}}$	207	20%
$V_{W2\text{-ch}}$	215	100%

Settings must be programmed into each inverter and protected from unauthorised changes as per section 3.5 of AS/NZS 4777.2:2020

### 4.10.3 LV EG Non-IES Synchronous Power Quality Response

Synchronous LV EG Non-IES connections shall be designed and operated to adequately control real and reactive power output through either of the following power quality response modes:

1. Voltage control mode  
OR
2. Fixed power factor mode that shall require achieving a power factor operating window at the connection point.

The power quality response mode and settings shall be determined depending on the outcomes of technical studies.

## 4.11 Communications Systems

TasNetworks' preferred communications medium is point-to-point fibre optic for all protection, control and remote monitoring. Where the implementation of fibre is excessively expensive or impractical, it may be appropriate for another communications medium to be used.

Protection schemes that rely on communication links must provide continuous monitoring (of the communication link integrity) and trip the generating system in the event of a communications failure.

The communication protocol for remote monitoring will be of a suitable format to allow integration with TasNetworks' existing SCADA system which is based on DNP 3.0.

### 4.11.1 LV EG IES Excluding ESS <200 kVA Communications Systems.

This section is left intentionally blank.

### 4.11.2 LV EG IES Excluding ESS >200 kVA Communications Systems

For LV EG IES systems excluding ESS greater than 200 kVA, TasNetworks may require appropriate communication systems be in place for the purposes of monitoring and control. This will be determined following the submission of a connection application.

TasNetworks' preferred communications medium is point-to-point fibre optic for all protection, control and remote monitoring. Where the implementation of fibre is excessively expensive or impractical, it may be appropriate for another communications medium to be used.

Protection schemes that rely on communication links must provide continuous monitoring (of the communication link integrity) and trip the *generating system* in the event of a communications failure.

The communication protocol for remote monitoring will be of a suitable format to allow integration with TasNetworks' existing SCADA system which is based on DNP 3.0.

### 4.11.3 LV EG Non-IES Communications Systems

For LV EG non-IES systems, TasNetworks may require appropriate communication systems be in place for the purposes of monitoring and control. This will be determined following the submission of a connection application.

TasNetworks' preferred communications medium is point-to-point fibre optic for all protection, control and remote monitoring. Where the implementation of fibre is excessively expensive or impractical, it may be appropriate for another communications medium to be used.

Protection schemes that rely on communication links must provide continuous monitoring (of the communication link integrity) and trip the *generating system* in the event of a communications failure.

The communication protocol for remote monitoring will be of a suitable format to allow integration with TasNetworks' existing SCADA system which is based on DNP 3.0.

## 4.12 Data and Information

### 4.12.1 Static Data and Information

The static data and information that is required to be provided by the proponent to TasNetworks is as per Appendix D: Static Data and Information.

### 4.12.2 Dynamic Data and Information

TasNetworks may require that the following information be provided via a communication interface for all LV EG Systems where communication systems are determined to be required:

1. Generator and mains incomer circuit breaker status.
2. Analogue measurement of generator real and reactive power output with a measurement accuracy of at least  $\pm 2\%$ .
3. Analogue measurement of generator and connection point line-to-line voltage with a measurement accuracy of at least  $\pm 0.5\%$ .



4. Analogue measurement of current (amps) on each of the three phases at the connection point. Measurement must be fundamental RMS with an accuracy of  $\pm 1\%$ .

The above information shall be provided to TasNetworks at a maximum rate of once every 4 seconds. Power data should have a resolution of 0.1 MW or 0.1% of the generator capacity, whichever is lower, voltage data should have a resolution of 0.1 kV and current data should have a resolution of 1 A. Other performance requirements may be acceptable by negotiation with TasNetworks.

TasNetworks may forgo the requirements of this section for the LV EG System to provide some of the information outlined should it be available through TasNetworks' Network Isolation device as per Section 4.13.

### 4.13 TasNetworks' network isolation device

For LV EG Systems, TasNetworks may install an isolation device upstream of the *connection point* to allow the *generating system* to be separated from the shared network without need to enter the *generator's* premises. This device may be operated locally and will not be accessible by the *generator*. The device may be operated to disconnect the *generating system* during periods of planned maintenance (on the network), or for abnormal network configurations that may follow faults or emergencies (bush fires, storm events, road accidents etc.).

For all EG Systems, the *generator* shall also provide an isolation device capable of being locked in the 'open' position. The device must be made accessible by TasNetworks upon request.

#### 4.13.1 Live line work and operational switching

Some work performed by TasNetworks on its electrical assets is conducted under live-line operating conditions, which for safety reasons, requires the configuration of specific protection settings in certain network devices, e.g. sensitive earth fault protection. TasNetworks may also at times perform temporary switching operations during planned work resulting in the connection of the generating system to a non-approved distribution feeder.

TasNetworks requires the *generating unit* to be disconnected during such works.

### 4.14 Cybersecurity

The Proponent must take reasonable steps, which are in accordance with *good electricity industry practice*, to prevent *cyber security incidents* from affecting the EG System to the extent that such incidents could affect or reasonably be expected to affect TasNetworks' systems.



## 4.15 Technical Studies

The technical studies listed in Table 11 are required to be completed as part of the connection application.

Table 11: Technical Studies Required for LV EG Connections.

Technical Studies	LV EG IES				LV EG Non-IES	
	$\leq 200$ kVA		$> 200$ kVA			
	Exporting	Non-Exporting	Exporting	Non-Exporting	Exporting	Non-Exporting
Voltage level (incl. power factor)	-	-	✓	-	✓	✓
Power flow	-	-	✓	-	✓	✓
Fault level	-	-	✓	-	✓	✓
Protection grading	-	-	✓	-	✓	✓
Power Quality Performance	-	-	✓	-	✓	✓

Where the following symbols are used to denote protection requirements in Table 11 above:

✓ Represents that technical studies shall be required

– Represents that technical studies may be required

x Represents that technical studies shall not be required

TasNetworks will undertake all the studies as per Table 11, with the exception of Power Quality Performance. TasNetworks will provide the proponent further information specific to their proposed generating system and what inputs are required to complete these studies as part of the connection enquiry response. Typically, the proponent is expected to provide the following information to TasNetworks to undertake these technical studies:

- Proposed location of the generating system
- Type of generating system
- Generating system MW/MVA size
- Reactive Power/Power Factor capability of generating system
- Maximum fault current contribution
- Proposed connection arrangement to network

TasNetworks has an obligation to existing customers to ensure quality of supply is maintained. The proponent is expected to provide evidence of compliance against TasNetworks power quality requirements as part of the connection application prior to connection. TasNetworks power quality requirements will be provided to the proponent as part of the connection enquiry response. Upon request, TasNetworks may provide relevant network information to the proponent to complete this assessment. The following information must be provided by the proponent to TasNetworks:

- Harmonic emission performance of the generating system against TasNetworks requirements
- Flicker and rapid voltage change performance against TasNetworks requirements

## 5 Fees and Charges

Fees and charges applicable to the installation of your generating unit(s) may include:

### Application to connect fee:

We may request an application fee from you to investigate:

- connection arrangements at your site - preliminary connection design (which includes as applicable the connection line, substation, provision of any engineering reports, protection, and communications);
- studies of our network to determine if any network construction is required (which may include an any impacts on our transmission network);
- liaising with AEMO to ensure there are no power system impacts; and
- preparation of our offer to connect and connection contract.

### Customer contribution

This is a 'once off' cost to cover all reasonable costs incurred by us in undertaking the scope of works as identified within the negotiated offer to connect your generating unit to the distribution network and includes:

- the provision, installation and commissioning of your generating units dedicated connection assets such as transformers; and
- any network extension assets; and
- any network augmentation required to facilitate your generating unit's connection such as reinforcement of the existing network, including any protection; and
- any design, project management and implementation costs incurred to facilitate the connection of your generating unit.

This charge will be calculated in accordance with our Distribution Connection Pricing Policy available on our website.

### Avoided TUoS

You may be eligible for payments for avoided Transmission Use of System usage charges (avoided TUoS). Clause 5.5(h) of the NER requires us to pass through to you any avoided charges for the locational component of prescribed transmission use of system services charges arising from your connection. Avoided TUoS is calculated and passed through retrospectively based on actual historic performance of your generation and the application of the published transmission cost allocation methodology and pricing methodology as approved by the Australian Energy Regulator.

TasNetworks does not guarantee that the connection of your generating unit(s) will necessitate the payment of avoided TUoS. Avoided TUoS payments will be confirmed, or otherwise, as part of the negotiations surrounding your connection.

### Connection service and management fee (where applicable)

This is an annual fee to cover all reasonable costs incurred by us in undertaking the following:

- routine maintenance and repairs of your connection assets including substation equipment specifically installed for your access to the distribution network (i.e. circuit breaker/recloser, protection equipment including inter-trip/radio communications equipment/telemetry interface relays/ SCADA RTU interface);
- maintenance planning / coordination with you;
- compliance monitoring of any interface protection in accordance with applicable regulations; and

connection contract management including periodic review of the contract to cover changes in industry practice in compliance with the NER and the TEC. Any costs applicable here will be detailed within your connection agreement.

## 6 Testing and Commissioning

The proponent shall provide TasNetworks no less than one months' notice prior to the commencement of energisation, commissioning and testing of the EG system.

TasNetworks will require at least two weeks to review documentation that verifies that the EG system is suitable for connection to our network. Documentation to be provided to TasNetworks shall be as per Table 12

The proponent shall also provide certification from the relevant regulatory authority that the EG system has been certified as electrically compliant and is safe for energisation. TasNetworks will not energise any connection until the proponent has demonstrated that it is safe to do so.

Table 12: Testing and Commissioning Requirements for LV EG Connections

Testing and commissioning requirements	LV EG IES				LV EG Non-IES	
	$\leq 200$ kVA		$> 200$ kVA			
	Exporting	Non-Exporting	Exporting	Non-Exporting	Exporting	Non-Exporting
Protection settings and performance	✓	✓	✓	✓	✓	✓
Power quality settings and performance	✓	✓	✓	✓	✓	✓
Export limits settings and performance	✓	✓	✓	✓	✓	✓
Communications settings and performance	-	-	✓	-	✓	✓
Shutdown Procedures	x	x	✓	-	✓	✓
Confirm system is as per specifications	✓	✓	✓	✓	✓	✓
Confirm SLD is located on site	✓	✓	✓	✓	✓	✓

Where the following symbols are used to denote protection requirements in Table 12 above:

- ✓ Represents that testing and commissioning shall be required
- Represents that testing and commissioning may be required
- x Represents that testing and commissioning shall not be required

TasNetworks may also require that the proponent demonstrate that the connection is safe to energise by obtaining the required signatures on the Asset Acceptance and Permission to Synchronise Certificate in Appendix F.

The connection process is completed once the required signatures for all fields of the Commissioning Certificate in Appendix G are obtained.

## 6.1 General requirements

Testing and commissioning shall only commence after the installation of metering, communications and distribution connection equipment required to facilitate the connection of the EG system.

The proponent shall prepare and provide to TasNetworks an appropriate testing and commissioning plan for the EG System. The testing and commissioning plan must be prepared by a suitably qualified engineer and is to be provided no less than one month prior to the commencement of testing and commissioning. Test plan submitted by the proponent must be agreed upon by TasNetworks prior to the commencement of testing and commissioning.

The test and commissioning plan shall include the following:

- The contact number(s) and details (including appropriate qualifications) of the person(s) responsible for undertaking the testing and commissioning
- Confirmation that the single line diagram reflects the installed system
- Confirmation that the EG system and its components are as per specification and have been certified as electrically compliant and safe to energise
- Description of the shutdown procedures for the EG system
- Outline of the communication settings and performance
- Confirmation of the export limit and settings (only for exporting or partially exporting EG systems)
- Confirmation that the power quality settings, control system settings, protection settings, performance and observations are as per TasNetworks' requirements
- Test procedures for validation of protection settings, performance and compliance against relevant standards (e.g anti-islanding, synchronising, tamper-proofing, control system settings, control system firmware and failsafe operation)
- Testing of the earthing connection settings and compliance to AS 2067 and relevant jurisdictional requirements
- Testing of power quality performance as per TasNetworks' requirements including the details of temporary or permanent measurement equipment
- Testing of any site specific requirements relevant for the EG system

## 6.2 Testing and commissioning for IES EG systems

Testing and Commissioning procedures for IES EG Systems should consider the following:

- Preferably meeting the requirements as per AS/NZ 4777.1 Section 7 (where applicable), AS/NZS 3000 (where applicable) and AS/NZS 5033 (where applicable)
- Compliance with the equipment manufacturer's specifications and TasNetworks' technical requirements to demonstrate that the IES EG System meets the requirements of the connection agreement.

## 6.3 Testing and commissioning for non-IES EG systems

Testing and Commissioning procedures for non-IES EG Systems should consider the following:

- Compliance with the equipment manufacturer's specifications and TasNetworks' technical requirements to demonstrate that the IES EG System meets the requirements of the connection agreement.
- Technical settings that will be required to be demonstrated are protection settings, power quality settings, export limits, communications settings and shutdown procedures.

## 6.4 Non-compliance

Should any non-compliance be identified prior to energisation or during final commissioning, the EG system will not be permitted to reconnect until the proponent prepares a rectification plan and provides evidence of corrective actions and/or demonstrates compliance. Depending on the severity of non-compliance TasNetworks may witness the testing at the proponent's expense prior to allowing connection.

# 7 Operations and maintenance

The following details will be formalised into a document called the JOP. Where there is a conflict between the details of this section and the JOP of a generator, the agreed JOP will take precedence.

The proponent shall provide to TasNetworks the name and contact number of at least one person who is responsible for the maintenance and operation of the LV EG system. TasNetworks' expectation is that this number will be contactable 24/7 if required.

The LV EG system shall be operated and maintained to ensure compliance with the *connection agreement* and all legislation, codes and/or other regulatory instruments at all times. The proponent shall ensure that it documents and undertakes adequate procedures and programs to ensure compliance with the *connection agreement*. It is the responsibility of the proponent to ensure that it implements adequate operations and maintenance plans in accordance with the *connection*

*agreement* and to maintain the electrical installation in a safe condition. All costs associated with the operations and maintenance of the EG system are to be borne by the proponent.

The proponent shall notify TasNetworks of any scheduled and unscheduled primary plant, protection or communication outages or failures.

The proponent must not increase the agreed export capability of the *generating system* or alter the *generating system* in a manner that contravenes the *Connection Agreement* without prior written consent from TasNetworks.

Upon receipt of a written request, TasNetworks will advise the proponent if it is necessary to undertake any new network analysis and produce an engineering report (at the cost of the proponent) in order to ascertain any operational constraints of the *generating system* with the proposed changes.

TasNetworks may require to isolate the *generating system* (EG System) from time to time for distribution system maintenance and testing. TasNetworks will endeavour to coordinate scheduling of planned outages with the proponent where practical to reduce outage periods and operational impacts.

Upon disconnection from the *distribution network*, the proponent must contact TasNetworks' *control centre* prior to reconnection onto the *distribution network*.

Non-complying EG systems shall be curtailed or disconnected, and not be permitted to reconnect until the proponent prepares a rectification plan and provides evidence of corrective actions and/or demonstrates compliance. TasNetworks is not liable for any losses incurred by the proponent for actions in response to non-compliance.



## Appendix A – Deviations from the National DER Connection Guidelines

Section	Description of deviation	Type of deviation	Justification
3.1 TasNetworks' Standards	Additional Section included	Jurisdictional requirement	Included new section that provides information on TasNetworks' standards for connections to our LV and MV network
3.4 Operating Limits	Additional Section included	Jurisdictional requirement	Included new section to enable alignment with the Tasmanian Electricity Code and Tasmanian Frequency Operating Standard
4.7.2 Central protection	Directional power protection (32R)	Improvement	Changed from "Grid reverse power" to provide better clarity to installers
4.7.2.4 Passive Anti-islanding Protection	Deviation from AS 4777.1	Jurisdictional requirement	Over frequency trip setting changed to align with Tasmanian Frequency Operating Standard
Appendix F & G	Additional sections included	Administrative	TasNetworks' Asset Acceptance and Commissioning Certificates included to align with TasNetworks' operational requirements.



## Appendix B – Connection arrangement requirements

TasNetworks' preferred connection arrangement shall be determined following a detailed connection assessment of the proposed LV EG system.

Figure 1 shows an example of one proposed methodology for connection to TasNetworks distribution network and is provided for general reference only. The specific earthing, switchgear and protection arrangements will be determined by the type of *generating system* to be connected. TasNetworks may also require the installation of its own network isolation device for all LV EG Systems.

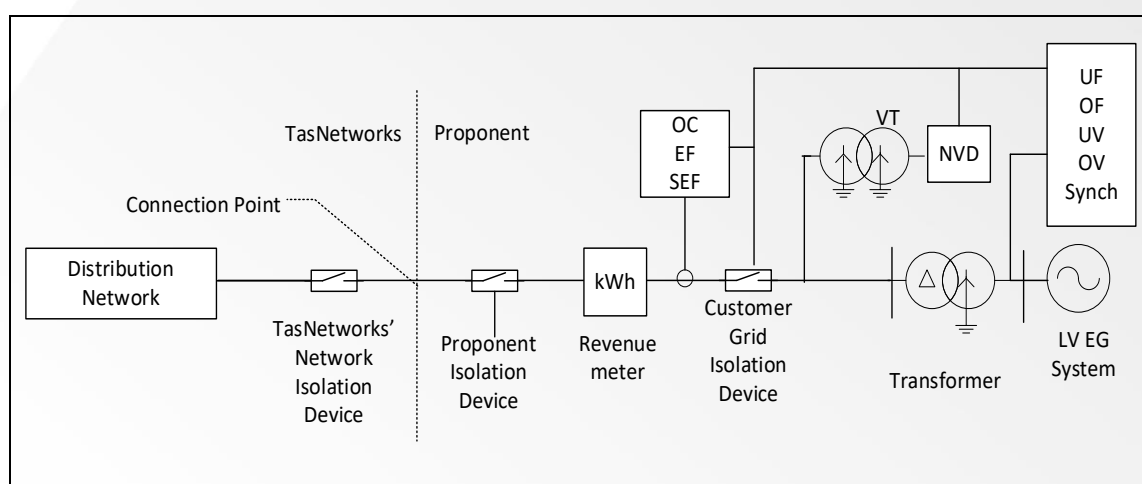


Figure 1: Example of TasNetworks preferred connection arrangement for LV EG Systems

## Appendix C – Model connection agreement

TasNetworks' Electricity Connection Contract - Standard Terms & Conditions can be found on our website on our [Contracts and policies](#) page.

## Appendix D – Static data and information

1. NMI meter numbers (10 digits)
2. DER Devices
  - a. Fuel source – primary {renewable/biomass/waste; fossil; hydro;
  - b. geothermal; solar; wave; wind; tidal; storage}
  - c. Fuel source – descriptor {as per appendix 8 of the NEM Generator registration guide}
  - d. Make, model and manufacturer
  - e. Maximum capacity (kW or MW)
  - f. Storage capacity (kWh/MWh of available storage)
  - g. Installer
  - h. Whether the device is registered for ancillary service provision (Y/N)
  - i. Whether the device is part of an aggregated control (Y/N)
  - j. Whether the device is remotely controllable (Y/N)
  - k. 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}

## Appendix F – Asset Acceptance and Permission to Synchronise Certificate

Project Title			
Customer		Customer Contact	
Customer Phone #		Customer Email	
Connection Date			
Summary of Work performed/Assets being connected to TasNetworks' Network			
CERTIFICATION			(Please tick appropriate boxes)
1	All offline commissioning tests have been completed and results confirmed to be satisfactory.	Customer Engineer	<input type="checkbox"/>
		Network Performance (TasNetworks)	<input type="checkbox"/>
2	CBOS have signed off that the new installation is safe for energisation.	Customer Engineer	<input type="checkbox"/>
3	TasNetworks Distribution Control Room are prepared for the customer plant to be energised for the first time.	Network Operations	<input type="checkbox"/>
4	The equipment complies with appropriate performance standards and connection agreement requirements. Identified defects and /or interim operating limits are documented and have been accepted by TasNetworks along with agreed timeframe for rectification.	Customer Engineer	<input type="checkbox"/>
		Asset Engineering (TasNetworks)	<input type="checkbox"/>
5	To the best of the connecting customer's knowledge the equipment is ready for safe connection to the Network.	Customer Engineer	<input type="checkbox"/>
List any limitations to the Equipment			
List variances from Performance Standards or Connection Agreement			

<b>Customer</b>	<b>Name</b>	<b>Sign</b>	<b>Date</b>
Engineer			
Project Manager			
<b>TasNetworks</b>	<b>Name</b>	<b>Sign</b>	<b>Date</b>
Network Performance			
Asset Engineering			
Network Operations			

## Appendix G – Commissioning Certificate

Project Title			
Customer		Customer Contact	
Customer Phone #		Customer Email	
Connection Date			
Summary of Work performed/Assets being connected to TasNetworks Network			
CERTIFICATION			(Please tick appropriate boxes)
1	All online commissioning tests have been completed and results confirmed to be satisfactory	Customer Engineer	<input type="checkbox"/>
2	Commissioning test results have been reviewed and accepted by TasNetworks	Network Performance (TasNetworks)	<input type="checkbox"/>
3	The equipment complies with appropriate performance standards and connection agreement requirements. Identified defects and /or interim operating limits are documented and have been accepted by TasNetworks along with agreed timeframe for rectification	Customer Engineer Network Performance (TasNetworks)	<input type="checkbox"/> <input type="checkbox"/>
4	All protection and/or auxiliary relays have been tested; final settings applied; SCADA commissioning completed	Customer Engineer Protection and Control (TasNetworks) Network Operations Control Systems (TasNetworks)	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
5	To the best of the connecting customer's knowledge the equipment is ready for safe connection to the Network	Customer Engineer	<input type="checkbox"/>
List any limitations to the Equipment			

List variances from Performance Standards or Connection Agreement

<b>Customer</b>	<b>Name</b>	<b>Sign</b>	<b>Date</b>
Engineer			
Project Manager			
<b>TasNetworks</b>	<b>Name</b>	<b>Sign</b>	<b>Date</b>
Network Performance			
Protection and Control			
Network Operations Control Systems			
Network Operations			