Technical requirements for connection of small capacity energy systems via inverters to Vector's network

Standard ENS4009

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I. DOCUMENT CONTROL

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Date for next review	1 July 2017	

Approved Versions	Date	Revision
1.0	13 May 2013	Initial publication
2.0	10 November 2014	Alignment of configuration settings to EN50438 and inclusion of three phase inverters to 30kW
3.0	14 October 2016	Alignment with AS/NZS 4777.1 2015
4.0	15 February 2017	Minor wording changes to accommodate batteries

II. ROLES AND RESPONSIBILITIES

Roles	Responsibility
Document Owner & Approver	Determining and responsible: • Relevant document name • Accurate, complete and up-to-date content • Document layout and formatting (using a standardised template) • Distribution of the document for review and approval to relevant stakeholders • Approval of the document • Document review frequency and storage • The owner can also be the document author or this role can be delegated to the document author
Document Author	Determining and ensuring: • Accurate, complete and up-to-date content • Document layout and formatting (using a standardised template)
Document Contributors	• People responsible for content/sections within a controlled document
Reviewed By:	• Validating accurate and complete content

III. RELATED DOCUMENTS

External Document No.	Document Title (Title & Description)
Electricity (Safety) Regulations	Electricity (Safety) Regulations 2010 http://www.legislation.govt.nz/regulation/public/2010/0036/latest/DLM27 63501.html?src=qs
AS 4777.1:2005	Grid connection of energy systems via inverters Part 1: Installation requirements
AS/NZS 4777.1:2016	Grid connection of energy systems via inverters Part 1: Installation requirements
AS/NZS 4777.2:2015	Grid connection of energy systems via inverters Part 2: Inverter requirements
EN 50438:2013	Requirements for micro-generating plants to be connected in parallel with public low-voltage distribution networks[1]
EEA PQ – 2013 rev 3.8	EEA (NZ) Power Quality Guidelines http://www.eea.co.nz/Attachment?Action=View&Attachment_id=1280
AS/NZS 3000:2007	New Zealand Wiring Rules
Electricity Industry Participation Code	Electricity Industry Participation Code (2010) – Part 6 Connection of Distributed Generation http://www.ea.govt.nz/code-and-compliance/the-code/

[1] Vector envisages imported inverters pre-set to the default settings specified in EN 50438 will be easier for prospective applicants to comply with Vector's protection settings.

IV. DOCUMENT METADATA

Document Security Level	Public Domain Information that is publicly available and is not sensitive and does not need to be labelled.
Enterprise Asset	☐ Information ☒ Network ☐ Products ☐ Systems ☐ Facilities
Asset Class	**Vector Wide** ☐ Non-Network Asset ☒ General **Electricity** ☐ Subtransmission Switchgear ☐ Power Transformer ☐ Underground Cables ☐ Overhead Lines ☒ Distribution ☐ Auxiliary Systems ☐ Infrastructure and Facilities ☒ PAC **Other:** Insert details **Gas** ☐ Gate Station ☐ Cathodic Protection ☐ District Regulator Station ☐ Mains ☐ North Harbour Pipeline ☐ Service Regulators ☐ Services ☐ Special Crossings ☐ Syphons ☐ Telemetry ☐ Valves
Purpose	☒ Planning ☐ Engineering Design ☐ Maintenance ☒ Operation ☐ Retirement/Disposal ☒ Information

1. INTRODUCTION

1.1 Purpose

The purpose of this standard is to describe the technical requirements for the connection of small scale energy systems using single or three phase inverters to Vectors network. Application of these devices will typically be used to connect solar, batteries or wind generation within residential dwellings.

1.2 Scope

The scope of this standard (which is based on the AS 4777.1-2005, .2-2005& .3-2005) includes:

a) Vector's technical requirements for inverters of 10kW or less connected to a Vector's 230V single phase supply, or 30kW or less, balanced across three phases and connected to Vector's 400V three phase supply[1].

The following is excluded from the scope of this standard:

b) The connection of inverters with capacities greater than 30kW three phase, or the connection of single phase inverters with capacities in excess of 10kW, to the single phase network.

2. HEALTH, SAFETY AND ENVIRONMENT

The use of inverters having connections to Vectors network pose a potential safety risk.

The potential for the inverter to export electricity onto the network either under normal operation or abnormal (e.g. fault) conditions, creates a potential risk to other connected customers or personnel working onto the network.

Within this standard we have adopted the use of New Zealand standards and regulations to ensure consistency of application. The area where we deviate from the standards is the adoption of protection configuration settings that are either required to meet New Zealand operating conditions (voltage and frequency) or are necessary for compatibility with Vectors network. Changes have been kept to a minimum in the interests of standardisation and to ensure ease of implementation.

It is important the technical requirements specified in this standard are implemented to ensure the safe operation of the inverter equipment, safety of other appliances connected to the network and the safety of personnel.

[1] Note that the new standard AS/NZS 4777.1:2016 will be applicable for inverter energy systems (IES) up to 200kVA. It also limits the maximum size of single phase inverters to be 5kVA.

3. STATUS OF STANDARDS

3.1 AS/NZS standards

New standards are in the process of being updated reflecting the New Zealand-only configuration settings applicable for the New Zealand environment. To facilitate the transition to these newer standards, Vector will continue to accept inverters configured in accordance AS 4777.1:2005, subject to the specific voltage and frequency requirements outlined in Section 4, until AS/NZS 4777.1:2016 and AS/NZS 4777.2:2015 are gazetted.

3.1.1 AS 4777.1:2005 – Grid connection of energy systems via inverters - Part 1: Installation requirements

AS 4777.1:2005 "Grid connection of energy systems via inverters – Part 1: Installation requirements" has been gazetted under the Electricity (Safety) Regulations and compliance is mandatory. However as an Australian standard there are features that are incompatible with the New Zealand power supply environment. The New Zealand requirements are highlighted in this technical standard.

3.1.2 AS/NZS 4777.2:2015 – Grid connection of energy systems via inverters - Part 2: Inverter requirements

Under the Electricity Industry Act 2010, the Electricity Authority has amended the Electricity Industry Participation Code (EPIC) to adopt AS/NZS 4777.2:2015 "Grid connection of energy systems via inverters – Part 2: Inverter requirements" as of 20 October 2016[3]. This standard has still to be gazetted under the Electricity (Safety) Regulations but compliance with this standard will meet Vectors requirements.

3.1.3 AS/NZS 4777.1:2016 – Grid connection of energy systems via inverters - Part 1: Installation requirements

A revised AS/NZS 4777.1:2016 "Grid connection of energy systems via inverters – Part 1: Installation requirements" was published on the 30 September 2016 and is expected to supersede AS 4777.1:2005[4]. This standard specifies the New Zealand and Australian voltage and frequency differences, and compliance with the New Zealand requirements of this standard will meet Vector's requirements.

[3] https://www.ea.govt.nz/dmsdocument/21271

[4] A new AS/NZS 4777.1: 2016 "Grid connection of energy systems via inverters – installation requirements" has a six months transition period from the date of publication.

4. VOLTAGE AND FREQUENCY SETTINGS

To ensure compatibility with Vectors network, voltage and frequency protection settings each inverter will comply with one of the following three requirements:

4.1 AS 4777.1:2005

Inverters configured to AS 4777.1:2005 must comply with the frequency and voltage settings in Table 1:

	Maximum disconnection/trip time	Protection limit
Over-voltage (V>>)	0.2 s	255 V for single-phase (or 445V for three-phase)
Over-voltage (V>)	2 s	250 V for single-phase (or 435V for three-phase)
Under-voltage (V<)	2 s	180 V for single-phase (or 313V for three-phase)
Over-frequency (f>)	2 s	52 Hz
Under-frequency (f<)	2 s	45 Hz

Table 1: New Zealand-only settings for inverters

4.2 European Standard EN50438

Vector envisages imported inverters pre-set to the default settings specified in EN 50438 will be easier for prospective distributed generation applicants to comply with Vector's protection settings. Inverters configured to European standard EN 50438 will be accepted on Vectors network.

4.3 AS/NZS 4777.2:2015

Inverters configured to the New Zealand settings in accordance with AS/NZS 4777.2 2015 will be accepted on Vectors network. Inverters configured to Australia-only settings are unacceptable.

5. INSTALLATION, TESTING, COMMISSIONING AND MAINTENANCE

The owner must ensure that the inverter is installed by a registered electrician in accordance with AS/NZS 3000. On completion of the installation Vector requires a copy of the Certificate of Compliance (COC) referencing installation of the inverter in accordance with AS 4777.1, and provide documented confirmation of the New Zealand-only settings (voltage and frequency) by way of a schedule or screen-shot of the relevant configuration settings to be emailed to DGInfo@vector.co.nz .

If the inverter is subsequently replaced, or alterations are made to the inverter installation, an updated Certificate of Compliance and settings schedule (or screen-shot verifying the correct settings have been installed) must be forwarded to Vector. The replacement inverter must meet Vector's technical standards applicable at the time of replacement.

The owner must ensure that each inverter is functional at all times and kept in good working order. If the inverter malfunctions, it must immediately be disconnected from Vector's network until it has been checked and tested by a suitably qualified person.