

AS/NZS 3001.2:2022



Australian/New Zealand Standard™

Electrical installations — Connectable electrical installations and supply arrangements

Part 2: Connectable electrical installations



AS/NZS 3001.2:2022

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- Australian Industry Group
- Communications, Electrical and Plumbing Union — Electrical Division
- Consumers' Federation of Australia
- Electrical Regulatory Authorities Council
- Electrical Safety New Zealand
- Electrical Workers Registration Board
- ElectroComms & Energy Utilities Industry Skills Council
- Energy Networks Australia
- Engineering New Zealand
- Engineers Australia
- Institute of Electrical Inspectors
- Master Electricians Australia
- Master Electricians NZ
- National Electrical and Communications Association
- National Electrical Switchboard Manufacturers Association
- The Manufacturers' Network
- WorkSafe New Zealand

Additional Interests

- B&R Enclosures
- Caravan Industry Association of Australia
- Coates Hire
- Dometic Power & Control (Enerdrive)
- Triple Electrical Inspections

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Australian/New Zealand Standard™

Electrical installations — Connectable electrical installations and supply arrangements

Part 2: Connectable electrical installations

Originated in Australia as part of AS 3001—1959 and AS 3005—1982.
Originated in New Zealand as part of AS/NZS 3001:2001.
Previous edition part of AS/NZS 3001:2008.
Jointly revised in part and redesignated as AS/NZS 3001.2:2022.

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Preface

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-001, Wiring Rules, to supersede AS/NZS 3001:2008, *Electrical installations—Transportable structures and vehicles including their site supplies*.

The objective of this Standard is to provide the requirements for electrical installations associated with connectable electrical installations, including their alterations and repairs. It includes provisions for the connection of electric power to various types of connectable electrical installations, including relocatable units, recreational vehicles, and non-recreational vehicles.

AS/NZS 3001:2008 will also remain current for 12 months after the date of publication of this Standard for the requirements covered in this Standard only. After this time it will be superseded by AS/NZS 3001.1:2022 and AS/NZS 3001.2:2022. 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.

This Standard forms Part 2 of the AS/NZS 3001 series as follows:

AS/NZS 3001.1, *Electrical installations — Connectable electrical installations and supply arrangements, Part 1: Site supplies for connectable electrical installations*

AS/NZS 3001.2, *Electrical installations — Connectable electrical installations and supply arrangements, Part 2: Connectable electrical installations* (this Standard)

The preparation of this Standard was undertaken following requests from industry for a comprehensive set of requirements applicable to connectable electrical installations with minimal reference to AS/NZS 3000.

This Standard does not attempt to include every installation method, but contains installation methods which are considered by industry to be the most commonly used for connectable electrical installations that are consistent with AS/NZS 3000.

The general principles and requirements of AS/NZS 3000 apply for the application of this Standard.

This Standard has been divided into separate sections for specific types of connectable electrical installations, reducing the need for the reader to refer to other sections of the Standard.

The major changes in this edition are as follows:

- (a) AS/NZS 3001 has been divided into two parts. Part 2 specifies requirements for electrical installations in connectable electrical installations.
- (b) [Section 1](#) provides the scope, inclusions and exclusions of this Standard. The definitions, as well as the alterations and repairs clauses have been expanded.
- (c) [Section 2](#) provides external supply connection and onboard supply installation requirements applicable to a connectable electrical installation.
- (d) [Section 3](#) provides the installation requirements for relocatable units.
- (e) [Section 4](#) provides the installation requirements for recreational vehicles and non-recreational vehicles.
- (f) [Section 5](#) provides the installation requirements for extra-low voltage wiring systems and equipment in all connectable electrical installations.
- (g) [Section 6](#) provides verification requirements in all connectable electrical installations.
- (h) The issuing of Warrants of Electrical Fitness has been amended for New Zealand, see [Appendix D](#).

- (i) [Appendix E](#) has been added, covering additional New Zealand requirements for the issue of Warrants of Electrical Fitness for imported connectable electrical installations.

All figures have been updated and new figures included for clarity.

The following sections are applicable to each type of connectable electrical installation:

- (i) Relocatable units — [Sections 1, 2, 3, 5 and 6](#).
- (ii) Recreational vehicles and non-recreational vehicles — [Sections 1, 2, 4, 5 and 6](#).

This Standard may be applied through legislative requirement, from a date to be set by the relevant regulatory authority. If work on an installation was commenced before publication of this edition, refer to the relevant regulatory authority or electricity distributor regarding permission for the installation to be completed under AS/NZS 3001:2008 as applicable.

Differences between requirements in Australia and New Zealand are as follows:

This Standard applies to new connectable electrical installations.

In Australia:

AS

- (A) 15 A, three-pin, flat-pin plugs complying with AS/NZS 3112 are the type most commonly used for single-phase supply to connectable electrical installations. Round-pin plugs and socket-outlets complying with AS/NZS 3123 may be used.
- (B) It is required that all protection devices and switching devices connected to the wiring of connectable electrical installations operate in all live (active and neutral) conductors, unless a polarity sensing device is installed on the input supply to the connectable electrical installation(s).

In New Zealand:

NZ

- (1) For single-phase supply, supply lead plugs complying with IEC 60309-2 are the norm for all types of connectable electrical installation, however other types may be used.
- (2) A diminishing number of older caravans are fitted with a neutral-earth connection. If supplied from a source that is protected by RCD, the RCD will trip. Supply must instead be obtained from a source not protected by RCD, e.g. an older service pillar in a caravan park. It is expected that such issues will become less frequent as older caravans are upgraded in accordance with this edition.

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.

See Introduction for information on how to interpret and use this Standard.

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Introduction

Application of typefaces

Four different typefaces are used in this Standard. Each of these has a specific purpose as follows:

- (a) Normal print indicates requirements that form the main part of a clause. It also indicates deemed to comply methods that satisfy the requirements. Normal print is used in the appendices to present informative material for guidance only.
- (b) *Italic print indicates exceptions or variations to requirements. Exceptions generally give specific examples where the requirements do not apply or where they are varied for certain applications. They may contain requirements. Examples are also presented in italic text.*

- (c) Reduced size normal print indicates Notes which give explanations and advice.

NOTE They are preceded by the word “NOTE” in the manner used in previous editions.

- (d) **Bold print indicates WARNINGS.**

It is important not to read text in any single typeface without consulting the preceding or following paragraphs, which may contain additional or modifying requirements.

National requirements

Certain provisions of the Standard have a different application in Australia and New Zealand. The following symbols appearing in the outer margin indicate that the identified section or clause is:

- (i) Applicable in Australia only.

AS

- (ii) Applicable in New Zealand only

NZ

Deemed to comply

The term “deemed to comply” means that a requirement can be met by following a specified Standard or method.

So, where an installation is carried out in accordance with the specified Standard or method, the installation is “deemed to comply” with the requirements of this Standard.

Conformance to a deemed to comply Standard may exceed the minimum requirements of this Standard.

Notes

Notes to clauses are informative and give explanations or advice. They do not form a mandatory part of this Standard.

Cross-references

Where reference to another clause has been made, such reference, unless otherwise stated, includes all appropriate subclauses and paragraphs of the clause or portion thereof referred to.

Typical figures

Figures labelled as “typical” show one method of complying with the requirements set by the clause(s) that refers to them. Other arrangements are not precluded, provided they comply with the relevant clause(s). Figures do not necessarily illustrate all requirements that may apply.

Provision for revision

This Standard is not intended to discourage invention or to exclude materials, equipment and methods that may be developed. Revisions will be made from time to time in view of such developments and Amendments to this edition will be made where essential.

NOTES

Australian/New Zealand Standard

Electrical installations — Connectable electrical installations and supply arrangements

Part 2: Connectable electrical installations

Section 1 Scope and general

1.1 Scope

1.1.1 General

This Standard sets out the requirements for connectable electrical installations used for the purposes of accommodation, habitation or other residential, commercial or recreational uses that are intended for connection to external low voltage a.c. (see [Clause 1.4.28](#)) supply systems by either —

- (a) a detachable supply lead; or
- (b) a supply lead directly connected to the connectable electrical installation.

A connectable electrical installation (see [Clause 1.4.8](#)) may comprise a number of types of low voltage supplies, however where a connectable electrical installation has the facility to connect to an external supply (see [Clause 1.4.23.2](#)), it is required to comply with this Standard.

This Standard also sets out requirements and provides guidance for the installation of extra-low voltage (see [Clause 1.4.28](#)) systems installed within connectable electrical installations that are intended for detachable connection to external low voltage a.c. supply systems.

For the purposes of this Standard, the term “connectable electrical installation” includes vehicles and units with or without wheels that can readily be moved from one site to another, either under their own motive power or by some other means.

The particular requirements of this Standard replace, modify or are additional to the general requirements of AS/NZS 3000 for the electrical wiring of connectable electrical installations.

These requirements are intended to protect persons, livestock, and property from electric shock, fire and physical injury hazards that may arise from a connectable electrical installation that is used with reasonable care and with due regard to the intended purpose of the electrical installation.

In addition, guidance is provided so that the electrical installation functions correctly for the purpose intended.

1.1.2 Inclusions

1.1.2.1 Relocatable units

Relocatable units (see [Clause 1.4.19](#)) including, but not limited to:

- (a) Homes.
- (b) Cabins/huts.
- (c) Site offices.
- (d) Cloakrooms.
- (e) Meeting offices.

- (f) Dormitories.
- (g) Canteens.
- (h) First aid rooms.
- (i) Toilet facilities.
- (j) Washroom facilities.
- (k) Other facilities.
- (l) Tents for accommodation.
- (m) Rigid and non-rigid annexes.

See [Figure 1.1](#) for further information.

1.1.2.2 Recreational vehicles

Recreational vehicles (see [Clause 1.4.18](#)) including, but not limited to:

- (a) Caravans.
- (b) Camper vans.
- (c) Motor homes.
- (d) Camper trailers.
- (e) Pop top caravans.
- (f) Tent trailers.
- (g) Fifth wheel caravans.
- (h) Slide on campers.
- (i) Converted buses or trailers.

See [Figure 1.1](#) for further information.

1.1.2.3 Non-recreational vehicles

Non-recreational vehicles (see [Clause 1.4.15](#)) including, but not limited to:

- (a) Horse floats.
- (b) Semi-trailers.
- (c) Livestock or car transporters.
- (d) Vehicles such as food and drink vending vans and trailers.
- (e) Educational display caravans and trailers, mobile classrooms.
- (f) Television outside broadcast vans.
- (g) Mobile stages.
- (h) Display units e.g. mobile electronic score boards and advertising signs, mobile traffic information signs.

- (i) Hybrid, any towable or self-propelled vehicle that does not fit specifically into any of the above categories.
- (j) Other vehicles such as emergency vehicles that have an external low voltage connection.
- (k) In New Zealand, mobile medical connectable installations complying with the requirements of this Standard.

NZ

NOTE Further requirements for mobile medical connectable installations can be found in NZS 6115.

See [Figure 1.1](#) for further information.

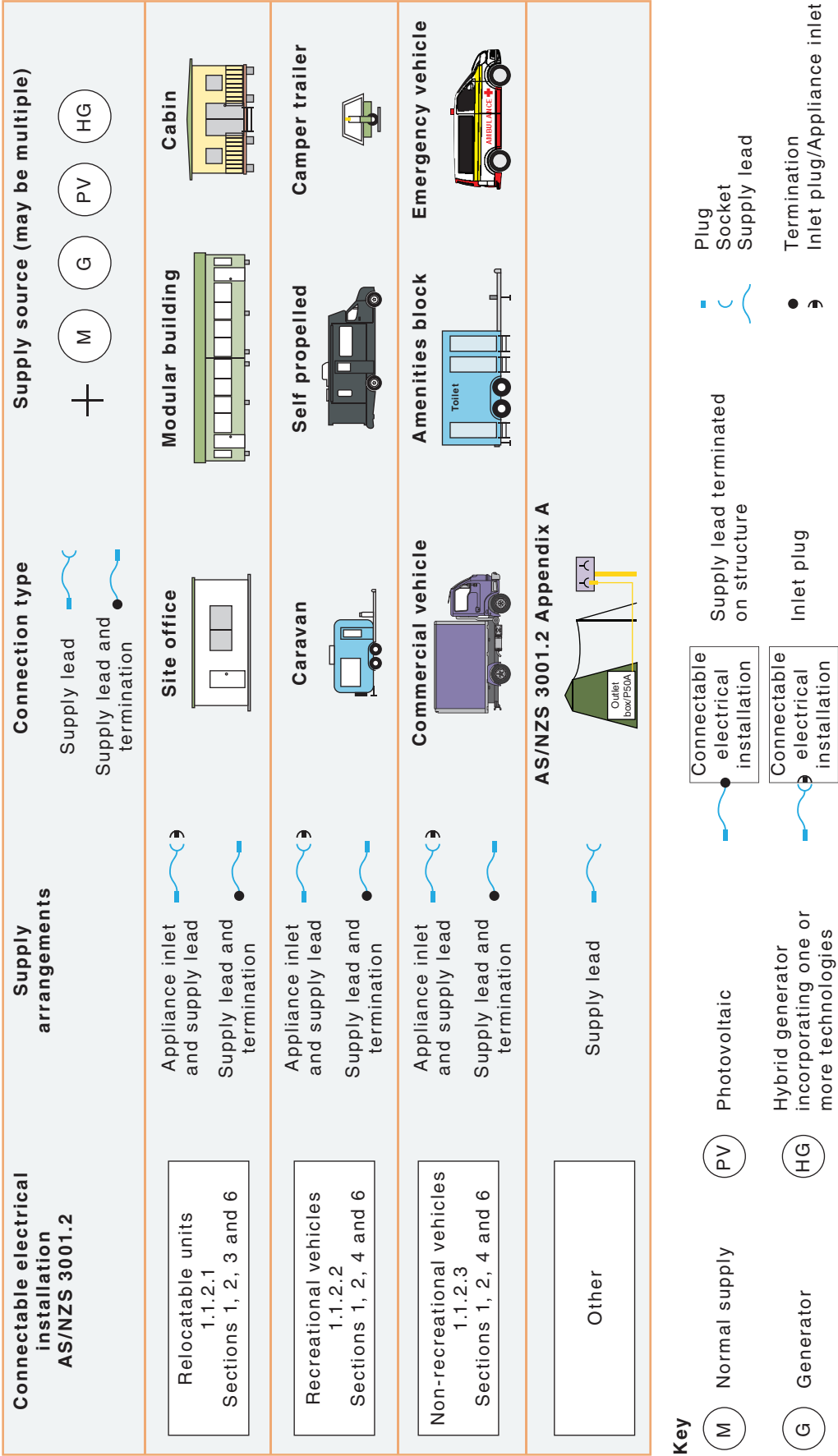


Figure 1.1 — Typical inclusions to this Standard

1.1.3 Exclusions

This Standard does not apply to connectable electrical installations that are immobilized or fixed in position and directly connected by installation wiring, and where the ability for relocation is not intended to be maintained. These structures are subject to the requirements of AS/NZS 3000.

Examples include but are not limited to the following:

- (a) Vehicles, recreational vehicles and non-recreational vehicles that are rendered immobile, e.g. tramcars, buses, etc.
- (b) Relocatable units, e.g. homes, huts, construction sheds and tents.

In addition, this Standard does not apply to the following:

- (i) Vehicles forming part of an amusement ride or device. These vehicles may be subject to the requirements of AS 3533.
- (ii) Structures for the provision of entertainment that do not contain an electrical installation e.g. circus and carnival tents and temporary vending stalls. These structures are subject to the requirements of AS/NZS 3002.
- (iii) Boats.
- (iv) Other vehicles such as emergency vehicles that do not have an external low voltage connection. In the case of these vehicles, this Standard may be used as a guide.
- (v) Non-recreational vehicle fitted with a permanently attached supply lead or inlet plug for the connection of a single item of electrical equipment, such as the following:
 - (A) Trailed concrete mixer.
 - (B) Single on board battery charger, only.
 - (C) Mobile elevated work platform (MEWP) battery charger only.
 - (D) Mobile battery powered equipment charger.
 - (E) Message boards and portable traffic advisory systems.

This Standard does not cover requirements for the following:

- (1) Re-generative drive/braking systems.
- (2) Battery charging while moving.
- (3) Enhanced protection arrangements that may be subject to design and original equipment manufacturer's requirements.

This Standard does not apply to automotive wiring systems, electrical fittings, and electrical wiring whose primary function relates to propulsion or roadworthiness of a vehicle.

See [Figure 1.2](#) for further information.

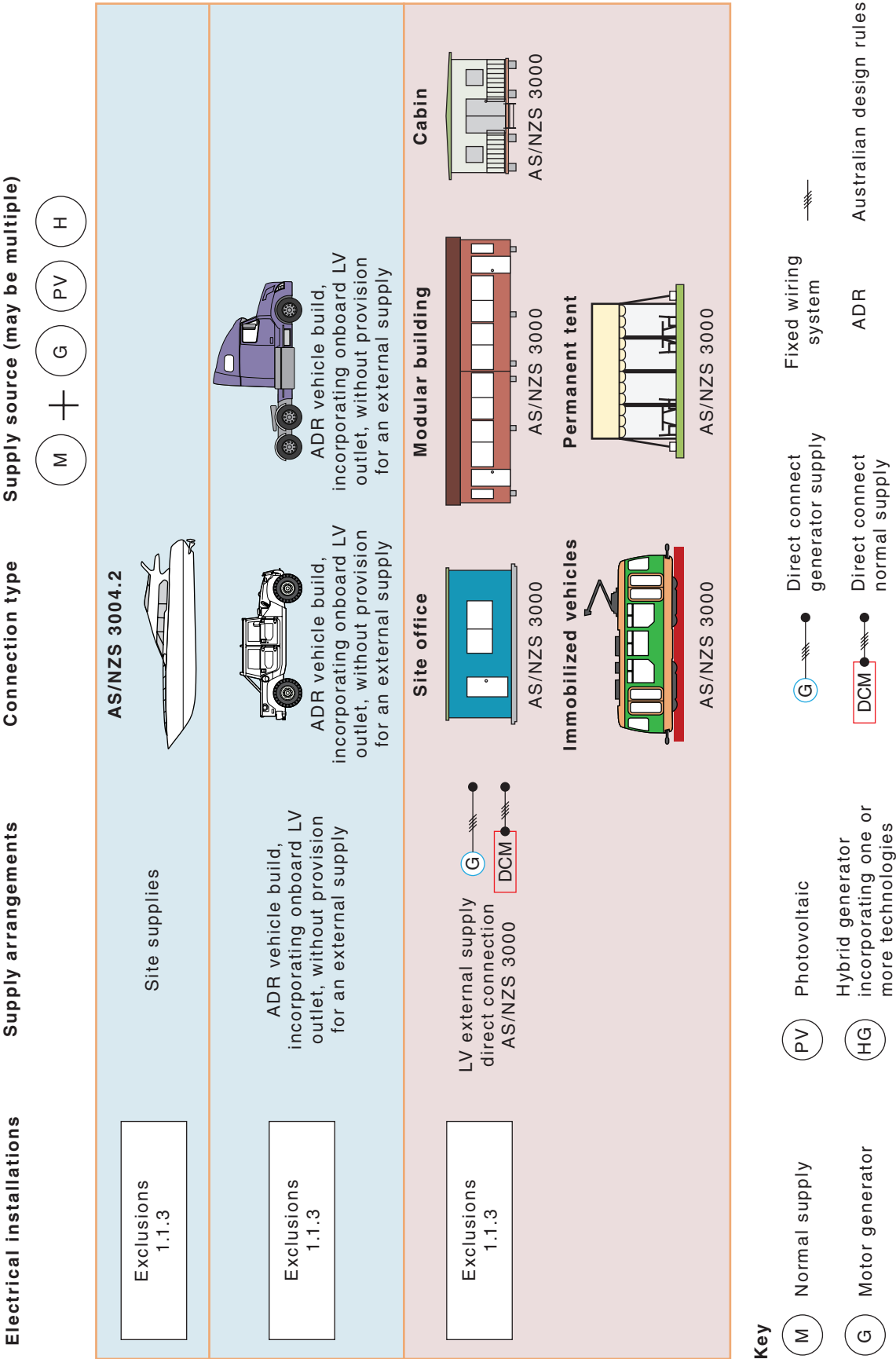


Figure 1.2 — Typical exclusions to this Standard

1.2 Application

The particular requirements of this Standard replace, modify, or are additional to the general requirements of AS/NZS 3000 for the electrical wiring of connectable electrical installations.

This Standard may be applied through legislative requirements, made in each State and Territory of Australia and in New Zealand, concerned with the safety of electrical installations. This Standard may also be applied in conjunction with any additional requirements, exemptions or restrictions in such legislation.

1.3 Normative references

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

NOTE Documents for informative purposes are listed in the Bibliography.

AS 60529, *Degrees of protection provided by enclosures (IP Code)*

AS 62040.1, *Uninterruptible power systems (UPS), Part 1: Safety requirements (IEC 62040-1:2017 (ED 2.0), MOD)*

AS IEC 62619, *Secondary cells and batteries containing alkaline or other non-acid electrolytes— Safety requirements for secondary lithium cells and batteries, for use in industrial applications*

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

AS/NZS 3001.1, *Electrical installations — Connectable electrical installations and supply arrangements, Part 1: Site supplies for connectable electrical installations*

AS/NZS 3010, *Electrical installations—Generating sets*

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

AS/NZS 3120, *Approval and test specification—Cord extension sockets*

AS/NZS 3123, *Approval and test specification—Plugs, socket-outlets and couplers for general industrial application*

AS/NZS 3131, *Approval and test specification—Plugs and socket-outlets for stationary appliances*

AS/NZS 3190, *Approval and test specification—Residual current devices (current operated earth-leakage devices)*

AS/NZS 3191, *Electric flexible cords*

AS/NZS 3760, *In-service safety inspection and testing of electrical equipment and RCDs*

AS/NZS 4417 (all parts), *Regulatory compliance mark for electrical and electronic equipment*

AS/NZS 4509 (all parts), *Stand-alone power systems*

AS/NZS 4763, *Safety of portable inverters*

AS/NZS 4777 (all parts), *Grid connection of energy systems via inverters*

AS/NZS 5000.1, *Electric cables—Polymeric insulated, Part 1: For working voltages up to and including 0.6/1 (1.2) kV*

AS/NZS 5000.2, *Electric cables—Polymeric insulated, Part 2: For working voltages up to and including 450/750V*

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

AS/NZS 5139, *Electrical installations — Safety of battery systems for use with power conversion equipment*

AS/NZS 5601.2, *Gas installations, Part 2: LP Gas installations in caravans and boats for non-propulsive purposes*

AS/NZS 5761, *In-service safety inspection and testing—Second-hand equipment prior to sale*

AS/NZS 60335.1, *Household and similar electrical appliances — Safety, Part 1: General requirements (IEC 60335-1 Ed 5.2, MOD)*

AS/NZS 61008.1, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs), Part 1: General rules (IEC 61008-1, Ed. 3.2 (2013) MOD)*

AS/NZS 61009.1, *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs), Part 1: General rules (IEC 61009-1, Ed. 3.2 (2013) MOD)*

AS/NZS 61558.2.6, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V, Part 2.6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers (IEC 61558-2-6 Ed 2, MOD)*

NZS 6115, *Electrical installations—Mobile medical facilities*

IEC 60309-2, *Plugs, socket-outlets and couplers for industrial purposes, Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories*

IEC 60364-7-717, *Low voltage electrical installations — Part 7-717: Requirements for special installations or locations — mobile or transportable units*

IEC 60364-7-721, *Low-voltage electrical installations — Part 7-721: Requirements for special installations or locations — Electrical installations in caravans and motor caravans*

1.4 Terms and definitions

For the purposes of this Standard, the terms and definitions in AS/NZS 3000 and those below apply. Where an additional term is defined in a particular section or clause, the term takes the meaning defined in that section or clause.

1.4.1

accessible

capable of being reached for inspection, maintenance or repairs but does not include the destructive dismantling of structural components

1.4.2

accessible, readily

capable of being reached quickly and without climbing over or removing obstructions, or using a movable ladder, and in any case not more than 2 m above the ground, floor or platform

1.4.3

annex

attachment to a connectable electrical installation used as an extension of the area. It may be rigid or non-rigid

1.4.4

appliance inlet

inlet plug

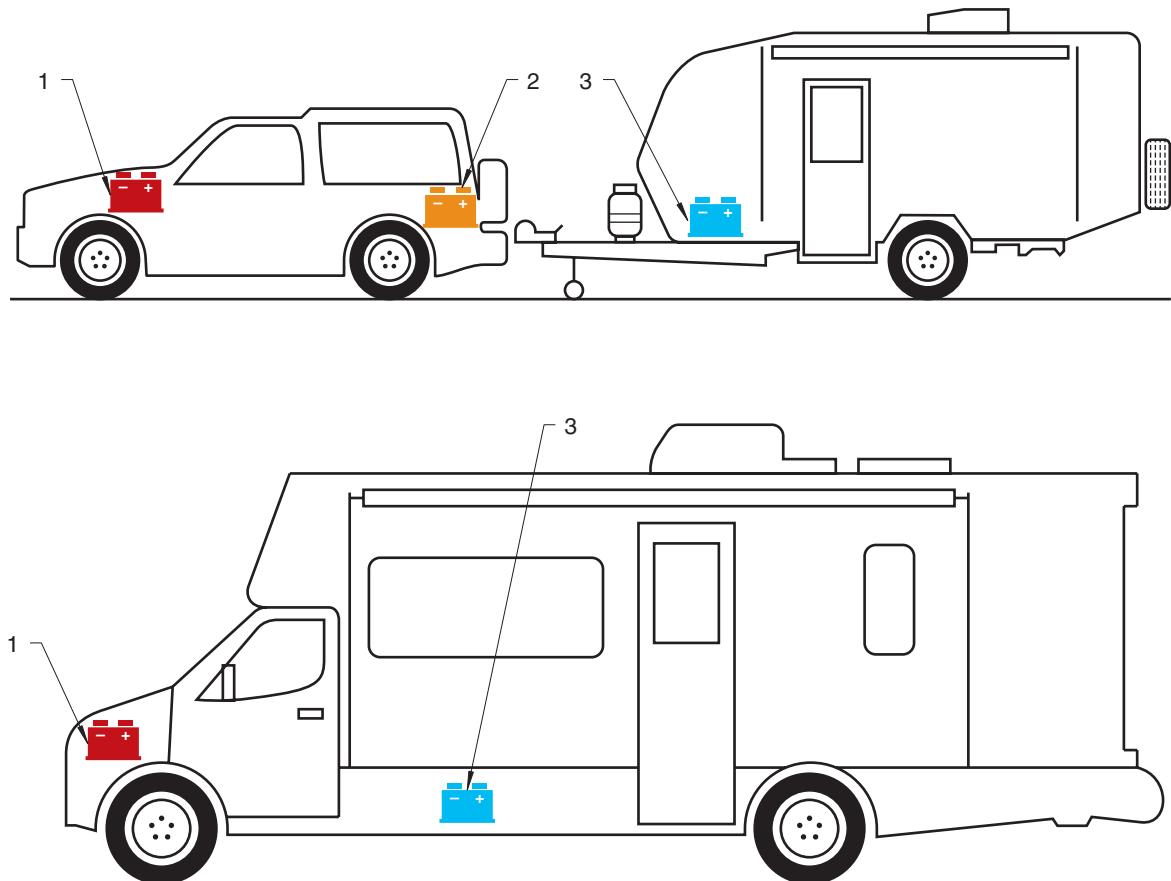
accessory, having pins designed to engage with the contacts of a cord extension socket, integrated or incorporated into equipment or intended to be fixed to it

Note 1 to entry: Inlet plugs were previously specified in AS/NZS 60320.1 as Group 3 appliance inlets.

1.4.5 battery

unit consisting of one or more rechargeable electrical energy storage cells connected in series, parallel, or series parallel arrangement

Note 1 to entry: See [Figure 1.3](#) for examples of batteries.



Key



1. Vehicle battery



2. Vehicle auxiliary battery



3. Connectable electrical installation battery

Figure 1.3 — Typical examples of battery types

1.4.5.1

connectable electrical installation battery

battery with the primary purpose of supplying circuits not related to either the propulsion of the vehicle or supply to equipment intended for compliance with vehicle/road transport requirements

Note 1 to entry: A connectable electrical installation battery may be charged by the charging system for the vehicle battery and may also have other charging facilities.

Note 2 to entry: A connectable electrical installation may be referred to as a house battery, general light and power battery or service battery.

1.4.5.2

vehicle battery

battery with the primary purpose of starting a vehicle engine

Note 1 to entry: A vehicle battery may also supply other circuits; including recreational vehicle and non-recreational vehicle circuits.

Note 2 to entry: This Standard sets no requirements for vehicle batteries.

1.4.5.3

vehicle auxiliary battery

battery that is connected in parallel with the vehicle battery

Note 1 to entry: A vehicle auxiliary battery may be charged by the charging system for the vehicle battery and may also have other charging facilities.

Note 2 to entry: A battery that is connected in parallel with the vehicle battery is deemed to be a vehicle battery.

Note 3 to entry: This Standard sets no requirements for vehicle auxiliary batteries.

1.4.6

caravan park camping ground

area of land —

- (a) that is used, or intended to be used, to site two or more connectable electrical installations; and
- (b) on which fittings are installed to supply electricity to those connectable electrical installations

1.4.7

competent person

person who has acquired, through training, qualification or experience or a combination of these, the knowledge and skill enabling that person to perform the required task correctly

1.4.8

connectable electrical installation

electrical installation of a *non-recreational vehicle* ([1.4.14](#)), a *recreational vehicle* ([1.4.17](#)) or a *relocatable unit* ([1.4.18](#)) that is designed, intended for, or capable of, connection to an external power supply that operates at low voltage by *detachable connection* ([1.4.11](#))

1.4.9

cylinder

container for the storage of LP Gas that has a capacity of more than 120 mL but not more than 500 L, and does not include an aerosol container

Note 1 to entry: Capacity is often referred to as “water capacity” and is the total internal volume i.e. 25 L water capacity is approximately 10 kg nominal LP Gas capacity.

1.4.10

cylinder enclosure

cylinder compartment

enclosed area or a partitioned space primarily used for the installing of a gas cylinder, pressure regulator and other associated equipment, or for the storing of a gas cylinder

1.4.11

detachable connection

electrical connection of a connectable electrical installation to a low voltage electrical installation by means of a plug and socket-outlet, or socket and *appliance inlet* ([1.4.4](#))

1.4.12 hazardous area

region surrounding an LP Gas cylinder(s) that is regulated so that the adverse effects of any gas leakage are reduced

Note 1 to entry: A hazardous area should include an administrative control in the form of a label indicating the cylinders should be isolated when not in use or when the vehicle is in transit.

Note 2 to entry: [Figure 4.5](#) shows an example of a hazardous area for LP Gas cylinders on the draw bar of a domestic caravan.

1.4.13

may

indicates the existence of an option

1.4.14

non-recreational vehicle

1 trailer designed to be towed by a road vehicle that has the provision for, or is intended for connection to a low voltage supply from an external source that is not deemed to be a *recreational vehicle* ([1.4.17](#))

2 self-propelled vehicle with the same features

EXAMPLE Cars, trucks and trailers, including: horse floats; semi-trailers; livestock or car transporters; vehicles such as food and drink vending vans and trailers; educational display caravans and trailers, mobile classrooms; television outside broadcast vans; mobile stages; display units e.g. mobile electronic score boards and advertising signs, mobile traffic information signs; or any towable, self-propelled or hybrid vehicle that does not fit specifically into any of the above categories.

1.4.15

outlet box

portable power distribution unit supplied via an attached or detachable flexible lead and fitted with one or more socket-outlets, which incorporates overcurrent protection, residual current protection and may also incorporate cord reeling or coiling arrangements

1.4.16

power conversion equipment

PCE

electrical device converting one kind of electrical power from a voltage or current source into another kind of electrical power with respect to voltage, current and frequency

Note 1 to entry: Examples include d.c./a.c. inverters, d.c./d.c. converters, charge controllers, etc.

1.4.17

recreational vehicle

1 trailer designed to be towed by a road vehicle, often used for living and accommodation, and has the provision for, or is intended for connection to a low voltage supply from an external source

2 self-propelled vehicle with the same features

EXAMPLE Camper vans; motor homes; camper trailers; caravans; pop top caravans; tent trailers; fifth wheel caravans; slide on campers; converted buses or trailers for the use of accommodation or recreational purposes; any towable, self-propelled or hybrid vehicle intended for use as accommodation or for recreational purposes that does not fit specifically into any of the above categories; or *vehicles* ([1.4.26](#)).

Note 1 to entry: Vehicles such as mobile site offices and similar, that are not used for living accommodation or recreational purposes, are not deemed to be recreational vehicles, see *vehicles* ([1.4.26](#)).

1.4.18

relocatable unit

unit designed for human occupation that may be relocated from one site to another and has the provision for, or is intended for connection to a low voltage supply from an external source

EXAMPLE Relocatable site offices, cloakrooms, meeting offices, dormitories, canteens, toilets, workshops, site huts or other facilities.

1.4.19

shall

indicates a statement is mandatory

1.4.20

should

indicates a recommendation

1.4.21

site

area in a *caravan park* ([1.4.6](#)), *camping ground* ([1.4.6](#)) or other location intended for the placement of one or more *connectable electrical installations* ([1.4.8](#)) under the control of one occupier

1.4.22

supply

1.4.22.1

alternative supply

supply system intended to maintain the functioning of an electrical installation or a part or parts thereof, in case of interruption of the normal supply

1.4.22.2

external supply

low voltage 230/400 V 50 Hz external source of supply from which the connectable electrical installation is supplied

Note 1 to entry: Does not include internal or onboard low voltage supply facilities.

1.4.22.3

normal supply

source of supply that the electrical installation is supplied from under normal conditions of operation

Note 1 to entry: The normal supply is usually from a distribution network but may instead be from a generation system.

1.4.23

supply lead

socket-outlet and plug arrangement, or a lead permanently connected to the connectable electrical installation, used to connect connectable electrical installation to the site supply

1.4.24

switchboard

assembly of a circuit protective device or devices, with or without switchgear, instruments, or connecting devices, suitably arranged and mounted for distribution to, and protection of, one or more submains or final subcircuits, or a combination of both

1.4.25

tent

portable shelter or dwelling with non-rigid walls

1.4.26

vehicle

means for transporting people, animals or goods, specifically on land

EXAMPLE Cars, trucks and trailers including: non-recreational vehicles ([1.4.14](#)), recreational vehicles ([1.4.17](#)), mobile offices, break facilities and similar, or rail vehicles (rolling stock).

1.4.27 voltage

differences of potential typically existing between conductors or between conductors and earth, as follows:

- (a) *Extra-low voltage (ELV)* — not exceeding 50 V a.c. or 120 V ripple-free d.c.
- (b) *Protected extra-low voltage (PELV)* — an extra-low voltage system that is not electrically separated from earth, but that otherwise satisfies all the requirements for SELV.
- (c) *Separated extra-low voltage (SELV)* — an extra-low voltage system that is electrically separated from earth and from other systems in such a way that a single fault cannot give rise to the risk of electric shock.
- (d) *Low voltage (LV)* — exceeding extra-low voltage, but not exceeding 1 000 V a.c. or 1 500 V d.c.
- (e) *High voltage (HV)* — exceeding low voltage.

1.4.28 wiring systems

assembly made up of one or more conductors, cables or busbars and the parts that secure their fixing and, if necessary, their mechanical protection

1.5 Alterations and repairs

1.5.1 Alterations

1.5.1.1 General

Alterations to electrical installations in connectable electrical installations shall comply with AS/NZS 3000, except as varied herein, and with the additional requirements of this Standard.

Alterations to connectable electrical installations shall not cause any portion of the original electrical installation, or electrical equipment connected thereto, to —

- (a) carry currents or sustain voltages in excess of those permitted by this Standard; or
- (b) be used in any manner that is not in accordance with this Standard.

1.5.1.2 New Zealand

In New Zealand, when any alteration is made to the LV electrical installation of the recreational vehicle, any neutral-earth link shall be removed. Also, the following shall be installed if not already in place:

NZ

- (a) Overcurrent protection for each external supply, in accordance with [Clause 4.5.3.1](#); and
- (b) RCD protection for all final subcircuits, in accordance with [Clause 4.5.4](#).

Alterations include:

- (i) Removal of a neutral-earth link or connection.
- (ii) Installation of a new final subcircuit.
- (iii) Extension of an existing final subcircuit.
- (iv) Removal of an in-line RCD from the supply lead.

Where a neutral-earth link is removed, the incoming earth conductor of the external supply shall be disconnected from the neutral bar (or equivalent) and reconnected to the earth bar (or equivalent).

NOTE Transferring the connection point of the incoming protective earthing conductor is necessary to ensure that all items required to be earthed remain connected to the earth pin of the supply lead.

1.5.2 Repairs

1.5.2.1 General

Repairs to existing electrical installations in connectable electrical installations or parts thereof may be effected using methods, fixtures and fittings that were acceptable when that part of the electrical installation was originally installed or with methods, fixtures and fittings currently available as a direct replacement, provided that the methods satisfy the fundamental safety principles of AS/NZS 3000.

1.5.2.2 Switchboard replacement

In New Zealand, when a switchboard is replaced, any neutral-earth link shall be removed. Also, the following shall be installed if not already in place:

NZ

- (a) Overcurrent protection for each external supply, in accordance with [Clause 4.5.3.1](#); and
- (b) RCD protection for all final subcircuits, in accordance with [Clause 4.5.4](#).

Section 2 Electrical supplies for connectable electrical installations

2.1 General

This section specifies the minimum requirements for the connection of external electrical supplies to connectable electrical installations, that is relocatable units, recreational vehicles and non-recreational vehicles, that have the ability to be connected to an external source of low voltage a.c. electricity supply, by the use of a detachable connection.

These requirements are intended to protect persons, livestock, and property from electric shock, fire and physical injury hazards that may arise from a connectable electrical installation that is used with reasonable care and with due regard to the intended purpose of the electrical installation.

In addition, guidance is provided so that the electrical installation functions correctly for the purpose intended.

See [Figure 2.1](#) for typical connectable electrical installations.

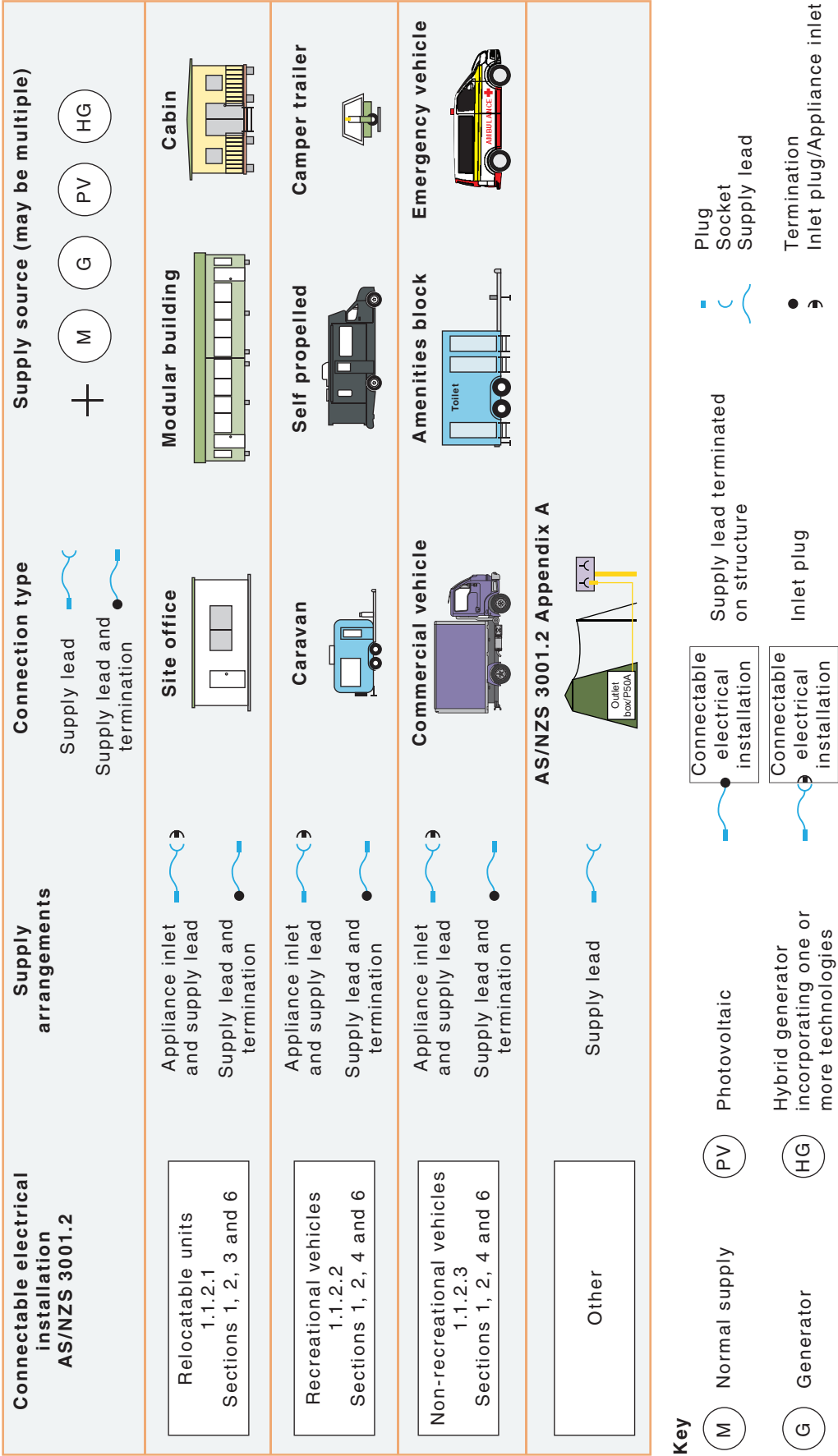


Figure 2.1 — Typical connectable electrical installations

2.2 Supply systems

The low voltage electrical supply for any connectable electrical installation shall be installed in accordance with:

- (a) AS/NZS 3000; and
- (b) the additional or modified requirements of AS/NZS 3001.1; and
- (c) other applicable Standards including:
 - (i) AS/NZS 4509.
 - (ii) AS/NZS 3010.
 - (iii) AS/NZS 5033.
 - (iv) AS/NZS 4777.
 - (v) AS/NZS 4763.
 - (vi) AS/NZS 5139.

See [Figures 2.2](#) and [2.3](#) for typical supply arrangements.

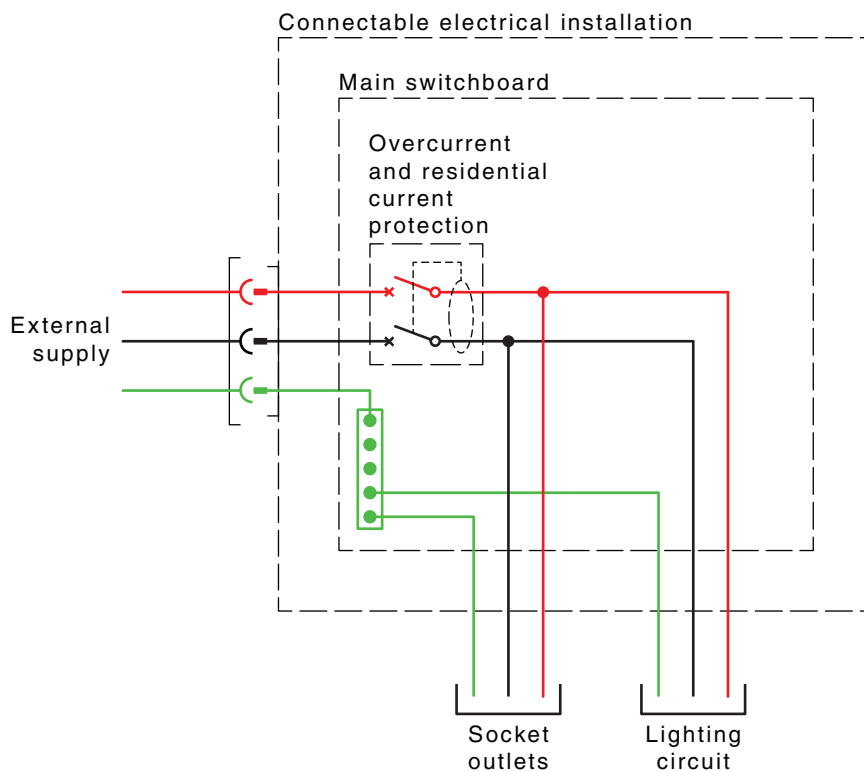
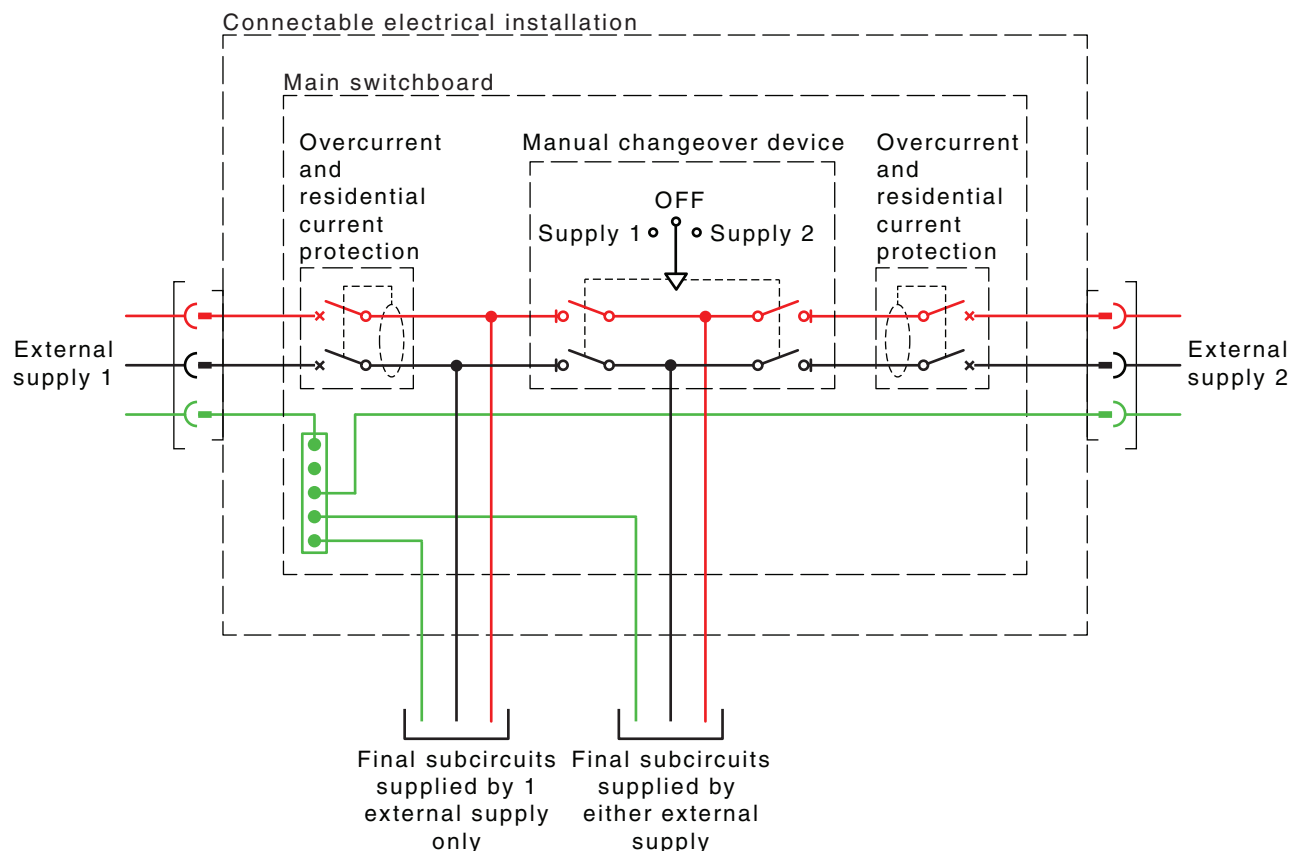


Figure 2.2 — Typical connectable electrical installation with one external supply



NOTE 1 External supply 1 and external supply 2 may be from any one or combination of the following:

- (a) Normal supply (caravan park pillar or socket-outlet at an installation); and/or
- (b) motor generator supply; and/or
- (c) inverter supply (renewable energy or battery energy storage system).

NOTE 2 External supplies should incorporate a neutral-earth connection.

Figure 2.3 — Typical connectable electrical installation with two external supply arrangements including manual changeover device

2.3 Generation

2.3.1 Generating sets (motor generator set)

Where an external generator is used to supply a connectable electrical installation, it shall comply with the safety requirements specified in AS/NZS 3010 for an isolated generator or for a generator protected by an RCD.

The generator set shall provide internal overcurrent protection as detailed in AS/NZS 3010.

2.3.2 Inverters

Where an external inverter is used to supply a connectable electrical installation, it shall comply with the safety requirements specified in AS/NZS 4763 for an isolated inverter, EPB (equipotentially bonded) inverter or for an inverter protected by an RCD.

The inverter shall provide internal overcurrent protection as detailed in AS/NZS 4763.

2.4 Provision for connection to electrical supply

2.4.1 General

The connectable electrical installation shall be configured for connection to the external supply in accordance with one or more of the methods specified in [Clauses 2.4.3](#) and [2.4.4](#).

2.4.2 Direct connection

Connections to supply by installation wiring, as shown in [Figure 2.4](#), are excluded from this Standard.

Where the supply to a connectable electrical installation is connected by means of fixed (installation) wiring, the requirements of AS/NZS 3000 apply.

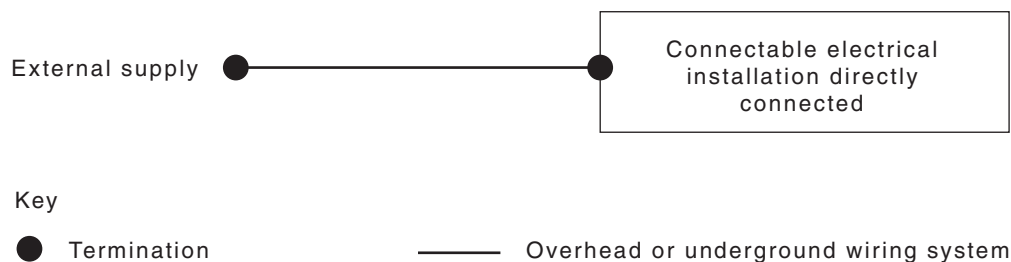


Figure 2.4 — A connectable electrical installation directly connected to electricity supply

2.4.3 Permanent connection of the supply lead

Where the supply lead is permanently connected to the connectable electrical installation, the connection shall be made at a permanent connection point mounted on or in the connectable electrical installation. See [Figure 2.5](#).

The permanent connection point shall be either —

- (a) the line terminals of one of the overcurrent protection devices; or
- (b) a permanent connecting facility which is connected to the line terminals of the overcurrent protection device. It shall have the following minimum degree of protection:
 - (i) Mounted internally — IP2X.
 - (ii) Mounted externally — IP34.

In addition, the supply lead shall —

- (A) comply with the applicable requirements of [Clause 2.5](#); and
- (B) be securely anchored at its point of termination to relieve strain from the terminals; and
- (C) be provided with a suitable means for storage when not in use; and
- (D) be constructed of double insulated or reinforced insulation.

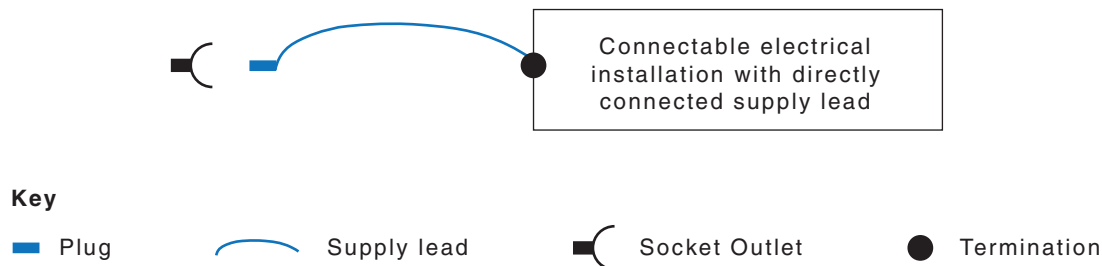


Figure 2.5 — Connectable electrical installation with supply lead directly connected

2.4.4 Detachable connection of the supply lead

Where the supply lead is connected to the connectable electrical installation by means of a detachable connection, the connectable electrical installation shall be fitted with one or more inlet plugs complying with —

- (a) AS/NZS 3112; or
- (b) AS/NZS 3123; or
- (c) IEC 60309-2.

See [Figure 2.6](#) for an example of a connectable electrical installation with inlet plug.

NOTE 1 The choice of the type of inlet plugs should be made following consideration of the conditions of use likely to apply in the area, state or country where it is anticipated that the connectable electrical installation is to be used. This should include the requirements of the relevant regulatory authorities.

Each inlet plug shall —

- (i) be mounted and fixed in a readily accessible position and in such a manner as to be mechanically protected against any risk of damage that may reasonably be anticipated; and
- (ii) comply with AS 60529 with a minimum degree of protection of IP34, both with and without a cord extension socket inserted; and
- (iii) be provided with a mechanical means of relieving the strain on the supply lead connector.

NOTE 2 A bracket and insulator, a hook and thimble, or a non-perishable guy rope tensioner are suitable ways of meeting this requirement.

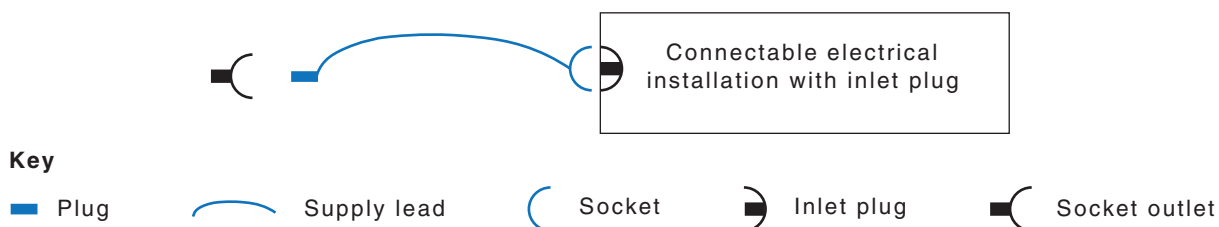


Figure 2.6 — Connectable electrical installation with inlet plug

2.4.5 Multiple connections

Where facilities for the connection of more than one supply lead to the connectable electrical installation are provided, the installation shall be arranged such that there are no interconnections between the live (active and neutral) conductors of different supplies or between the pins of different inlets.

For multiple connection earthing requirements, see the following clauses for the applicable requirements:

- (a) [Clause 3.9](#) for relocatable structures.
- (b) [Clause 4.11](#) for recreational vehicles and non-recreational vehicles.

2.5 Supply lead

2.5.1 General

A supply lead used to connect a connectable electrical installation, or the electrical equipment in a tent or non-rigid annexe, to a site supply shall be in one length and comply with [Clauses 2.5.2](#) and [2.5.3](#).

NOTE 1 See [Appendix A](#) for information on electrical supply to tents and non-rigid annexes.

NOTE 2 In New Zealand, the requirement for supply leads to be in one length does not preclude the use of an adaptor, provided it has a suitable IP rating and includes an overcurrent device to limit the current to the rating of the adaptor's plug. NZ

2.5.2 Technical details

The supply lead shall consist of the following:

- (a) A flexible cord or cable complying with AS/NZS 3191, AS/NZS 5000.1 or AS/NZS 5000.2.
- (b) A plug that (except where a plug of another rating or configuration, or both, is chosen for special purposes) complies with —
 - (i) AS/NZS 3112 with a minimum rating of 15 A; or
 - (ii) In Australia, AS/NZS 3123 with a minimum rating of 20 A.
 - (iii) In New Zealand, IEC 60309-2 with a minimum rating of 16 A.

Exception: When connecting a connectable electrical installation to a 10 A socket-outlet complying with AS/NZS 3112, the plug may have a 10 A rating, provided that the lead includes a device to limit the current to maximum 10 A.

- (c) A cord extension socket or coupler complying with —
 - (i) AS/NZS 3120 with a minimum rating of 15 A; or
 - (ii) AS/NZS 3123 with a minimum rating of 20 A; or
 - (iii) IEC 60309-2 with a minimum rating of 16 A.

Exception: [Clause 2.5.2\(c\)](#) is not applicable to supply leads permanently connected to connectable electrical installations.

The choice of plug, cord and socket types and their ratings shall be dictated by:

- (A) The current ratings of the elements to be connected; and
- (B) the relevant conditions of use; and
- (C) local conditions.

NOTE Local regulatory authorities may have alternative requirements for choice of plug, cord and socket type.

All parts of the supply lead shall have a minimum ingress protection rating of IP34, in accordance with AS 60529.

2.5.3 Length

Supply leads used in caravan parks shall be not less than 10 m long. This is to reduce the risk of series joins in detachable supply leads. In other applications, no minimum length is specified.

In all cases, the length shall not exceed the relevant figure specified in [Table 2.1](#) for the applicable conductor cross-sectional area.

Table 2.1 — Maximum lengths of supply leads

Single-phase			3 Phase		
Cable size mm ²	CB rating	Length of lead m	Cable size mm ²	CB rating	Length of lead m
1.5	16	15	1.5	16	15
2.5	16	25	2.5	16	25
2.5	20	20	2.5	20	20
4	20	30	4	20	35
4	25	25	4	25	30
6	32	30	6	32	30
10	50	30	10	50	35
16	63	40	16	63	45
25	80	50	25	63	70
35	100	55	25	80	55
—	—	—	35	100	65
—	—	—	35	125	50
—	—	—	50	125	70

NOTE 1 The minimum length of 10 m is specified for use in caravan parks for the benefit of park designers when they are designing site layouts.

NOTE 2 Values calculated in [Table 2.1](#) are based upon voltage drop considerations and the overload characteristics of the protection devices.

2.5.4 Coiled leads

Where a reel, drum, storage box or similar is provided for the purpose of coiling the supply lead, a prominent notice should be fixed on or near the device to warn that the supply lead should not be connected to the supply while it is in coiled or reeled configuration.

2.6 External source of supply

2.6.1 Limitation of incoming supply current

Every external supply shall be protected against overload by an overcurrent device on, or within, the connectable electrical installation to which the supply is connected. The rating of this device shall not exceed the rating of the supply lead or supply lead fittings, whichever is the smaller. See [Figure 2.7](#).

A 16 A miniature circuit breaker (MCB) may be used as overcurrent protection for a 15 A three-pin flat-pin fitting to AS/NZS 3112 in a recreational vehicle.

In Australia, the overcurrent protection device for connectable electrical installations shall operate in all live (active and neutral) conductors.

AS

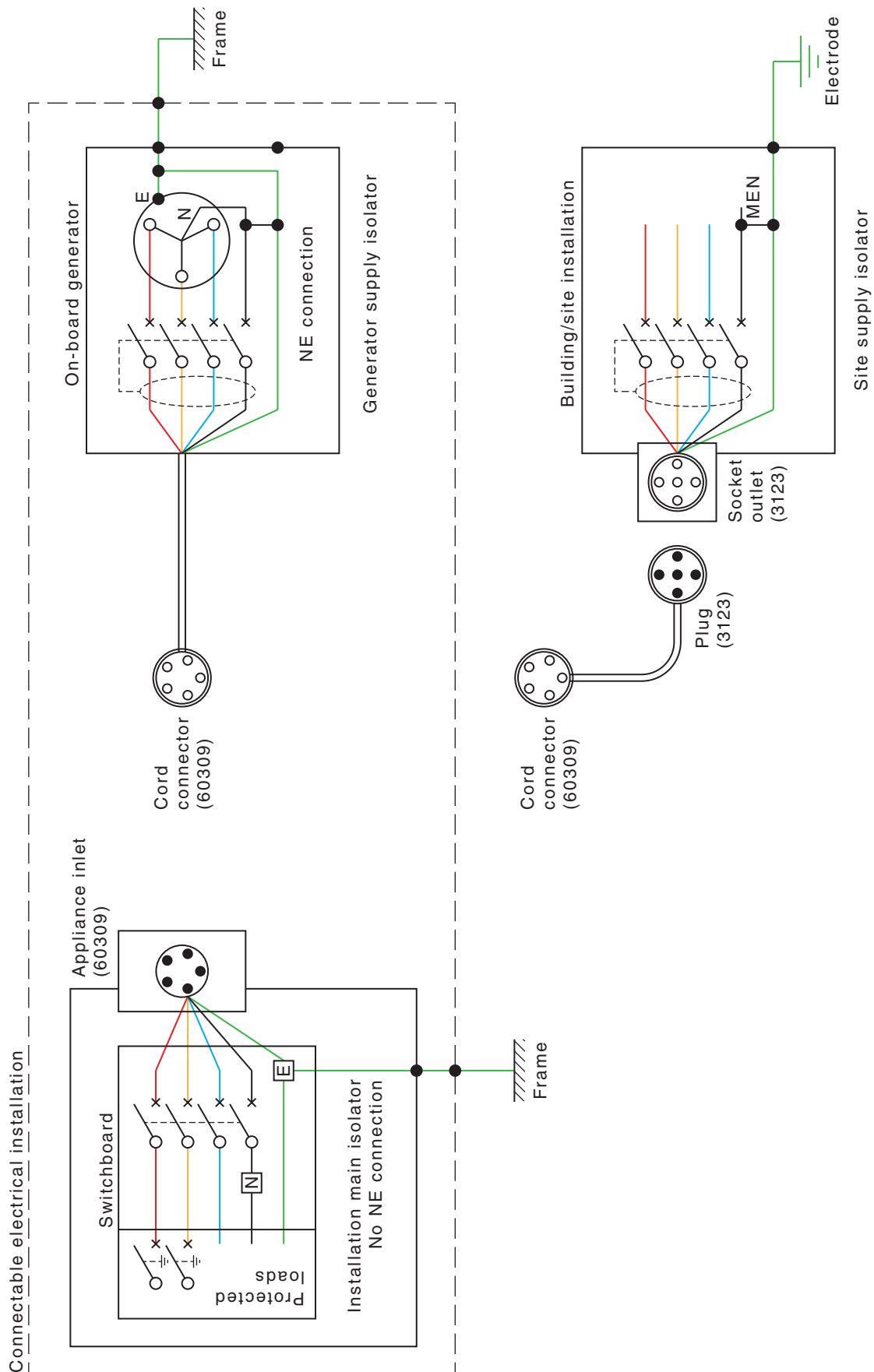


Figure 2.7 — Example of a typical connectable electrical installation with one external supply and one onboard supply where only one supply can be connected for use

2.6.2 Earthing

The protective earthing conductors associated with any external supply to any connectable electrical installation shall be directly connected to the earthing conductor of every other external supply.

Where internal supplies exist, see [Clauses 2.7.4](#) and [2.7.5](#) for requirements on earthing arrangements.

2.6.3 Phase sequence sensors

2.6.3.1 Multi-phase installations

In multi-phase electrical installations, provision shall be made for the ability to check the phase sequence of any external supply, and to match the supply phase sequence with the connectable electrical installation phase sequence.

Exception: This requirement does not apply where all multi-phase equipment within the connectable electrical installation is such that safety is not adversely affected by incorrect phase rotation.

NOTE A combined phase sequence sensor and transposition sensor may be used to satisfy this requirement.

2.6.3.2 Location

Phase sequence sensors shall be installed between the input inlet plug (appliance inlet) and the switchboard located in the connectable electrical installation.

Where installed, the phase sequence indicators shall be visible.

2.6.4 Protection against incorrect polarity

2.6.4.1 General

For every single-phase external supply, protection against transposition of the active and neutral conductors of the supply shall be by one of the following methods:

- (a) transposition sensor; or
- (b) onboard isolating transformer or electricity converter with a polarized output; or
- (c) protective devices and switching devices in a connectable electrical installation shall operate in all live (active and neutral) conductors in accordance with [Sections 3, 4](#) and [5](#).

See [Sections 3](#) and [4](#) regarding switching of all live conductors.

2.6.4.2 Transposition sensor

NOTE 1 A transposition sensor is commonly referred to as a reverse polarity sensor.

The transposition sensor shall be either —

- (a) an interlocking device with visual indication such that any supply cannot be connected if the polarity is incorrect; or
- (b) an automatic correction device with visual indication that matches the polarity of the external supply to the polarity of the connectable electrical installation.

Transposition sensors shall be installed between the input inlet plug (appliance inlet) and the switchboard located in the connectable electrical installation.

NOTE 2 A combined transposition sensor and phase sequence sensor may be used to satisfy this requirement.

2.7 Multiple sources of supply

2.7.1 General

A connectable electrical installation may have multiple sources of supply, either external or internal at low voltage or extra-low voltage.

Parts of the electrical installation within the connectable electrical installation may be supplied either —

- (a) as independent installations, each supplied from only a single source; or
- (b) from multiple sources, provided that each source is at the same voltage and frequency, in accordance with [Clause 2.7.7](#).

Each supply shall comply with the relevant provisions of this section. In addition to the following requirements:

- (i) External low voltage supplies shall comply with [Clauses 2.4](#) to [2.6](#).
- (ii) Internal low voltage supplies shall comply with [Clause 2.7.2](#).
- (iii) All extra-low voltage supplies shall comply with [Section 5](#).
- (iv) Interconnections between supplies shall comply with [Clause 2.7.7](#).
- (v) DC systems shall operate at extra-low voltage and comply with [Section 5](#).

For the purposes of this Standard, power conversion equipment (PCE), such as inverters and battery chargers are regarded as a delineation point between separate systems operating at different voltage and frequency. See [Figures 2.10, 2.11](#) and [2.12](#).

NOTE The input of an inverter is regarded as an extra-low voltage d.c. load and the output is regarded as a low voltage a.c. source.

Each supply shall be connected to the connectable electrical installation at a switchboard.

Exception: This requirement does not apply to extra-low voltage supplies intended solely for charging of batteries.

2.7.2 Onboard supplies

2.7.2.1 General

Onboard supplies for a connectable electrical installation are supplies that are dedicated to and are located within the connectable electrical installation.

NOTE Sources of internal low voltage supplies may include motor-driven generating sets or inverters.

2.7.2.2 Internal/onboard low voltage supplies

Internal/onboard supplies for a connectable electrical installation shall be provided by either —

- (a) an RCD protected supply; or
- (b) an isolated supply.

Sources shall comply with the relevant safety requirements of —

- (i) AS/NZS 4763 for an inverter; and
- (ii) AS/NZS 3010 for a generator.

The source shall provide short circuit protection in accordance with AS/NZS 3000.

See [Figures 2.8](#) and [2.9](#) for typical onboard supply wiring diagrams.

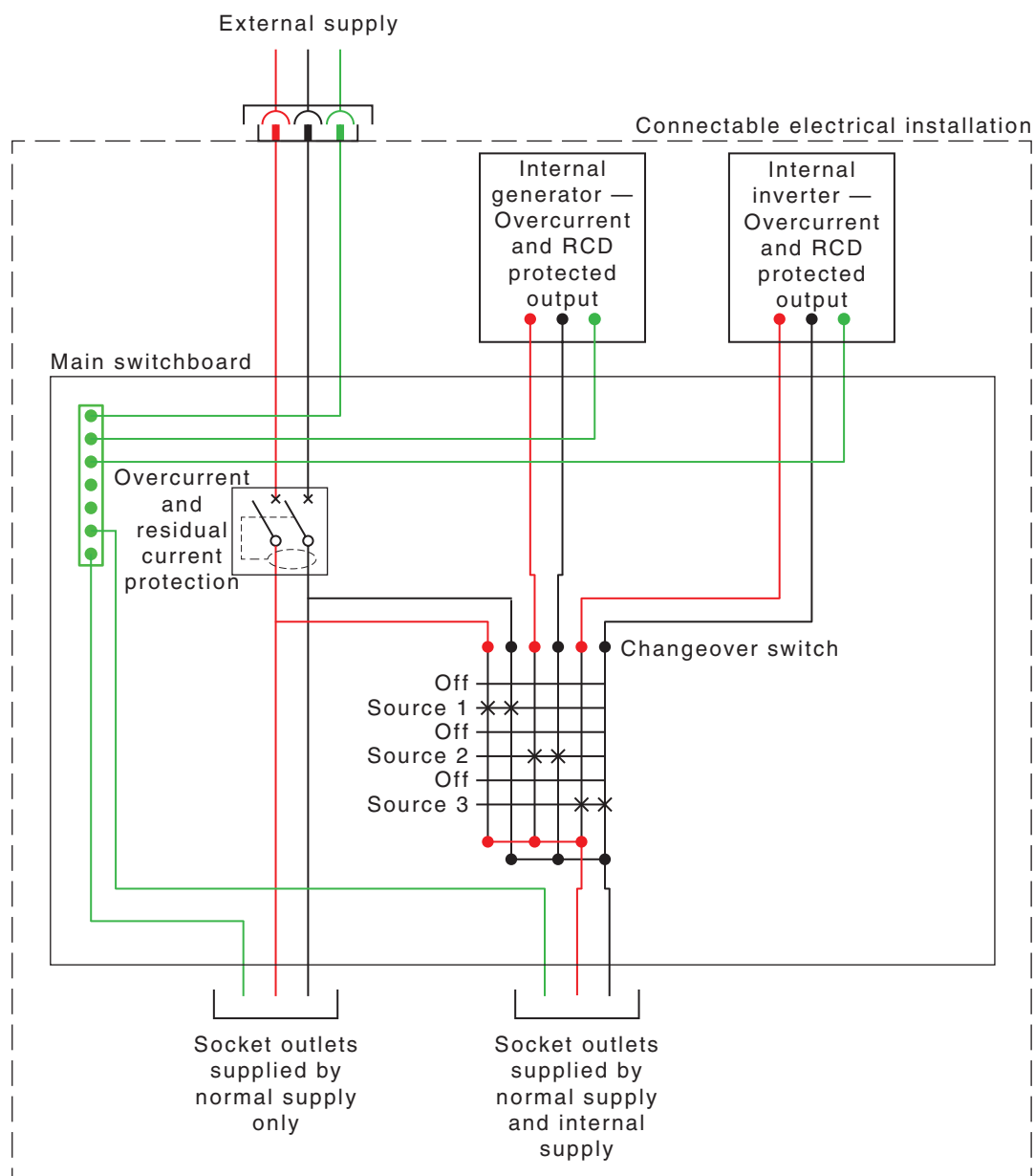
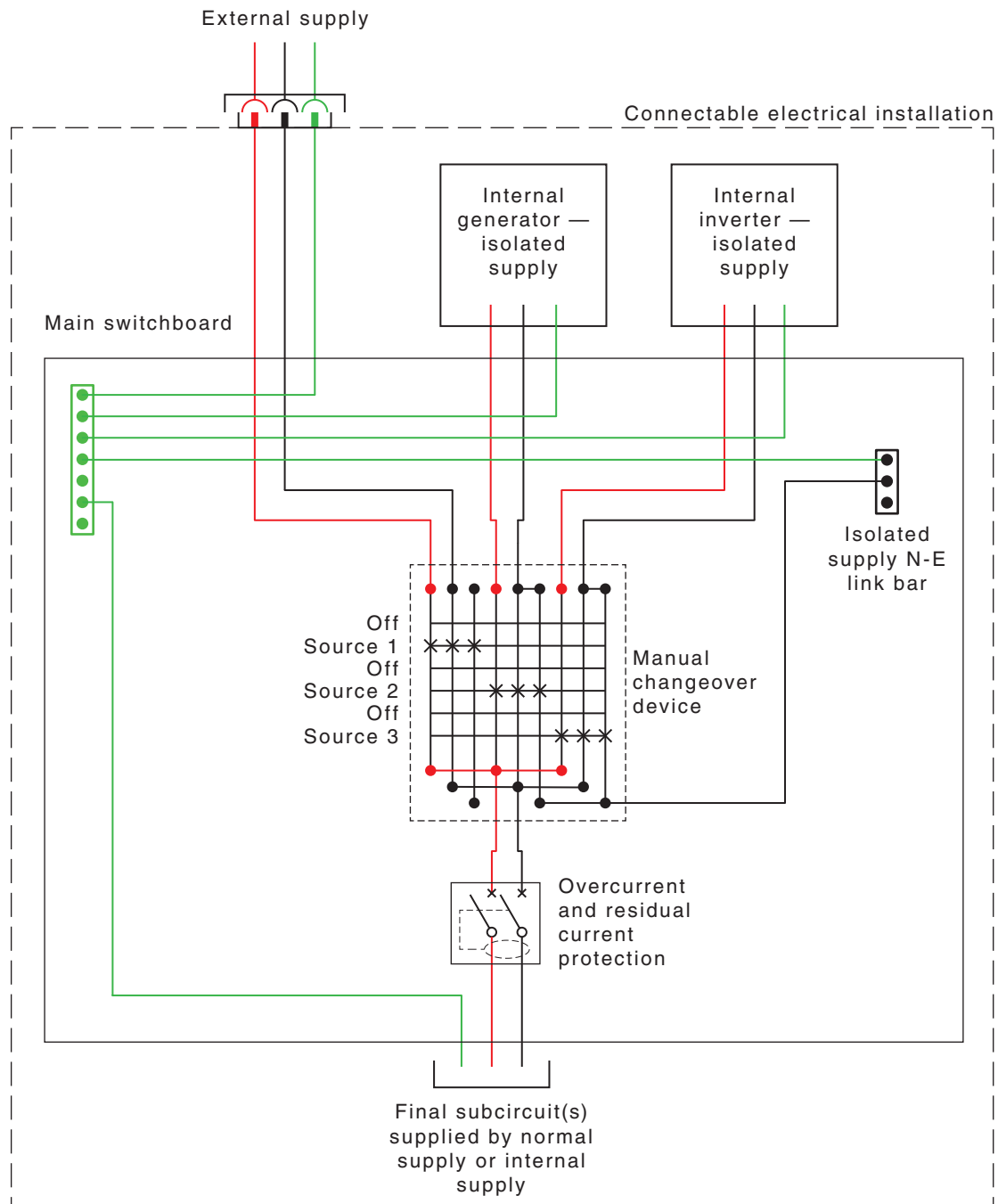


Figure 2.8 — Typical connectable electrical installation with one external supply and two onboard RCD protected supplies including manual changeover device



NOTE 1 Isolated supply neutral-earth link bar optional.

NOTE 2 Isolated supply switched neutral tails connected between the main switch (changeover device) and neutral-earth link bar may be directly connected to the earth bar.

Figure 2.9 — Typical connectable electrical installation with one external supply and two internal supply arrangements including manual changeover device

2.7.2.3 Inverter/inverter charger units

2.7.2.3.1 General

Inverter charger units charge batteries when the normal power supply is available and provide a 230 V a.c. power supply when the normal supply or supplementary supply (i.e. generator) is not available. An inverter charger takes d.c. power from a battery or d.c. source and converts it to 230 V a.c.

See [Figures 2.10, 2.11](#) and [2.12](#) for typical inverter charger connection diagrams.

2.7.2.3.2 Inverters and inverter charger requirements

Inverters and inverter chargers shall —

- (a) have separate terminals for the a.c. input and the a.c. output, which are isolated from each other and from the d.c. battery input terminals; and

NOTE 1 Where common or linked a.c. terminals are used, it is not possible to avoid back-feeding of the circuit providing normal supply to the unit.

NOTE 2 Relays or electronic switching may not provide the required isolation between a.c. input and output, see [Clause 2.7.7.2](#).

- (b) have short circuit and overload protection on the low voltage output of the inverter charger unit in accordance with AS/NZS 3000; and
- (c) be non-rotating power inverters; and
- (d) be designed to operate up to an ambient temperature of 50 °C and withstand an ambient temperature of 70 °C without damage; and
- (e) be automatically controlled; and
- (f) provide isolation of the a.c. output from the d.c. supply circuit; and
- (g) have controls which are readily accessible.

2.7.2.3.3 Final sub-circuits supplied by inverter and inverter charger units

Final sub circuit(s) supplied by an inverter and by inverter charger units shall not be supplied by any other source.

Inverters and inverter charger units with internal socket-outlets shall be —

- (a) an isolated output type; or
- (b) the output shall be protected by an RCD device.

A visible indicator shall be provided at the a.c. switchboard indicating the inverter and inverter charger is active online or in standby mode together with a warning label to indicate that the electrical system includes an inverter.

Exception: Where the connectable electrical installation switchboard is installed externally, the visible indicator shall be placed in a prominent position within the connectable electrical installation e.g. above a door.

An example of a warning label is as follows:

WARNING — DANGEROUS VOLTAGE

THIS UNIT IS EQUIPPED WITH A POWER INVERTER

TO AVOID SERIOUS INJURY OR DEATH FROM ELECTRICAL SHOCK DISCONNECT ALL A.C. EXTERNAL POWER SUPPLY(S) AND DC. BATTERY POWER TO INVERTER BEFORE OPENING PANEL OR SERVICING ELECTRICAL SYSTEMS

2.7.2.3.4 Inverter and inverter charger installation location

Inverters and inverter chargers shall be permanently installed.

Inverters and inverter chargers shall not be permanently installed in any of the following locations:

- (a) near sources of heat such as engine exhaust pipes; or
- (b) below fuel lines; or
- (c) within battery enclosures, see [Section 5](#).

2.7.2.3.5 Inverter and inverter charger nameplate information requirements

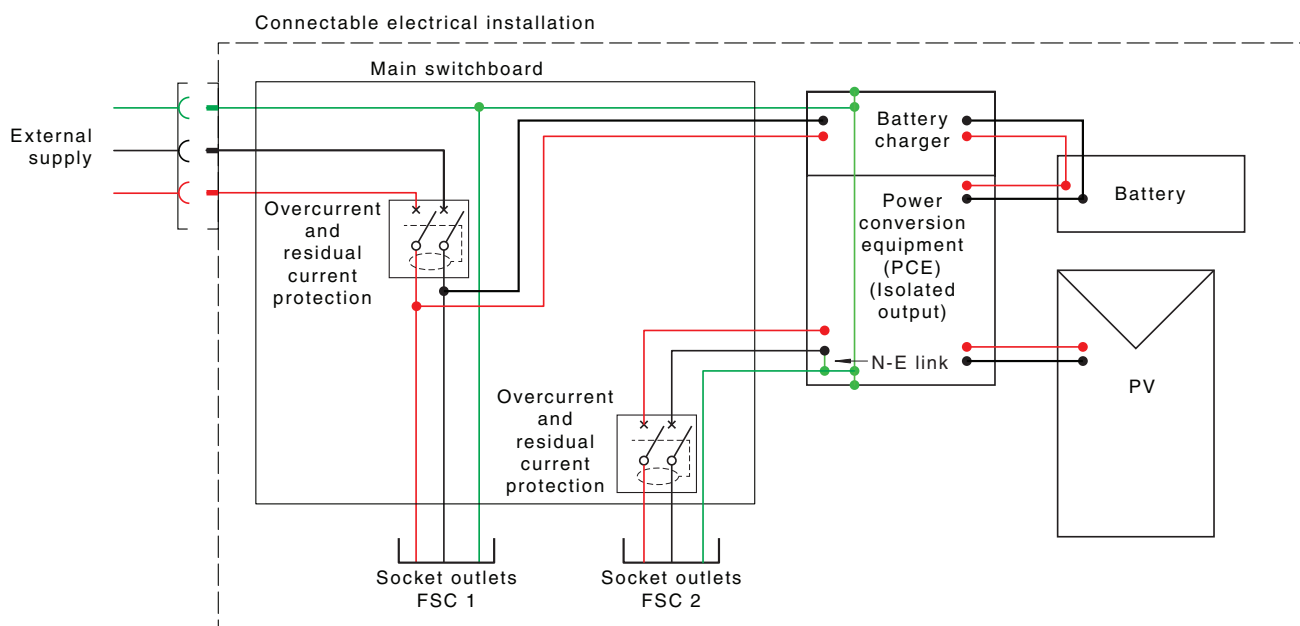
All inverters shall include the following information:

- (a) input voltage and current; and
- (b) continuous output current at rated voltage; and
- (c) nominal output voltage and frequency; and
- (d) surge capability and duration.

All inverter-chargers shall include the following information:

- (i) input voltage, current and frequency; and
- (ii) nominal output voltage and current; and
- (iii) d.c. output voltage at float or shut off, if applicable; and
- (iv) continuous output current at nominal battery voltage at 25 °C; and
- (v) battery type.

NOTE For further guidance, refer to ISO 13297, AS/NZS 4763, AS/NZS 60335.2.29, AS/NZS 60335.1.



NOTE 1 See [Clauses 2.7.7](#) and [2.7.8](#) for power conversion equipment (PCE) requirements.

NOTE 2 See [Clause 2.7.7.5](#) for neutral-earth connection requirements in PCE.

Figure 2.10 (A) — Typical arrangement for a connectable electrical installation including inverter charger supply

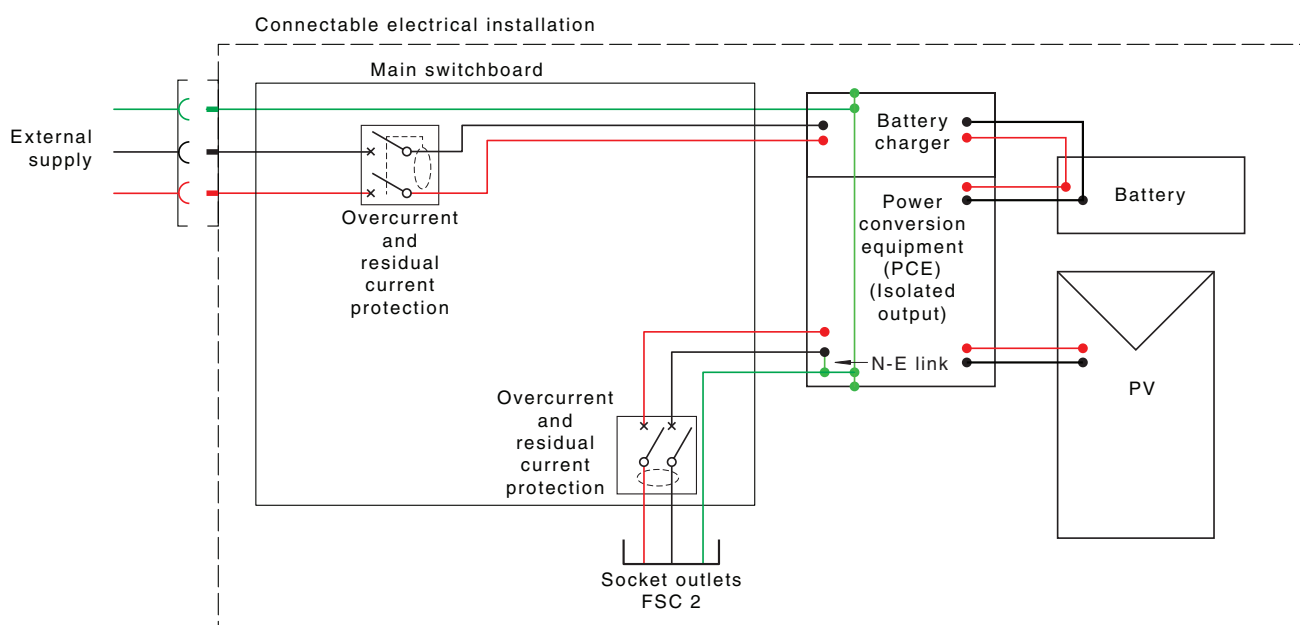
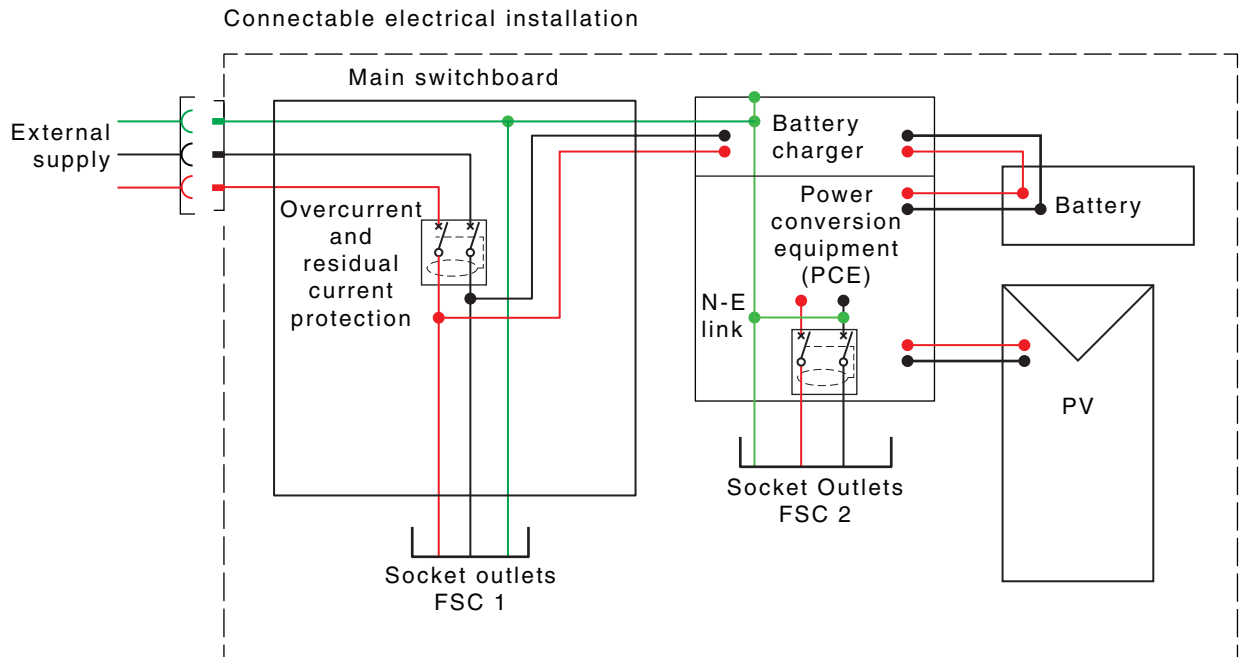


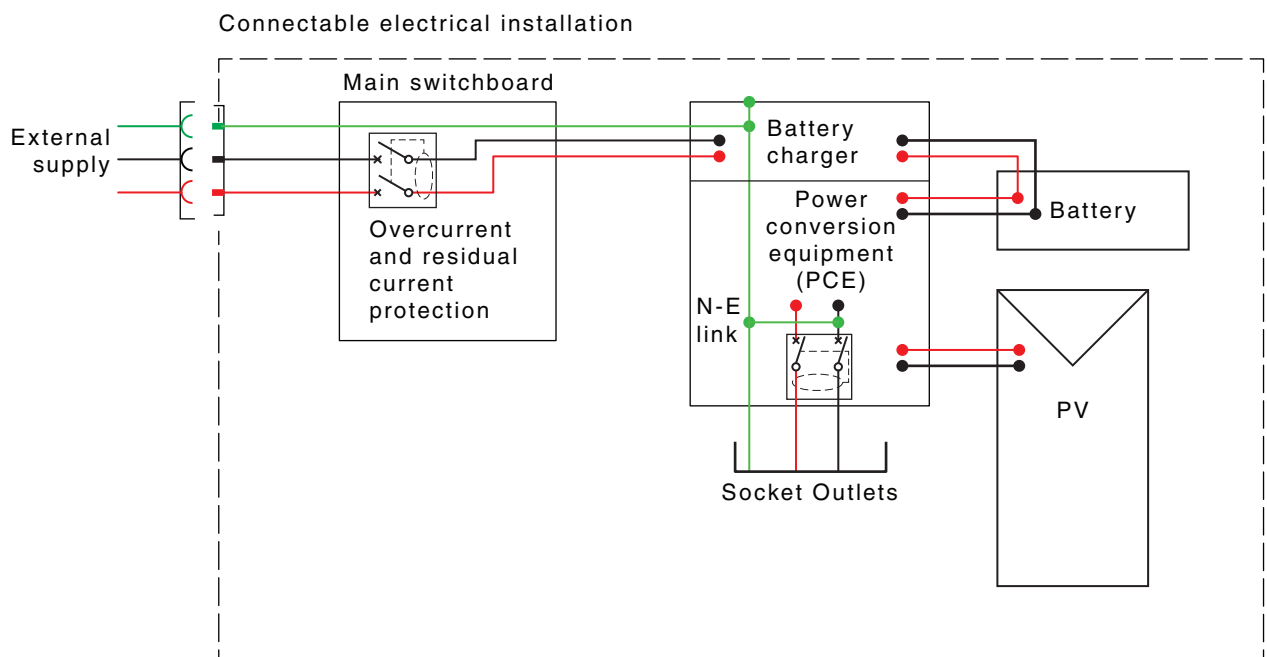
Figure 2.10 (B) — Typical arrangement for a connectable electrical installation including inverter charger supply



NOTE 1 See [Clauses 2.7.7](#) and [2.7.8](#) for PCE requirements.

NOTE 2 See [Clause 2.7.7.5](#) for neutral-earth connection requirements in PCE.

Figure 2.11 — Typical arrangements for connectable electrical installation onboard supplies



NOTE 1 The PCE contains an automatic changeover device. Refer to the manufacturer's installation instructions.

NOTE 2 See [Clauses 2.7.7](#) and [2.7.8](#) for PCE requirements.

NOTE 3 See [Clause 2.7.7.5](#) for neutral-earth connection requirements in PCE.

Figure 2.12 — Typical arrangements for connectable electrical installation with external supply and RCD protected circuit to power conversion equipment (PCE)

2.7.2.4 Onboard uninterruptible power supplies

2.7.2.4.1 General

An uninterruptible power supply (UPS) system may be used to provide an alternative supply for all or part of a low voltage installation in a connectable electrical installation, provided all the following conditions are met:

- (a) The UPS shall comply with AS 62040.1; and

NOTE 1 AS 62040.1 requires UPS equipment to be designed and tested to prevent back-feeding into the a.c. input connection when the input a.c. supply is absent, and the UPS is producing an a.c. output.

- (b) the UPS shall be installed in accordance with AS/NZS 3000 and the UPS manufacturer's instructions; and
- (c) the circuit(s) supplied by the UPS shall not be able to be supplied by any other source; and
- (d) the circuits supplied by the UPS shall be provided with RCD protection; and

NOTE 2 The RCD needs to be suitable for the output waveform under earth fault conditions. This may require use of Type B or Type F RCD.

- (e) a transformerless UPS shall not be used to supply fixed wired circuits. Transformerless UPSs may be used only for direct supply to equipment, where the supply input and load output are connected by a detachable connection.

Typical arrangements for a UPS system are shown in [Figure 2.13](#).