



Tasmanian Networks Pty Ltd  
ABN 24 167 357 299

# **Requirements for Connecting Micro Embedded Generating Systems to the TasNetworks Distribution Network**

**(AS4777.2:2015 Compliant)**

**NG R PD 09**

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**TABLE OF CONTENTS**

- 1. INTRODUCTION.....3
- 2. DEFINITIONS .....3
- 3. RESPONSIBILITIES.....5
- 4. CONNECTION CHARGES .....5
- 5. PLANNING AND SELECTION .....5
- 6. TECHNICAL REQUIREMENTS.....6
  - 6.1. TECHNICAL STANDARDS AND REQUIREMENTS .....6
  - 6.2. INVERTER REQUIREMENTS.....7
  - 6.3. DISTRIBUTION NETWORK CONSTRAINTS AND ISSUES .....7
  - 6.4. OPERATIONAL AND SAFETY REQUIREMENTS .....8
  - 6.5. METERING REQUIREMENTS.....9
- 7. CONNECTION PROCESS.....9
- 8. DISCLAIMER.....9
- 9. REVISIONS.....10
- 10. Attachment 1 - Connection Application Process .....11
- 11. Appendix: TASMANIAN OPERATIONAL PARAMETERS FOR MICRO-EMBEDDED GENERATING SYSTEMS .....16

## 1. INTRODUCTION

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

Please note when you are considering connecting an embedded generating system that you contact us regarding the physical connection of the system and your Retailer to discuss billing and tariff arrangements.

The installation of an embedded generating system at your premises provides the opportunity for you to reduce your power bills through reduced consumption of electricity from the grid and the ability to generate your own electricity. The embedded generating system may also enable you to export electricity to the grid if the output of your generating system exceeds your own consumption.

These requirements have been developed to provide information for customers who are proposing to connect micro embedded generating systems to our distribution network, via AS4777.2:2015 approved electronic inverters (e.g. solar, wind, micro hydro etc.), with outputs up to:

- 10 kW single phase or 30 kW three phase or as contemplated by AS 4777.

AS4777.2:2015 compliant inverters are given automatic access to our distribution network provided adverse impacts to other customers and the network are not expected.

These requirements aims to provide assistance to identify the responsibilities of all parties involved with respect to connection requirements for embedded generating systems and assist applicants applying for a connection to our distribution network.

## 2. DEFINITIONS

There are a number of terms that are used within these requirements that require a definition and they are outlined below.

**AEMC** means the Australian Energy Market Commission.

**Business day** means a day that is not or Saturday or a Sunday and is not observed in Tasmania as a public holiday pursuant to the Statutory Holidays Act 2000 (TAS).

**CECA** means the Clean Energy Council of Australia

**Connection contract** means the contract between you (the embedded generator) and us (TasNetworks) that needs to be entered into in accordance with either chapter 5 or chapter 5A of the NER.

**Connection point** is the agreed point of supply between our distribution network and your electrical installation.

**Distribution network** means the electricity network owned and operated by TasNetworks.

**Embedded generator** means a person that owns, controls or operates an embedded generating unit (you). It also includes customers with their own generation.

**Embedded generating unit** is a generating unit connected within a distribution network and not having direct access to the transmission network. This includes all technologies capable of sending active power into the distribution network: e.g. battery energy storage systems, photo-voltaic (PV) cells, wind turbines and (micro) hydro-electric turbines etc.

**Generating unit** is the actual generator of electricity and all the related equipment essential to its functioning as a single entity.

**Generating system** is a system comprising one or more generating units.

**Islanding (island)** means any situation where the part of the distribution network containing your connection point becomes separated from the power system and your embedded generating system maintains any form of electrical supply, be it stable or not, to any section of the separated distribution network.

**Kilo Watt (kW)** is an instantaneous measurement of electrical energy flow produced, consumed or transported, i.e. active power.

**Low Voltage (LV)** means a voltage used for the supply of electricity at or below 1 kV; that is, the 230 Volt/400 Volt distribution network.

**Mega Watt Hours (MWh)** is a measure over a period of time of the total amount of electrical energy produced, consumed, or transported.

**Micro generating unit** means a generating unit having a capability of less than 10 kW for a single phase connection or 30 kW for a three phase connection, or as contemplated by AS 4777.

**Model standing offer** means a document approved by the AER as a model standing offer for TasNetworks to provide basic connection services (see NER clause 5A.B.3) or as a model standing offer to provide standard connection services (see NER clause 5A.B.5).

**NER** means the National Electricity Rules that are published by the AEMC.

**Power system** means the electricity power system of Tasmania including associated generation, transmission and distribution networks for the supply of electricity, operated as an integrated arrangement.

**TasNetworks, us, we or our** means Tasmanian Networks Pty Ltd, ABN 24 167 357 299, in its capacity as a distribution network service provider licensed in accordance with the provisions of the ESI Act unless an alternative meaning is explicitly given in the text.

**TEC** has the same meaning as “Code” in the ESI Act, or as amended or succeeded from time to time, and is issued by the Tasmanian Economic Regulator.

**Tee-up** means an appointment requested by your installer or your electrical contractor with us for the purpose of connecting your generating system.

### **3. RESPONSIBILITIES**

We are responsible for the safe and effective operation of the distribution network in compliance with the TEC.

As a licensed entity in accordance with the *Electricity Supply Industry Act 1995*, we are responsible for ensuring that generating systems connected to our distribution network meet the requirements placed upon generating systems in the TEC and the NER.

We have established procedures in place to process requests for micro embedded generating systems connecting to our distribution network. We may disconnect your generating system if it adversely impacts other customers connected to our distribution network.

As the owner and operator of a generating system, you are responsible for the safe and correct installation, operation and maintenance of your generating system in accordance with appropriate legislation and standards. For further guidance please contact your electrical consultant or Building Standards and Occupational Licensing - visit [www.justice.tas.gov.au/building](http://www.justice.tas.gov.au/building).

### **4. CONNECTION CHARGES**

Connection service charges to effect the actual connection may be applicable for the connection of micro embedded generating systems in accordance with our Customer Capital Contributions Policy. Ongoing charges may also be applicable regarding the installation and operation of your generating system while maintaining the connection to our distribution network. Depending on the electrical infrastructure required to be installed to connect to the network you may be charged for a Basic Connection Service (if for example you only require a service wire and meter) or a Negotiated Connection Service for anything else.

Connection application fees may also apply under certain circumstances.

### **5. PLANNING AND SELECTION**

We are not able to offer assistance to you in the planning and selection of your generating system. It is advisable to engage the services of an experienced consultant in this field to assist you in the planning and selection of your generating system.

To avoid unnecessary expenditure once you have decided upon your preferred generating system, it is suggested you contact us to discuss your chosen designs and equipment to confirm compatibility with our distribution network. For example, embedded generation systems which are at high risk of generating over voltages, may be required to have a three phase connection.

Please refer to the Appendix in this document regarding some of the operational parameters required for Tasmania.

You may elect to submit an enquiry form prior to your application to gain an understanding of any additional requirements for your connection.

You should also contact your retailer regarding tariffs before entering into purchase contracts.

The Clean Energy Council of Australia (CECA) has details of accredited installers, suppliers and consultants. You may visit the CECA website at [www.cleanenergycouncil.org.au](http://www.cleanenergycouncil.org.au).

## 6. TECHNICAL REQUIREMENTS

These requirements only cover micro embedded generating systems connected to our LV network. For other embedded generating system connections please refer to the Requirements for the Connection of Embedded Generators to the TasNetworks Distribution Network. The following sections aim to provide a uniform standard for connection of embedded generating systems and give relevant performance, operation, testing, safety and maintenance considerations for the connection.

### 6.1. TECHNICAL STANDARDS AND REQUIREMENTS

The following are applicable to the connection of your embedded generating system.

- Tasmanian Electricity Code
- National Electricity Rules
- TasNetworks Service and Installation Rules
- Energy Networks Association (Australia) Customer Guide to Electricity Supply November 2008

The relevant technical standards and requirements are shown in Table 1.

Table 1 Relevant technical standards and requirements

Australian Standards	Standard Title
AS 4777.1:2005	Grid Connection of Energy Systems via Inverters, Part 1
AS 4777.2:2015	Grid Connection of Energy Systems via Inverters, Part 2
AS/NZS 3000	Electrical Installations (Wiring Rules), 3010 – Electrical Installations – Generating Sets, 3017 – Testing Guidelines
AN/NZS 61000	Electromagnetic Compatibility
AS 2184	Low voltage switchgear and control gear
AS 2373	Electric Cables
AS 2915	Solar Photovoltaic Modules – Performance Requirements
AS 3010	Electrical Installations
AS/NZS 3008	Electrical installations - Selection of cables - Cables for alternating voltages up to and including 0.6/1 kV
AS/NZS 5033	Installation of photovoltaic (PV) arrays
AS 60038	Standard Voltages

## 6.2. INVERTER REQUIREMENTS

If your generating system connects through an inverter, the inverter must be compliant with AS4777.2:2015. The CECA has information on models of inverters that comply with AS4777.2:2015.

Only inverters that comply with the AS4777.2:2015 standard can be connected under these requirements. If your inverter does not comply with this standard you will need to follow the Requirements for the Connection of Embedded Generators to the TasNetworks Distribution Network.

## 6.3. DISTRIBUTION NETWORK CONSTRAINTS AND ISSUES

The connection of your generating system to our distribution network may have impacts upon other customers and our network. As a result, before approval is given by us, we may need to undertake specific studies to ascertain these effects and to implement mitigation where necessary. Mitigation measures may include network and/or customer service wire augmentations.

When sending power into the network, the power factor at the *micro EG connection* point must be controlled to 0.9 lagging, i.e. absorbing reactive power as calculated from the net active power sent. For example, this means that the output of a battery energy storage system must be added to other *embedded generating units* to calculate the net active power sent.

If a *micro embedded generator* receives active power from the network, i.e. the customer operates as a load, then the net power factor at the *micro EG connection* must remain within the normal bounds required of a load. Refer to Section 8.5.3 of:-

[http://www.energyregulator.tas.gov.au/domino/otter.nsf/LookupFiles/Ch\\_8\\_Revised\\_Code\\_1\\_July\\_2014\\_140616.pdf/\\$file/Ch\\_8\\_Revised\\_Code\\_1\\_July\\_2014\\_140616.pdf](http://www.energyregulator.tas.gov.au/domino/otter.nsf/LookupFiles/Ch_8_Revised_Code_1_July_2014_140616.pdf/$file/Ch_8_Revised_Code_1_July_2014_140616.pdf)

Where the capacity of all *embedded generating units* at a site exceeds 10 kW single phase or 30 kW three phase TasNetworks must be satisfied that no more than the allowable power can be produced by the combined system. TasNetworks will accept a 50 A circuit breaker that is in series with the total output of all *embedded generating units* as evidence of compliance with this requirement. Other designs may be approved on application to TasNetworks.

If an installation is upgraded to include multiple *embedded generating units*, for example due to the upgrade of an existing solar PV connection with an AC coupled battery energy storage system, the customer's *micro EG connection* point must comply with the TasNetworks' policy in place at the time of upgrade.

If the customer's *embedded generating unit(s)* is (are) to be controlled remotely TasNetworks must be informed. For example if the customer gives control of its battery storage system to an Aggregation Service Provider (or

other remote controlling entity), TasNetworks must first be notified regarding the details of the arrangement. The customer must state:

1. Who or what can control their *embedded generating unit(s)*.
2. If their *embedded generating unit(s)* is (are) controlled for a particular service.
3. How their *embedded generating unit(s)* is (are) controlled.

Refer to the Appendix in this document for specific connection requirements for connecting micro embedded generating systems at a customer premises to mitigate potential issues. Please note that your embedded generating system will not be permitted to connect unless it is compliant with this policy.

TasNetworks may request a different performance from a micro embedded generator in some circumstances. This could be as part of a request for network support.

#### **6.4. OPERATIONAL AND SAFETY REQUIREMENTS**

Key safety and operating issues that require consideration with demonstrated compliance and compatibility with our distribution network include, but are not limited to:

- voltage flicker;
- voltage harmonics;
- voltage magnitude limits;
- impulse voltage withstand;
- power system frequency limits;
- disconnection capability and reconnection procedures; and
- anti-islanding protection.

Micro generating systems can be connected to our LV network subject to their operation being consistent with the following requirements and the specific circumstances of the connection point. Specific circumstances to be considered include:

- capability of our LV network,
- voltage regulation,
- voltage balance,
- fault level, and
- capability of the local distribution substation.

Our involvement in micro generating system installation is limited to evaluation of its impact on our distribution network and ensuring compliance with standards and regulatory instruments.



## **6.5. METERING REQUIREMENTS**

The type of metering and associated requirements depends on the annual amount of electrical energy throughput as detailed in NER schedule 7.2.

You may have to arrange for your own metering requirements. We can make an offer on suitable terms and conditions to provide the entire metering service.

For tariff customers, TasNetworks is responsible for providing, maintaining and reading the metering.

Customers with annual energy consumption less than 150 MWh, who accept a model standing offer, are deemed to be tariff customers for the purposes of metering requirements. Under these circumstances we are responsible for:

- the provision, installation and maintenance of metering installations; and
- the validation, substitution and estimation of metering data for type 5 to 7 metering installations in accordance with the metrology procedure.

Tariff assignment will vary according to the load requirements of the customer. A Generator might be a demand customer and on a demand tariff for load purposes but meters will only record exported energy as kWh.

Please note that an embedded generator may elect to feed its power output via multiple tariffs for example T31, T41. This is only possible where a system has two inverters and effectively operates as two systems. If the set up requires additional metering, additional metering charges may be applicable. Alternatively a single element meter could be employed to offset TOU tariff charges. For further information on acceptable installation arrangements and tariffs please refer to the TasNetworks Service and Installation Rules, which is currently under review.

## **7. CONNECTION PROCESS**

One of two connection processes will be followed in the establishment of your embedded generation connection. These are detailed at attachment 1 and include:

- micro generating units with AS4777.2:2015 compliant inverters (as a basic connection service); or
- micro generating units with AS4777.2:2015 compliant inverters (as a negotiated connection service).

## **8. 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:

- we make no warranty, guarantee or promise, express or implied, in relation to the content or accuracy of this information and material;

- you will seek verification and/or professional advice from an independent source before relying on or acting upon any of this information and material; and
- we are not liable or responsible in any way for the results of any actions taken on the basis of this information and material.

To the fullest extent permitted by law, we expressly exclude any and all liability whatsoever and responsibility to any person arising in connection with their use or reliance of the information and material in whole or in part.

Please note that approval from us to connect a micro 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 you 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. Your eligibility should be determined with the relevant agencies responsible for the payment or provision of such entitlements.

## **9. REVISIONS**

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.

## 10. Attachment 1 - Connection Application Process

### 1 INTRODUCTION

This document outlines the application process to be followed when an embedded generator wishes to connect an AS4777.2:2015 compliant micro generating system (examples include wind, solar, micro hydro).

A '**micro**' embedded generating system is a generating system up to 10 kW (single phase) or 30 kW (three phase) or as contemplated by AS4777 and connected to our distribution network.

This process commences at the point you enquire about arranging such a connection, through to the final "switch-on" of your generating unit.

**Important: Please note this process does not deal with any approach you should make to your retailer regarding their tariffs or payments that your retailer may make for any electricity utilised within the distribution network.**

### 2 PROCESS

#### 2.1 YOU WISH TO INSTALL A MICRO GENERATING SYSTEM

The **first step** if you are interested in connecting an embedded generating system to our distribution network is to either contact us (telephone, letter, e-mail, or visit [www.tasnetworks.com.au](http://www.tasnetworks.com.au)) and/or contact an equipment supplier, consultant or a Clean Energy Council of Australia accredited installer who deals with micro embedded generating systems.

Where we have been contacted by you, we will write to you sending a copy of the connection enquiry form or application form as per your request. If you choose to submit an enquiry form you will then be required to submit an application form to progress your connection. You may also refer to our website where this information can be located.

Our letter will advise you that further information can be provided on request or alternatively can be found on our website listed under "Embedded Generation".

Where you have specific enquiries that raise issues regarding your connection, we will respond within 10 **business days** noting any issues to be resolved or negotiated.

If you have initially contacted an equipment supplier, consultant or accredited installer, they may deal with your initial enquiry and completion of the connection application form [see step 2.2].

In the majority of cases your installer will manage and submit the relevant paperwork on your behalf.

#### 2.2 COMPLETED CONNECTION APPLICATION FORM

You should return the completed and signed connection application form as early as possible to avoid any delays in your connection.

## 2.3 CHECK APPLICATION DETAILS

Within 10 business days we will confirm or otherwise that your connection application includes approved certification that your inverter complies with AS4777.2:2015.

You will also be advised:

- further information that we may consider is required;
- whether a network study and applicable application fee is required; and
- whether an extension to the distribution network is required and any applicable application fee.

You should provide the requested information and updated connection application form along with application fee as early as possible.

Please note that any application fee must be paid by you before we will undertake any assessment and make you an offer to connect.

We will then review the information and undertake the study in consultation with you.

We will also prepare a connection offer.

## 2.4 OFFER TO CONNECT AND SCHEDULES

Once the details provided in your connection application form are sufficient and correct certification has been provided that your inverter(s) comply with AS4777.2:2015, we can make a connection offer to you.

There are two different processes depending on the type of connection service you require. These are either a basic connection service or a negotiated connection service.

### Basic Connection Service

In instances where extensions of or alterations to the distribution network **are not** required we will offer a **basic connection service** with model standing offer conditions for micro embedded generating system connections. You should refer to our website for the model standing offer conditions at: [www.tasnetworks.com.au](http://www.tasnetworks.com.au). Your connection application together with your acceptance of our basic connection service offer will form the connection contract between you and us.

You will be invoiced by us the applicable basic connection service charge (this will occur after the connection has been made) and we are satisfied that any relevant conditions have been met. You should go to step 2.5.

### Negotiated Connection Service

In instances where extensions of or alterations to the distribution network **are** required we will offer a **negotiated connection service** based on an individually prepared connection offer including the applicable connection charge.

We will negotiate any terms with you in accordance with our negotiating framework.

You should return the signed acceptance to us, along with applicable connection charge, within **20 business days**.

If you have not returned the signed acceptance within 20 business days we will assume that you no longer wish to pursue the connection.

Your connection application together with your acceptance of our negotiated connection service offer will form the connection contract between you and us.

Once your signed acceptance is forwarded to us you should go to the next step.

## **2.5 INSTALLER INSTALLS GENERATING SYSTEM AND SENDS EWR TO TASNWORKS VIA THE RETAILER**

Your installer (an electrical contractor) may then install your generating system.

Your installer is required to submit an Electrical Works Request (EWR) to your electricity retailer. The electricity retailer will send us a request to progress your connection and fit an import/ export meter and to undertake any necessary works to alter or augment the distribution network. This must occur prior to the installer switching your generating system on.

## **2.6 ACCEPTANCE RECEIVED**

We will match your received connection offer acceptance against the installer's received EWR.

If alterations have been made to the technical specification of your generating system then a new technical assessment and connection offer will have to be prepared and re-sent by us for your signature [return to step 2.4].

If we receive an EWR but have not received a connection application form or connection offer acceptance from you, we will investigate who the applicant is and ask that you, or your installer submit a connection application form and/ or signed acceptance letter. [return to step 2.2 regarding the submission of a connection application form or step 2.4 regarding an outstanding connection contract and acceptance].

## **2.7 NETWORK CONSTRUCTION**

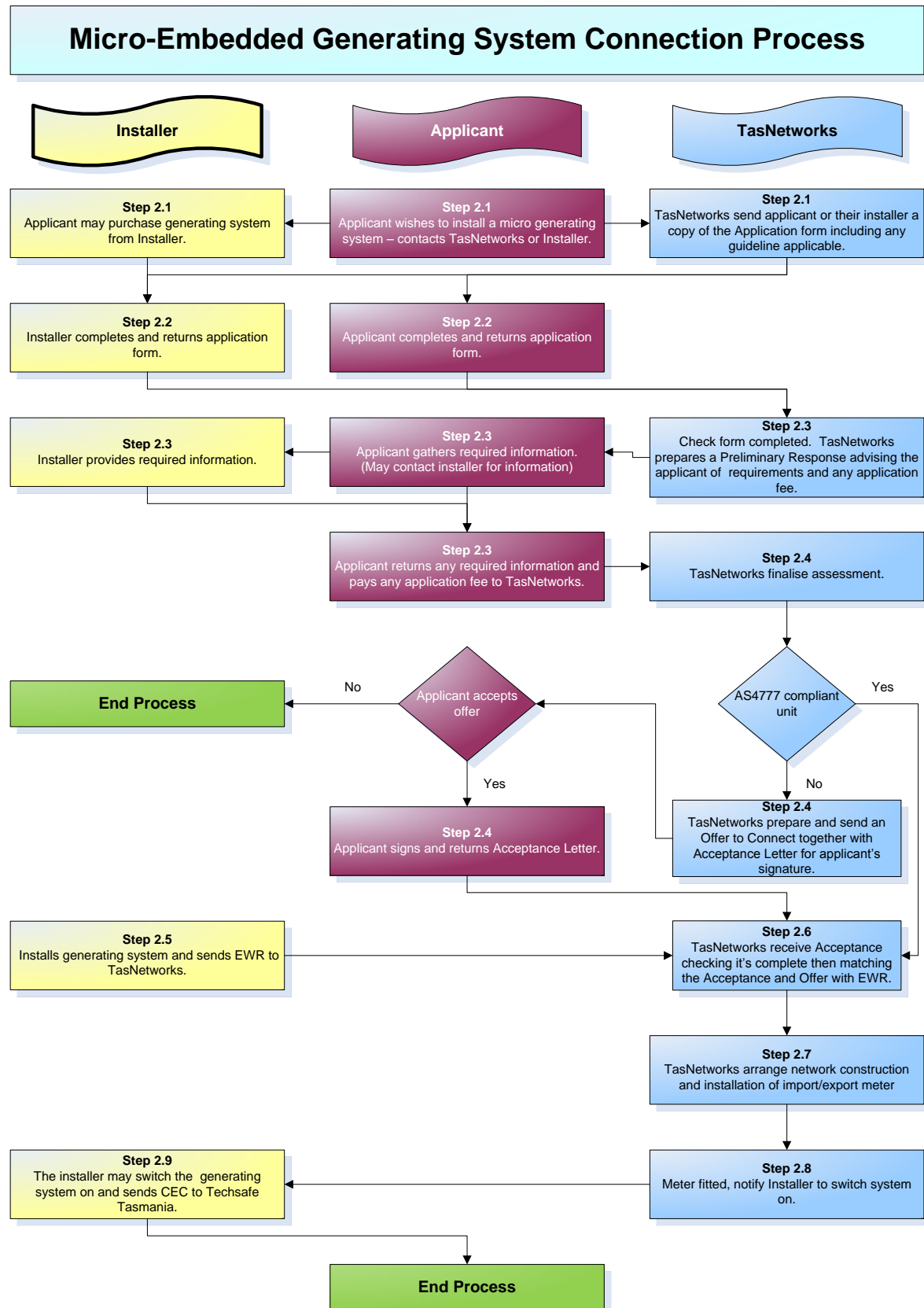
Any necessary works to alter or extend the distribution network will be undertaken within an agreed time as per the connection contract.

## **2.8 METER FITTED**

Once we have completed required connection works and your electricity retailer has fitted the meter, we will give your installer permission to switch your generating system on.

## **2.9 CERTIFICATE OF ELECTRICAL COMPLIANCE PREPARED WITHIN THREE DAYS OF SYSTEM BEING ENERGISED OR CAPABLE OF.**

Your installer (the electrical contractor) is also responsible for providing a Certificate of Electrical Compliance (CEC) to TechSafe Tasmania within three days of your generating system being energised or capable of.



## 11. Appendix: TASMANIAN OPERATIONAL PARAMETERS FOR MICRO-EMBEDDED GENERATING SYSTEMS

### TASNETWORKS POLICY REQUIREMENTS

1. All *embedded generating units*, **above 10 kW** rating, that connect to the LV supply must use a 3-phase connection, unless otherwise directed by TasNetworks.
2. All *embedded generating units* that connect to the LV supply with a high risk of generating over-voltages (as advised by TasNetworks) must use a 3-phase connection.
3. When sending active power into the network the **net** displacement power factor of all *embedded generating units* must have a constant value of **0.90 lagging** (i.e. var absorption) for all current outputs from 25 % to 100 % of rated current.

Note: For *embedded generating unit* current outputs below 25 % of rated current, it is acceptable for the power factor to be tapered from 0.90 lagging towards 1.0 as the current output approaches zero.

4. All *embedded generating units* that connect to the LV supply must have overvoltage protection settings that are consistent with AS 61000.3.100-2011 or AS4777.2:2015 (section 7.5.2).
5. *Embedded generating units* must **not disconnect** from the distribution network, due to frequency disturbances, while the power system frequency remains **above 47.0 Hz** and **below 53.0 Hz**.
6. If the site capacity of all *embedded generating units* exceeds 10 kW (1-phase) or 30 kW (3-phase), e.g. due to upgrade with battery storage, the allowable power exported to the network must be limited. TasNetworks will accept a 50 A circuit breaker in series with the total output of all *embedded generating units* or other approved designs for compliance with this requirement.
7. TasNetworks may revise these requirements from time to time.

### TASNETWORKS POLICY REQUIREMENTS APPLICABLE TO AS4777.2:2015 PARAMETER SETTINGS

1. Frequency Limits (AS4777 Table 13) – TasNetworks require that the inverter's under frequency set-point is 47.0 Hz and the inverter's over frequency set-point is 53.0 Hz.
2. TasNetworks accept the default set-point for  $V_{nom-max}$  of 255 V (AS4777 section 7.5.2 a).
3. TasNetworks accept the default set-point for  $f_{stop}$  of 52.0 Hz (AS4777 section 7.5.3.1).
4. Frequency Response - TasNetworks require that inverters with energy storage stop charging at 48.0 Hz ( $f_{stop-CH}$ ) (AS4777 section 7.5.3.2).

Refer to Table 2 for a summary of protection settings applicable to *micro EG connections*.

Table 2 Summary of TasNetworks Protection Settings

Parameter	Threshold	Time delay (s)
(V<) under voltage trip	180 $V_{rms}$	2.0
Long-term over voltage trip	255 $V_{rms}$ (average)	600.0
(V>) over voltage 1 trip	260 $V_{rms}$	2.0
(V>>) over voltage 2 trip	265 $V_{rms}$	0.2
Under frequency trip	47.0 Hz.	2.0
Over frequency trip	53.0 Hz.	0.2