

AS/NZS 4777.2:2020

Grid connection of energy systems via inverters

Part 2: Inverter requirements

Amendment No. 2

Revised text amendment

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Council of Standards Australia Approval: 3 August 2024

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Summary

This Amendment applies to the following elements:

- Preface
- Clauses 1.1, 1.3, 1.4
- Clauses 2.2, 2.3.1, 2.3.2, 2.3.3, 2.3.3.1, 2.3.3.2, 2.3.4, 2.4.2, 2.5, 2.6, 2.7, 2.10, 2.11, 2.12.1, 2.12.2, 2.12.3, 2.12.4, 2.12.5, 2.14
- Clauses 3.3.4.3.3, 3.3.4.3.4, 3.4.1, 3.4.2, 3.4.4, 3.4.5, 3.5
- Clauses 4.2, 4.3, 4.5.4.1, 4.7, 4.8, 4.9
- Clauses 6.1, 6.2.1, 6.2.2, 6.3.1
- Clauses 7.1, 7.2.1, 7.2.3, 7.2.4, 7.3.1, 7.3.3, 7.3.4, 7.3.6
- Clauses A.3, A.5, A.6, B.2, C.3, E.2.3, E.2.4, F.2, G.3, I.2.3, I.2.4, I.2.5, I.5.4, J.2.1, J.3.3, J.3.5, J.3.7, J.3.9, L.2, L.4.1, L.4.2.1, L.4.2.3, L.4.2.4, L.4.3
- Tables 2.5, 4.10 (new), G.2, G.3, I.4, L.1, L.3, L.4 (new), M.3
- Appendix M
- Figures 2.2, L.1, L.2, L.5
- Bibliography

Amendment Details

AS/NZS 4777.2:2020 is amended as follows. The amendments should be inserted in the locations as instructed.

Element	Instruction/New text
Preface 1	Delete first paragraph and <i>replace</i> with the following: 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, <i>Grid connection of energy systems via inverters, Part 2: Inverter requirements</i>.



Element	Instruction/New text
	AS/NZS 4777.2:2020 incorporating Amendment No. 1 will remain current for 12 months from the date of publication of this document (Amendment No. 2). After this time, it will be superseded by AS/NZS 4777.2:2020 incorporating Amendment No. 1 and Amendment No. 2. 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.
	2 After the third paragraph, <i>add</i> the following new paragraph: This Standard now incorporates the terms “independent supply” and “substitute supply” introduced in AS/NZS 4777.1:2024 in addition to “supplementary supply” and “alternative supply” as defined in AS/NZS 3000. In the next revision the terminology grid-interactive inverter/port may be changed to supplementary supply inverter/port so that the terminology aligns with AS/NZS 4777.1:2024.
	3 Item (g), <i>delete</i> “stand-alone” and <i>replace</i> with “independent supply”.
CI 1.1	1 <i>Delete</i> the first paragraph and <i>replace</i> with the following: 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 a normal supply from the grid, connected at low voltage and that provide a supplementary supply. This document is for low voltage systems with nominal values of 230 V/400 V that conform to AS IEC 60038 for Australia or IEC 60038 for New Zealand. This includes electric vehicles (EV) and EV supply equipment that can operate as an energy source and energy storage system that can supply an electrical installation connected to the grid.
	2 Second paragraph, <i>delete</i> “stand-alone inverters” and <i>replace</i> with “inverters capable of operating in an independent supply mode”.
	3 Third paragraph, <i>delete</i> “stand-alone inverters” and <i>replace</i> with “independent supply inverters”.
CI 1.3	1 <i>Delete</i> “AS 60038” and <i>replace</i> with “AS IEC 60038”.
	2 At end of clause <i>add</i> “ISO 17409, <i>Electrically propelled road vehicles – Conductive power transfer – Safety Requirements</i> ”.
CI 1.4	1 Entry 1.4.9, <i>delete</i> Note 1 to entry and <i>replace</i> with the following: Note 1 to entry: For the purposes of this document, a.c. to a.c. converters that use semiconductor devices to transfer power between non-grid energy sources and an a.c. source or load are considered to be inverters.
	2 <i>Delete</i> Entry 1.4.10 and <i>replace</i> with the following: 1.4.10 inverter energy system IES system comprising one or more inverters together with one or more energy sources and controlled up to the single main switch for that system Note 1 to entry: Multiple IES installations can exist within a single electrical installation. Note 2 to entry: Energy sources may include batteries or EVs for energy storage. Note 3 to entry: The IES may include additional equipment used for monitoring and control.
	3 Entry 1.4.13, in Note 2 to entry, <i>delete</i> “Vehicle to grid capable electric vehicle supply equipment”, and <i>replace</i> with “EV and EV supply equipment capable of reverse power transfer”.
	4 Entry 1.4.13, in the source statement, <i>delete</i> “IEC 62109-2:2014” and <i>replace</i> with “IEC 62109-2:2011”.
	5 Entry 1.4.15, in the source statement, <i>delete</i> “IEC 62109-1:2014” and <i>replace</i> with “IEC 62109-1:2010”.
	6 Entry 1.4.16, in the source statement, <i>delete</i> “IEC 62109-1:2014”, and <i>replace</i> with “IEC 62109-1:2010”.

Element	Instruction/New text
7	Entry 1.4.17, <i>delete</i> “Note 3 to entry: Electric vehicle connections that use AS IEC 62196.2 or IEC 62196-3 are examples of pluggable equipment type B.”
8	Entry 1.4.17, in the source statement, <i>delete</i> “IEC 62109-1:2014” and <i>replace</i> with “IEC 62109-1:2010”.
9	Entry 1.4.18, in the source statement, <i>delete</i> “IEC 62109-1:2014”, and <i>replace</i> with “IEC 62109-1:2010”.
10	Entry 1.4.19, in the source statement, <i>delete</i> “IEC 62109-1:2014”, and <i>replace</i> with “IEC 62109-1:2010”.
11	Entry 1.4.20, <i>delete</i> “IEV 151 04 03” and <i>replace</i> with “IEC 62109-1:2010, 3.77, modified”.
12	<i>Delete</i> entry 1.4.28.
13	<i>Delete</i> entry 1.4.29.
14	After entry 1.4.30, <i>add</i> the following:
	1.4.31
	Mode 3
	method for the connection of an EV to an a.c. EV supply equipment permanently connected to an a.c. supply network, with a control pilot function that extends from the a.c. EV supply equipment to the EV
	[SOURCE: IEC 61851-1:2017 Clause 6.2.3]
	1.4.32
	Mode 4
	method for the connection of an EV to an a.c. or d.c. supply network utilizing a d.c. EV supply equipment, with a control pilot function that extends from the d.c. EV supply equipment to the EV
	[SOURCE: IEC 61851-1:2017 Clause 6.2.4]
	1.4.33
	region
	category that aligns with an electricity distribution area that specifies default parameters for configuration of an inverter as specified by an electricity distributor
	1.4.34
	reverse power transfer
	supply of electric power from an EV using the EV plug [case A], the vehicle inlet [case B or case C], or automatic coupler [case D or case E] to an external electric circuit
	Note 1 to entry: Unintended current flow from an EV to an external electric circuit is not considered a reverse power transfer.
	Note 2 to entry: Supply of power by using an on-board equipment that is equipped with a socket-outlet is not reverse power transfer.
	Note 3 to entry: See AS/NZS 3000 for case A, case B, and case C description for types of connections.
	[SOURCE: ISO 17409:2020, modified — Note 3 to entry has been added.]
	1.4.35
	supply, alternative
	Refer to AS/NZS 3000 for alternative supply definition
	Note 1 to entry: A supply that is only available in the event of an outage of the grid supply can be a type of alternative supply.
	1.4.36
	supply, independent

Element	Instruction/New text
	supply system intended to supply the functioning of an electrical installation or part thereof, as an islanded operation instead of the normal supply from the grid, while the normal supply remains connected to the electrical installation
	1.4.37
	supply, normal
	Refer to AS/NZS 3000 for normal supply definition
	Note 1 to entry: The grid supply is a type of normal supply.
	1.4.38
	supply, substitute
	electrically separated supply system intended to supply a single socket-outlet in the event of an outage of the normal supply where another energy source is available. The supply is limited to the energy source available
	1.4.39
	supply, supplementary
	Refer to AS/NZS 3000 for supplementary supply definition
CI 2.2	1 First paragraph, <i>delete</i> “photovoltaic (PV) arrays and/or batteries” and <i>replace</i> with “photovoltaic (PV) array port/s”.
	2 Third paragraph, <i>delete</i> “energy storage (batteries)” and <i>replace</i> with “energy storage (e.g. batteries or EVs)”.
	3 Fourth paragraph, <i>delete</i> “energy sources other than photovoltaic (PV) arrays or batteries” and <i>replace</i> with “other types of energy sources without photovoltaic (PV) arrays”.
CI 2.3.1	1 <i>Delete</i> second paragraph.
	2 Fourth paragraph, after Item (b), <i>delete</i> “All inverter ports (except communications ports)” and <i>replace</i> with “All inverter source or load ports”.
	3 Before final paragraph, <i>add</i> “Exception: Where an EV or EV supply equipment is part of an inverter energy system then Clause 2.3.4 shall apply. Inverters integrated into an EV are not considered portable equipment.”
CI 2.3.2	First paragraph, between “inverters” and “shall”, <i>add</i> “and EV Supply Equipment capable of reverse power transfer”.
CI 2.3.3.1	<i>Delete</i> clause heading “2.3.3.1 General”.
CI 2.3.3.2	<i>Delete</i> Clause 2.3.3.2.
CI 2.3.4 (new)	After Clause 2.3.3, <i>add</i> the following new clause:
	2.3.4 Electric vehicle connections
	For connection to the electrical installation of EV supply equipment capable of reverse power transfer used in an inverter energy system, Clause 2.3.2 shall apply.
	The connection of EV to the EV supply equipment used in an inverter energy system shall —
	(a) be Mode 3 or Mode 4 in accordance with IEC 61851-1; and
	(b) utilize connectors that comply with AS IEC 62196.2 in the case of Mode 3 or IEC 62196-3 in the case of Mode 4.
CI 2.4.2	At end of the clause, <i>add</i> “NOTE: EVs and EV Supply Equipment capable of reverse power transfer are a type of energy storage; they are not categorized as a battery system that conforms to AS/NZS 5139 as they are excluded from the scope of AS/NZS 5139.”
CI 2.5	1 Second sentence, <i>delete</i> “AS 60038” and <i>replace</i> with “AS IEC 60038”.
	2 In Note, <i>delete</i> “AS 60038”, and <i>replace</i> with “AS IEC 60038”.
CI 2.6	1 First paragraph, before the last sentence, <i>add</i> the following:
	Where the active power level is less than 4 % of the rated apparent power, the inverter shall not absorb or supply reactive power of more than 4 % of the rated apparent power, unless required to do so by a reactive power mode.

Element	Instruction/New text
2	After first paragraph, <i>add</i> the following new paragraph The reactive power capability of the inverter shall be declared in the test report.
3	In Note, <i>delete</i> “controlled” and <i>replace</i> with “limited”.
CI 2.7	After the note, <i>add</i> the following: <i>Exception: The inverter may include a harmonic mitigation mode that does not conform to this clause. The harmonic mitigation mode shall be disabled by default and when the inverter is undergoing type testing in accordance with Appendix B. The harmonic mitigation mode shall only be enabled with agreement of the local electricity distributor.</i>

Figure 2.2 Delete Figure 2.2 and *replace* with the following:

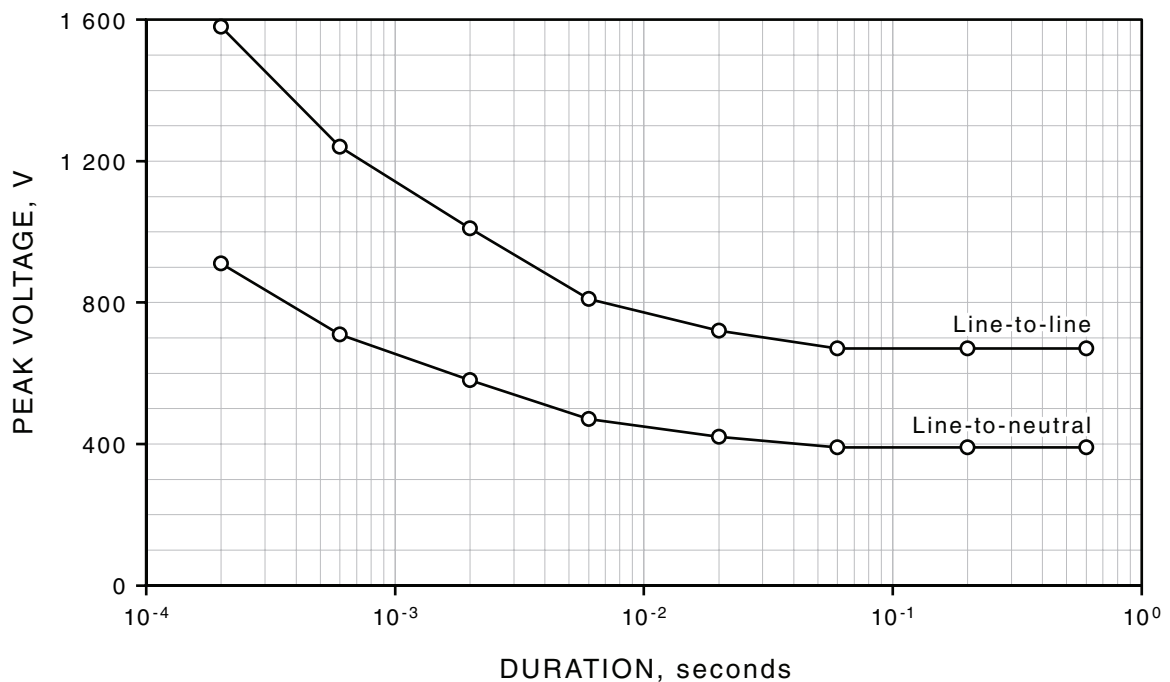


Figure 2.2 — Voltage duration curve of transient voltage limits

Element	Instruction/New text
CI 2.10	1 First paragraph, <i>delete</i> “and/or stand-alone port” and <i>replace</i> with “alternative supply, substitute supply and/or independent supply port”. 2 Second paragraph, <i>delete</i> “and/or stand-alone port” and <i>replace</i> with “alternative supply, substitute supply and/or independent supply port”.
CI 2.11	At end of clause, <i>add</i> the following: <i>Exception: The inverter may include a current imbalance mitigation mode that does not conform to this clause. The current imbalance mitigation mode shall be disabled by default and before the inverter is evaluated to the requirements of this clause. The current imbalance mitigation mode shall only be enabled with agreement of the local electricity distributor.</i>
CI 2.12.1	1 Delete Items (e) and (f). 2 Item (g), <i>delete</i> “those listed in Items (e) and (f)” and <i>replace</i> with “PV and Battery systems”. 3 Delete last paragraph.
CI 2.12.2	1 Delete Item (e) and <i>replace</i> with the following two new list items: (e) conform to additional requirements of Clause 2.12.4 for PV array energy source;

- (ee) conform to additional requirements of Clause 2.12.5 for battery system energy sources;
- CI 2.12.3** At the end of clause, *add* “NOTE: Circuit breakers are permitted for use in all ports of an inverter including PV array ports and battery system ports.”
- CI 2.12.4** 1 First paragraph, *delete* “the isolating devices for PV array ports that are part of or within the inverter” and *replace* with “where a switch disconnecter is used for PV array ports that are part of or within the inverter, the switch disconnecter”.
- 2 Second paragraph, *delete* “the isolating devices for PV array ports as a part of or within the inverter” and *replace* with “where a switch disconnecter is used for PV array ports that are part of or within the inverter, the switch disconnecter”.
- CI 2.12.5** *Delete* first paragraph and *replace* with “Where a switch disconnecter is used for battery system ports that are part of or within the inverter, the switch disconnecter shall meet the following additional requirements”:
- Tbl 2.5** In note to table, *delete* “AS 60038” and *replace* with “AS IEC 60038”.
- CI 2.14** After first paragraph, *add* the following:
- NOTE: Grid support functions may be implemented through agreement with the electricity distributor and system operator, including specification of the response required and how the response is ordered within the prioritization of functions.
- CI 3.3.4.3.3** 1 *Delete* “NOTE” and *replace* with “NOTE 1”.
- 2 After note, *add* the following new note:
- NOTE 2: The ramp rate associated with changes in a.c. operation and control does not apply when the inverter is being remotely controlled (other than by DRM) or providing grid support functions. See Table 2.6 for prioritization of other response directly by the inverter.
- CI 3.3.4.3.4** 1 First paragraph, third sentence, *delete* “consumption” and *replace* with “charging of the energy storage through the grid-interactive port”.
- 2 First paragraph, fourth sentence, *delete* “For this mode, the power rate limit (W_{Gra}) should be able to be enabled or disabled. The power rate limit shall be disabled by default.” and *replace* with “For this mode the power rate limit (W_{Gra}) shall be available and disabled by default.”
- CI 3.4.1** *Delete* all 11 instances of “stand-alone” in clause and *replace* with “alternative supply”.
- CI 3.4.2** 1 *Delete* heading and *replace* with “Sinusoidal output when providing alternative supply, independent supply and substitute supply”.
- 2 *Delete* first paragraph and *replace* with “The a.c. output voltage waveform of a multiple mode inverter when providing an alternative supply, independent supply or substitute supply shall have a voltage total harmonic distortion (THD) not exceeding of 5 % and no individual harmonic at a level exceeding 5 %.”
- CI 3.4.4** 1 *Delete* clause heading and *replace* with “Independent supply inverters”.
- 2 First paragraph, first sentence, *delete* “variety of stand-alone inverters, which are intended for supply of 230 V a.c. power” and *replace* with “variety of independent supply inverters, which are intended for supply of 230 V/400 V a.c. power”.
- 3 First paragraph, second sentence, *delete* “have a stand-alone port” and *replace* with “have an independent supply port”.
- 4 First paragraph, last sentence, *delete* “A stand-alone inverter is”, and *replace* with “An independent supply inverter is”.
- 5 Second paragraph, *delete* “not considered a stand-alone inverter” and *replace* with “not considered an independent supply inverter”.
- 6 Third paragraph, *delete* “port of a stand-alone inverter” and *replace* with “port of an independent supply inverter”.
- 7 *Delete* fourth paragraph and *replace* with the following:
- Independent supply inverters shall not output power towards the grid from the a.c. input port during normal operation or fault conditions. An IES connected to the independent supply port shall not be able to pass power towards the grid through the a.c. input port of the independent supply inverter in any mode of operation.