AS/NZS 4777.2:2020

Australian/New Zealand Standard™

Grid connection of energy systems via inverters

Part 2: Inverter requirements

AS/NZS 4777.2:2020

This Joint Australian/New Zealand Standard™ was prepared by Joint Technical Committee EL-042, Renewable Energy Power Supply Systems and Equipment. It was approved on behalf of the Council of Standards Australia on 27 November 2020 and by the New Zealand Standards Approval Board on 10 December 2020.

This Standard was published on 18 December 2020.

The following are represented on Committee EL-042:

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This Standard was issued in draft form for comment as DR AS/NZS 4777.2:2020.

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ISBN 978 1 76113 136 3

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Originated in Australia in part as AS 4777.2—2003 and AS 4777.3—2003.
Second editions 2005.
Jointly revised, amalgamated and redesignated as AS/NZS 4777.2:2015.
Fourth edition AS/NZS 4777.2:2020.

Preface

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-042, Renewable Energy Power Supply Systems and Equipment, to supersede AS/NZS 4777.2:2015, *Grid connection of energy systems via inverters, Part 2: Inverter requirements*. AS/NZS 4777.2:2015 will also remain current for 12 months after the date of publication of this Standard and after this time they will be superseded by AS/NZS 4777.2:202X. Regulatory authorities that reference this Standard in regulation may apply these requirements at a different time. Users of this Standard should consult with these authorities to confirm their requirements.

The objective of this Standard is to specify minimum performance and safety requirements for the design, construction and operation of inverters intended for grid connection of energy systems.

This Standard is part of a series on the grid connection of energy systems via inverters. The series is as follows:

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* (this Standard)

The differences between this and the previous edition include but are not limited to the following:

(a) Revision of sustained frequency response.

(b) Revised set-points and limits to match electricity distributor and grid operator requirements.

(c) Revision of provisions for demand response and power quality response modes.

(d) Inclusion of requirements for electrical safety of non-PV energy sources in accordance with IEC 62477-1.

(e) Inclusion of requirements for improved withstand capabilities including multiple voltage disturbances, rate of change of frequency and voltage phase shift.

(f) Inclusion of requirements for measurement system accuracy and functional prioritization.

(g) Inclusion of requirements for stand-alone inverters.

(h) Inclusion of requirements for generation limit and export limit control function.

(i) Revised and expanded testing procedures.

The following documents were used for information and guidance in the preparation of this Standard to ensure that features and requirements were aligned with international developments.

IEEE 1547-2018, *IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces*

VDE-AR-N 4105:2018-11, *Generators connected to the low-voltage distribution network — Technical requirements for the connection to and parallel operation with low-voltage distribution networks*

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The terms “normative” and “informative” are used in Standards to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is only for information and guidance.

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Section 1 Scope and general

1.1 Scope

This Standard specifies device specifications, functionality, testing and compliance requirements for electrical safety and performance for inverters designed to facilitate connectivity between energy sources and/or energy storage systems and the grid, connected at low voltage. This includes electric vehicles that can operate as an energy source and energy storage system that can supply an electrical installation connected to the grid.

This Standard also applies to stand-alone inverters within an electrical installation that may be connected to the grid at low voltage via an a.c. input port.

General requirements relating to the test methods set out in Appendices B to L are specified in Appendix A. Appendix M specifies requirements for stand-alone inverters.

NOTE This Standard does not include the regulatory requirements mandated in Australia by the Australian Communications Media Authority (ACMA) and in New Zealand by Radio Spectrum Management. Refer to ACMA, *Electromagnetic Compatibility—Information for suppliers of electrical and electronic products in Australia and New Zealand,* for guidance.

1.2 Application

This Standard enables the inverters to be installed as part of an inverter energy system (IES) in accordance with the requirements of AS/NZS 4777.1. This Standard applies in conjunction with the requirements of the electricity distributor approving the connection. Relevant legislation and regulations also apply.

1.3 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE Documents referenced for informative purposes are listed in the Bibliography.

AS 60038, *Standard voltages*

AS 60947.3, *Low voltage switch gear and control gear, Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units (IEC 60947-3:2015 (ED. 3.2) MOD)*

AS IEC 62040.3, *Uninterruptible power systems (UPS), Part 3: Method of specifying the performance and test requirements*

AS IEC 62196.2, *Plugs, socket-outlets, vehicle connectors and vehicle inlets — Conductive charging of electric vehicles, Part 2: Dimensional compatibility and interchangeability requirements for a.c. pin and contact-tube accessories*

AS/NZS 3000, *Electrical installations (known as the Australian/New Zealand Wiring Rules)*

AS/NZS 3112, *Approval and test specification—Plugs and socket-outlets*

AS/NZS 4777.1, *Grid connection of energy systems via inverters, Part 1: Installation requirements*

AS/NZS 5033, *Installation and safety requirements for photovoltaic (PV) arrays*

AS/NZS 60320.1, *Appliance couplers for household and similar general purposes, Part 1: General requirements (IEC 60320-1 Ed. 2.1 (2007) MOD)*

AS/NZS 61000.3.2, *Electromagnetic compatibility (EMC), Part 3.2: Limits—Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)*

AS/NZS 61000.3.3, *Electromagnetic compatibility (EMC), Part 3.3: Limits—Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection*

AS/NZS 61000.3.4, *Electromagnetic compatibility (EMC), Part 3.4: Limits—Limitation of emission of harmonic currents in low-voltage power supply systems for equipment with rated current greater than 75 A*

AS/NZS 61000.3.11, *Electromagnetic compatibility (EMC), Part 3.11: Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems—Equipment with rated current less than or equal to 75 A and subject to conditional connection*

AS/NZS IEC 60947.2, *Low-voltage switch gear and control gear, Part 2: Circuit-breakers*

AS/NZS IEC 61000.3.12, *Electromagnetic compatibility (EMC), Part 3.12: Limits—Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase*

AS/NZS IEC 62116, *Utility-interconnected photovoltaic inverters—Test procedure of islanding prevention measures*

IEC 60309-1, *Plugs, socket-outlets and couplers for industrial purposes — Part 1: General requirements*

IEC 61851-1, *Electric vehicle conductive charging system — Part 1: General requirements*

IEC 62109-1, *Safety of power converters for use in photovoltaic power systems — Part 1: General requirements*

IEC 62109-2, *Safety of power converters for use in photovoltaic power systems — Part 2: Particular requirements for inverters*

IEC 62196-3, *Plugs, socket-outlets, vehicle connectors and vehicle inlets — Conductive charging of electric vehicles — Part 3: Dimensional compatibility and interchangeability requirements for d.c. and a.c./d.c. pin and contact-tube vehicle couplers*

IEC 62477-1, *Safety requirements for power electronic converter systems and equipment — Part 1: General*

1.4 Terms and definitions

For the purpose of this document, the following terms and definitions and those of AS/NZS 3000 apply.

1.4.1
active anti-islanding protection
method of preventing islanding by actively varying the output of the inverter

1.4.2
cease power generation
cease active power output and any power quality response while remaining connected to the grid during voltage disturbances

Note 1 to entry: Passive reactive power flow may continue (e.g. due to inverter filter capacitors).

1.4.3
displacement power factor
cosine of the angle (φ) between the fundamental voltage and the fundamental current