



# Technical Requirements - Connection of Small to Medium Scale Distributed Generation Standard

## Document summary

This document details Northpower’s **technical requirements for the connection of small to Medium -scale DG.**

(<10kW) Small Distributed Generation (“DG”) and (10kW <300kW) Medium Distributed Generation (“DG”) systems using inverters to connect to Northpower’s low voltage electricity distribution network.

## Document approval

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Controlled Document



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## 1.0 Introduction

### 1.1 Purpose

This Standard provides Northpower's technical requirements for the connection of small to medium scale (0kW < 300kW) Distributed Generation ("DG") systems using inverters to connect to Northpower's low voltage electricity distribution network.

### 1.2 Scope

The scope of this standard relates to the connection of small to medium scale distribution generation to the Northpower Network:

- generation systems that are  $\leq 300\text{kW}$  in capacity, and
- are inverter connected to Northpower's low voltage network

This also applies to:

- grid connected energy storage systems (batteries), including Electric Vehicle (EV) batteries with vehicle to grid export capability.

#### Exclusions:

This document does not cover:

- Generation systems greater than 300kW. *Refer to Technical Requirements for Large Scale Distributed Generation Standard.* However this document can be used as a general background guide (only) and individual projects/proposals shall be discussed with Northpower to determine the required additional technical requirements.
- Large scale systems greater than 300kW or systems connected directly to the high voltage network (greater or equal to 11kV) – these will need connections to be specifically designed for each system.
- Stand alone, standby or emergency generation systems that are not capable of feeding power into Northpower's network.
- The economics or the design of Distributed Generation systems.

The process of connecting Distributed Generation to Northpower's network is detailed in the *New LV Service Connections Standard*. This includes details of the customer application, network approval and connection process. This standard should be read alongside the technical requirements.

### 1.3 Application

This Standard applies to all distribution generation systems and is provided for internal and external users.





## 2.0 References

Internal Reference	Details
Technical Requirements for Large Scale Distributed Generation Standard	This document details Northpower’s technical requirements for the connection of large-scale (>300kW) Distributed Generation (“DG”) systems to Northpower’s electricity distribution network.
New LV Service Connections	This document outlines Northpower’s core processes and technical requirements for low voltage service connections to Northpower’s network. This includes: <ul style="list-style-type: none"> <li>the creation of new connections and installation control points (ICPs),</li> <li>changes to existing connections, and</li> <li>the connection of small to medium scale distributed generation (DG).</li> </ul> <p>(<b>Note:</b> Section 10 details Distributed Generation)</p>
Customer Guide	Customer Guide - DG Connection (available on website)
Distributed Generation Livening Form	The Livening Form is required to be submitted to Northpower, certifying the details of the distributed generation installation. This form is linked to the <i>New LV Service Connections Standard</i> .
Generation Congestion Management Policy	This congestion management policy outlines Northpower’s approach and conditions under which Distributed Generation that is connected to Northpower’s network may be curtailed or interrupted from time to time to ensure that Northpower’s other connection and operations standards are met.
Northpower Website	Distributed Generation – Online Application Form

External Reference	Details
Accredited Inverter List	Australian Clean Energy Council Website “solar accreditation” <a href="http://www.solaraccreditation.com.au/products/inverters/approved-inverters.html">http://www.solaraccreditation.com.au/products/inverters/approved-inverters.html</a>
AS/NZS 3000	Electrical Installations (Wiring Rules)
AS/NZS 4777.1 (2024)	Grid Connection of Energy Systems via Inverters - Part 1: Installation requirements
AS/NZS 4777.2:(2020)	Grid Connection of Energy Systems via Inverters - Part 2: Inverter requirements. ( <b>Note:</b> Previous <i>version AS/NZS 4777.2:2015.</i> )
AS/NZS 5033	Installation and Safety Requirements for Photovoltaic (PV) Arrays
AS/NZS 61000.3	Electromagnetic Compatibility (EMC)
BS EN 50160	Voltage characteristics of electricity supplied by public distribution system
EEA Metering Safety Guide	EEA Metering Safety - Good Practice Guide, 2018
ECP 36	NZ Electrical Code of Practice for Harmonic Levels





External Reference	Details
EEA Guide	Electricity Engineers Association “ <i>Guide for the Connection of Small Scale Inverter Based Distributed Generation</i> ” 2018, Interim Guide
EIPC Code	Electricity Industry Participation Code 2010 - <i>Part 6, Connection of Distributed Generation</i> <a href="http://www.ea.govt.nz/code-and-compliance/the-code/part-6-connection-of-distributed-generation/">http://www.ea.govt.nz/code-and-compliance/the-code/part-6-connection-of-distributed-generation/</a>
Electricity Authority	The Electricity Authority, website and reference material / guide documents
Electricity Safety Regulations	Electricity (Safety) Regulations 2010

### 3.0 Definitions

Terminology	Definition
<b>Distributed Generation (DG)</b>	means distributed generation being equipment used, or proposed to be used, for generating electricity that is: <ul style="list-style-type: none"> <li>connected, or proposed to be connected, to the Network or to a customer installation which is connected to the Network; and</li> <li>capable of injecting electricity into the Network.</li> </ul> This includes Electric Vehicles (EV) or battery storage systems capable of exporting (injecting) electricity into the network.
<b>Inverter</b>	An electronic device intended to convert DC to AC.
<b>Quality of Supply</b>	The term “quality of supply” generally means: <ul style="list-style-type: none"> <li>the electrical voltage and frequency are maintained between limits defined in the Electricity (Safety) Regulations, and</li> </ul> the harmonic levels comply with: ECP 36 NZ Electrical Code of Practice for Harmonic Levels and AS/NZS 61000.3.6 Electromagnetic Compatibility, measured at the installation “point of supply” as applicable to the scenario.
<b>Smart Meter Data</b>	Smart meter data (also known as Network Operational Data) is information about voltage, current and phase angle measured at set intervals.



## 4.0 Impact of DG Connections on safety & operations

### 4.1 Safety Risks

The potential for a distributed generation system (inverter connected) to export electricity onto the network either under normal operation or fault conditions, creates a potential risk to other connected customers and personnel working on the electricity distribution network.

Technical requirements and standards have been established that address these risks, with specific grid protection settings to manage:

- Faults within the generation system or installation
- Faults occurring within the electricity distribution network
- Preventing the generation system from feeding power into the electricity distribution network during an unplanned network outage (i.e. faults) or planned shutdown (i.e. maintenance works).

In addition, all electrical assets and wiring that are part of the customer's installation (including the service main, meter station, switchboard and internal wiring) must comply with *AS/NZS 3000 Electrical Installations* and the *EEA Metering Safety Guide*.

Where possible, Northpower has adopted the use of New Zealand standards and regulations to ensure consistency of equipment and application.

### 4.2 Quality of supply

Where generation exports electricity to the network, it can impact the quality of the electricity supply on that section of network (for example voltage fluctuations). This can impact on the electricity supply to nearby customers and neighbours.

There are regulatory requirements and industry standards that Northpower must meet, which are the basis of Northpower's technical requirements for the connection of the generation system. This includes maintaining the quality of electricity supplied (as measured at the customer installations "points of supply) in compliance with:

- electrical voltage and frequency levels, as detailed in the *Electricity (Safety) Regulations*
- harmonic levels, as detailed in *ECP 36 NZ Electrical Code of Practice for Harmonic Levels* and *AS/NZS 61000.3.6 Electromagnetic Compatibility* as applicable to the scenario.





## 5.0 Network Requirements for Distributed Generation

The following sections detail the technical requirements for connecting distributed generation to Northpower’s electricity distribution network.

### 5.1 Inverters & protection settings

Inverters that are allowed to be used to connect generation systems to Northpower’s network must:

- Comply with *AS/NZS 4777.2 (2020) Grid Connection of Energy Systems via Inverters: Part 2 - Inverter requirements*.
- include a grid protection or anti islanding device which must prevent power being feed into the network during a power outage or shutdown. *Note that the generation system may run, if capable, the associated installation while islanded or disconnected from the network.*
- be set to the specific New Zealand voltage settings detailed in AS/NZS 4777.2 and detailed below in Table 1.

**Table 1 – AS/NZS4777 NZ Settings for Inverter Settings**

Inverter Voltage and Frequency Limits (Passive Anti-Islanding Set-Point Values)			
Parameter	Limit	Minimum Trip Delay Time	Maximum Disconnection (trip) Time
Vnom-max (10 minute average)	248 V		
Overvoltage 1	260 V	1 second	2 seconds
Overvoltage 2	265 V	-	0.2 seconds
Undervoltage	180 V	1 second	2 seconds
Under-frequency	45 Hz	1 second	2 seconds
Over-frequency	52 Hz	-	0.2 seconds
Minimum reconnection time	60 Seconds		

#### 5.1.1 Voltage Response Capability

Northpower requires that, if available, the Inverter’s voltage response is enabled to avoid any adverse effect on the network voltage at the point of supply. Our preference in enabling this feature is as follows:

- If both Volt-VAr and Volt-Watt responses are available, then both should be enabled (if possible).
- If both modes cannot be enabled simultaneously then just the Volt-VAr response shall be enabled.
- If only the Volt-Watt response is available, then that shall be enabled.

If Northpower does not require the voltage response to be enabled, this will be advised by Northpower as part of the generation connection approval process.

The required volt responses are specified in Table 2 below – these are the recommended preferences of the *Green Grid Network Analysis Group (NAG)* and the *EEA Guide for the connection of small scale inverter based distributed generation*.





**Table 2 – Volt Response requirements**

Volt Response Reference Values		
Reference	Volt-VAr Response	Volt-Watt Response
V1	207	207
V2	220	220
V3	235	244
V4	244	246

### 5.1.2 Acceptable Inverters

Northpower will accept Inverters that are compliant with the current *AS/NZS4777 standard*. A list of inverters accredited as compliant with AS/NZS4777 can be found on the Australian Clean Energy Council website:

<http://www.solaraccreditation.com.au/products/inverters/approved-inverters.html>.

### 5.2 Photovoltaic Arrays

Photovoltaic (PV) arrays which form part of the generation system are to comply with *AS/NZS 5033 Installation and Safety Requirements for Photovoltaic (PV) Arrays*.

### 5.3 Connection Requirements

#### 5.3.1 Point of Isolation

In most cases, Northpower considers a readily accessible service main fuse as the point of Isolation from the network. If this is not readily accessible, an additional point of isolation may be required.

#### 5.3.2 Connection Requirements

The connection of distributed generation must meet Northpower’s phasing and generation requirements, which are detailed in Table 3 below, and depend on:

- the generation capacity of the generation system
- the supply capacity of the network and associated distribution transformer that it will be connected to
- any constraints on generation output (as identified in the Connection Approval)
- any network congestion management requirements for that location (refer to *Congestion Management Policy - Distributed Generation*)
- Agree and consent with the Alternative Energy Connection Terms and Conditions and Technical Requirements as referenced within the *New LV Service Connections* standard.





**TABLE 3 – Generation & Connection Phasing requirements**

DG Type.	Connection Phasing Requirements & Capacity.
Residential with or without battery storage.	1, 2 or 3 phase as available and requested. 5kW per phase Maximum export.
Commercial / light industrial (0-300kW) with or without battery storage.	1, 2 or 3 phase and as available capacity. 1, 2 or 3 phase as requested and as available.

### 5.4 Signs or Labelling

For the purposes of safety, it is the Customer’s responsibility to ensure that the generating circuit is clearly labelled on the main switchboard and any sub-main switchboards it passes through. A label should also be placed on the Customer’s service fuse as a reminder to test and prove that the circuit is de-energised before carrying out any work on the Customer’s service main.

Northpower will identify the DG Connection in our Geographical Information System (GIS) system, to alert our personnel to its location.

### 5.5 UPS Installations

Generation may be used in conjunction with batteries to provide an uninterruptible power supply (UPS) for certain circuits within the premises.

In this instance, no protection device shall interrupt the neutral or earth conductors between the network and the inverter.

This prevents the use of residual current devices (RCD’s) between the inverter and the network.

## 6.0 Metering & sale of exported electricity

Electricity metering that allows measurement of electricity import (consumption) and export, is required to be installed on site. Metering installation is to be arranged by the Customer with their Electricity Retailer, along with an agreement for the sale/purchase of the exported electricity.

Further details should be obtained from the customer’s Electricity Retailer.

## 7.0 Installation, Inspection and Commissioning Information

### 7.1 Installation

The installation must meet *AS/NZS 4777.1 (2024) Grid Connection of Energy Systems via Inverters - Part 1: Installation requirements*. All internal wiring must meet *AS/NZS 3000 (Wiring Rules)*.



## 7.2 Testing and Electrical Inspection

The generation system requires an electrical inspection by a registered mains parallel generation systems endorsed electrical inspector, as it is defined as high-risk prescribed electrical work in the Electricity (Safety) Regulations.

The generation system is required to meet Northpower's requirements as specified in this Standard, including the following standards:

- AS/NZS 4777.1 (2024) Grid connection of energy systems via inverters: Part 1 - Installation requirements
- AS/NZS 4777.2 (2020) Grid connection of energy systems via inverters: Part 2 - Inverter requirements
- AS/NZS 5033 Installation and safety requirements for photovoltaic (PV) arrays (*where applicable*)

## 7.3 Northpower Verification

Northpower may require to visit the generation system to verify compliance with Northpower's requirements, generally held in conjunction with the Electrical Inspection. This is to verify the following is satisfactory:

- Certificate of compliance
- Inspection and record of inspection
- Generation System meets Northpower's requirements including:
  - Northpower's Network Approval
  - Network Standards, including these technical requirements
  - Generation capacity and phasing
  - Operation of the grid protection device (typically anti-islanding)
  - Volt-VAr and Volt-Watt response enabled and set correctly when available

## 7.4 Commissioning Information to be provided to Northpower

Key details from the commissioning of the generation system are required to be provided to Northpower. Northpower's information requirements are detailed in Northpower's standard *New LV Service Connections* (Distributed Generation Liveness Form).

Information required includes details such as:

- Customer, ICP and physical location (site address)
- Generation system details – type, make, model, capacity, approved net export
- Inverter make, model and AS/NZS 4777 compliance.
- Test results for operations and protection mechanisms.
- Electrical Inspector details



## 8.0 Responsibility of Owner/Operator of the Generation System

The owner or operator of the distributed generation system is responsible for the following:

- Maintenance and safe operation of the generation system (including inverters, protection devices, cabling and solar panels).
- Ensure the generation system complies with all relevant acts, regulations, standards rules and codes of practice.
- Operating the system within the generation capacity approved by Northpower.

## 9.0 Access by Northpower

The Customer shall provide Northpower with safe unobstructed access to the generation site and all upstream equipment at all reasonable times, providing:

- Access is required for matters concerning the generation circuit and its connection to the Northpower network.
- Northpower shall make a written request to the Customer to access the site for scheduled works.
- Northpower may not interfere with the Customer's equipment without their express permission. This does not include methods of isolation. Northpower may require immediate access to the Customer's equipment in the event of an emergency (i.e., to prevent a breach of safety or damage to property). Northpower shall inform the Customer of the circumstances and events as soon as practicable.

## 10.0 Remote monitoring

The Customer acknowledges that Northpower may use Smart Meter Data (also known as Network Operational Data) at the request of an authorised persons or to solve a serious safety issue relating to connection of the Customer's DG to the Northpower Network.

## 11.0 Interruptions / Temporary Disconnection from the Network

Interruptions / Temporary Disconnection from the Network

Northpower may, from time to time, isolate any Distributed Generation in order to perform certain maintenance tasks or manage the network capacity in accordance with the requirements of Northpower's operational requirements and *Congestion Management Policy - Distributed Generation*.

## 12.0 Application for Connection of DG

The process of connecting distributed generation to Northpower's network is detailed in Northpower's standard *New LV Service Connections*. This includes details of the customer application, network approval and connection process. For further details, please refer to this document.





### 13.0 Document Review History

Version Number	Date	Revision Notes (reason for change)
1.0	29/07/2022	<p>Australian Standard references (4777:2) changed to latest versions. Migrated content to new template and new ID code</p> <p>This document replaces standards:</p> <ul style="list-style-type: none"> <li>• APL.S.01.06 Technical Requirements - Connection of Small Scale Distributed Generation</li> <li>• ENS 02.01.065 Technical Requirements for Small Scale Distributed Generation.</li> </ul>
2.0	07/02/2025	<p>Changes in this version:</p> <ul style="list-style-type: none"> <li>• Residential with or without battery storage limited to 5kW per phase.</li> <li>• Added Definition data i.e. included meter data monitoring. For safety only or if requested by customer.</li> <li>• Generation system needs to be inspected by an endorsed EWRB inspector.</li> </ul> <p>Replaced previous version:</p> <ul style="list-style-type: none"> <li>• APL.S.200.01 Technical Requirements - Connection of Small to Medium Scale Distributed Generation</li> </ul>

