

Australian/New Zealand Standard™

Electrical installations—Construction and demolition sites



AS/NZS 3012:2019

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The following are represented on Committee EL-001:

Australian Building Codes Board
Australian Energy Council
Australian Industry Group
Communications, Electrical and Plumbing Union—Electrical Division
Consumers Federation of Australia
Electrical Contractors Association of New Zealand
Electrical Regulatory Authorities Council
Electrical Safety New Zealand
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Energy Networks Australia
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This Standard was issued in draft form for comment as DR AS/NZS 3012:2018.

Australian/New Zealand Standard™

Electrical installations—Construction and demolition sites

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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 3012:2010.

This Standard incorporates Amendment No. 1 (March 2020). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The objective of this Standard is to establish sound practices for the safe use of electricity at construction and demolition sites. It is to be used in conjunction with AS/NZS 3000, *Electrical installations (known as the Australian/New Zealand Wiring Rules)*.

The main differences between this Standard and AS/NZS 3012:2010 include the following:

- (a) The requirements of this Standard have been updated to reflect changes to AS/NZS 3000.
- (b) A reference to AS/NZS 61439.4 has been included for switchboard compliance for Assemblies for Construction Sites (ACS) (see Clause 1.4.3).
- (c) Clause title has been amended to ‘Multi-level buildings’ (see Clause 2.3.1.2).
- (d) Clause title has been amended to ‘Assemblies for construction sites (ACS) switchboard construction’, and a reference to AS/NZS 61439.4 has been included for switchboard compliance (see Clause 2.3.2.2).
- (e) Reference to AS 2790 has been deleted, as have Notes (b)2 and (b)6 (see Clause 2.4.6.3).
- (f) Figure from AS/NZS 3010:2017 for connection from a standalone generator to a site switchboard with an MEN link and electrode has been included (see Figure 2.1).
- (g) Figure from AS/NZS 3010:2017 for an isolated winding generator with integral socket outlets has been included (see Figure 2.2).
- (h) Figure from AS/NZS 3010:2017 for a generator with integral RCD protected socket outlets has been included (see Figure 2.3).
- (i) Clause has been reworded for reference to AS/NZS 3190 and for requirements for marking and regulatory approval (see Clause 2.6.10).
- (j) Requirement to prevent unauthorized disconnection of emergency lighting that has detachable connections (see Clause 2.7.3.1).
- (k) Temporary protected lighting (TPL) as defined in AS/NZS 60598.2.20 is not considered to be festoon lighting (see Clause 2.7.6).
- (l) Clause 3.3 has been deleted and reference to personnel requirements to be a qualified person or a competent person has been included in Clauses 3.3.1 to 3.6.
- (m) Out of service tag to be attached to non-compliant equipment (see Clause 3.7.2).
- (n) Tag for compliant equipment to include the name of the person (and the company if applicable), and the test and re-test date (see Clause 3.7.3).
- (o) Reference to AS 2790 deleted.
- (p) Reference to AS/NZS 60598.2.20, *Luminaires, Part 2.20: Particular requirements—Lighting chains*, included.
- (q) Reference to Building Code of Australia (BCA) deleted and replaced with National Construction Code of Australia (NCC) (see Appendices A and B) and New Zealand

Building Code (NZBC) (see Appendix A). The NCC extracts in Appendix B for use in Australia and New Zealand have been deleted, and Appendix B made void.

- (r) New appendix has been added for New Zealand only on construction power arrangements for domestic housing sites (see Appendix J).

Any requirement that is applicable in Australia only or New Zealand only is indicated by the symbol **A** or **NZ** in the right margin.

Statements expressed in mandatory terms in notes to figures and tables are deemed to be requirements of this Standard.

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

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Electrical installations—Construction and demolition sites**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out minimum requirements for the design, construction and testing of electrical installations that supply electricity to appliances and equipment on construction and demolition sites, and for the in-service testing of portable, transportable and fixed electrical equipment used on construction and demolition sites.

In Australia only, for a single domestic residence intended to be occupied as a residential housing unit, or, adjoining units each with a separate exterior entry and intended to be occupied as residential housing units, the requirements of this Standard are modified as detailed in Appendix A. A

NOTE: The National Construction Code (NCC) for Australia and New Zealand Building Code (NZBC) classification of building and structures is given in Appendix A.

In New Zealand only, for domestic housing sites where an electricity supply not exceeding 32 A single phase is installed specifically for the purposes of construction work, the requirements of this Standard are modified as detailed in Appendix A and Appendix J. NZ

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

NOTE: For requirements and recommendations regarding safe working on or near electrical equipment and installations, refer to AS/NZS 4836 and to Codes of Practice or other guidance issued by the regulatory authorities.

This Standard applies to electrical installations associated with construction and demolition sites, which include—

- (a) building work, excavation work, compressed air work and diving work;
- (b) parts of buildings that undergo structural alterations, such as extensions, major repairs or demolition, to the extent that the work necessitates the provision of a temporary electrical installation;
- (c) work on or in connection with the construction or maintenance of roads, airfields or airstrips, civil engineering works or bridges, or of the permanent way of a railway or tramway;
- (d) dredging or salvaging work;
- (e) the laying, lining or maintenance of pipes or cables;
- (f) earthmoving work carried out with equipment requiring the use of other than manual power;
- (g) any work in which explosives are used;
- (h) site offices, cloakrooms, meeting rooms, dormitories, canteens, toilets, appliances and other facilities provided during any work referred to in Items (a) to (g); and
- (i) land clearing in preparation for any work referred to in Items (a) to (g).

1.2 APPLICATION

Electrical installations on construction and demolition sites shall be carried out in accordance with AS/NZS 3000, except as modified herein, and with the applicable additional requirements of this Standard.

This Standard shall be read and used in conjunction with the requirements of relevant legislation.

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

- 2293 Emergency escape lighting and exit signs for buildings
- 2293.1 Part 1: System design, installation and operation
- 3111 Approval and test specification—Miniature overcurrent circuit-breakers
- 60529 Degrees of protection provided by enclosures (IP Code)

AS/NZS

- 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)
- 3001 Electrical installations—Transportable structures and vehicles including their site supplies
- 3008 Electrical installations—Selection of cables
- 3008.1.1 Part 1.1: Cables for alternating voltages up to and including 0.6/1 kV—Typical Australian installation conditions
- 3008.1.2 Part 1.2: Cables for alternating voltages up to and including 0.6/1 kV—Typical New Zealand installation conditions
- 3010 Electrical installations—Generating sets
- 3105 Approval and test specification—Electrical portable outlet devices
- 3112 Approval and test specification—Plugs and socket-outlets
- 3120 Approval and test specification—Cord extension sockets
- 3123 Approval and test specification—Plugs, socket-outlets and couplers for general industrial application
- 3190 Approval and test specification—Residual current devices (current-operated earth-leakage devices)
- 3191 Electric flexible cords
- 3199 Approval and test specification—Cord extension sets
- 3760 In-service safety inspection and testing of electrical equipment
- 4763 Safety of portable inverters
- 5000 Electrical cables—Polymeric insulated (series)

AS/NZS

- 60598 Luminaires
- 60598.2.8 Part 2.8: Particular requirements—Handlamps (IEC 60598-2-8, Ed.3.0 (2013) MOD)
- 60598.2.20 Part 2.20: Particular requirements—Lighting chains (IEC 60598-2-20:1996, MOD)

AS/NZS

- 60898 Electrical accessories—Circuit-breakers for overcurrent protection for household and similar applications
- 60898.1 Part 1: Circuit-breakers for a.c. operation (IEC 60898-1, Ed. 1.2 (2003) MOD)
- 61439 Low-voltage switchgear and controlgear assemblies
- 61439.4 Part 4: Particular requirements for assemblies for construction sites (ACS) (IEC 61439-4, Ed. 1.0 (2012), MOD)
- 61558 Safety of transformers, reactors, power supply units and combinations thereof
- 61558.2.23 Part 2.23: Particular requirements and tests for transformers and power supply units for construction sites

AS/NZS IEC

- 60947 Low-voltage switchgear and controlgear
- 60947.2 Part 2: Circuit-breakers

IEC

- 60269 Low-voltage fuses (series)
- 60309 Plugs, socket-outlets and couplers for industrial purposes
- 60309.2 Part 2 Dimensional interchangeability requirements for pin and contact-tube accessories
- 61008 Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs)
- 61008-1 Part 1: General rules
- 61009 Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs)
- 61009-1 Part 1: General rules

Australian Building Code Board (ABCB)

NCC National Construction Code

New Zealand Building Code (NZBC)

1.4 DEFINITIONS

For the purpose of this Standard the definitions given in AS/NZS 3000 and those below apply.

1.4.1 Appliance

A consuming device, other than a lamp, in which electricity is converted into heat, motion, or any other form of energy, or is substantially changed in its electrical character.

1.4.2 Appliances

1.4.2.1 Fixed

An appliance that is fastened to a support or otherwise secured in a specific location.

1.4.2.2 Hand-held

A portable appliance intended to be held in the hand during normal use. The motor, if any, forms an integral part of the appliance.

1.4.2.3 Portable

Either an appliance that is moved while in operation or an appliance that can easily be moved from one place to another while connected to the supply.

1.4.2.4 Stationary

Either a fixed appliance or an appliance having a mass exceeding 18 kg and not provided with a carrying handle.

1.4.3 Assembly for construction sites (ACS)

Switchboards complying with AS/NZS 3439.4 or AS/NZS 61439.4 and the requirements of Clause 2.3.2.

NOTE: Further information is given in Appendix I.

1.4.4 Auxiliary socket-outlet panel

A socket-outlet assembly, supplied by a fixed-wired dedicated final sub-circuit of construction wiring.

1.4.5 Cable, flexible

A cable, the conductors, insulation and covering of which provide flexibility.

1.4.6 Competent person

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

1.4.7 Construction and demolition site

A site where work in accordance with Clause 1.1 is carried out.

1.4.8 Construction wiring (construction and demolition wiring)

A system of wiring that is installed to provide electrical supply for construction and demolition work and is not intended to form part of the permanent electrical installation.

The term includes—

- (a) consumers mains and sub-mains supplying site switchboards; and
- (b) sub-mains to site facilities in which electricity is used, such as sheds, amenities or transportable structures; and
- (c) final sub-circuits connected at circuit-breakers on a site switchboard, supplying plant, construction equipment such as temporary construction lighting, auxiliary socket-outlet panels, hoists, and personnel lifts.

Construction wiring does not include flexible cords (1.4.9) or flexible cables (1.4.5) used to connect appliances or luminaires to a socket-outlet, but does include flexible cords or flexible cables used for Items (a), (b) or (c) above.

NOTE: Construction wiring and equipment is normally intended to be removed at the completion of construction work and is not intended to form part of the permanent installation. This does not exclude parts of the permanent installation being used to support or supply construction wiring provided it satisfies the relevant requirements of this Standard. Unused conductors need to be treated in accordance with the requirements of AS/NZS 3000.

1.4.9 Cord, flexible

A flexible cable (1.4.5), no wire of which exceeds 0.31 mm diameter and no conductor of which exceeds 4 mm² cross-sectional area, and having not more than five cores.

1.4.10 Detachable connection

The connection of electrical equipment to a source of supply by means of a plug and socket.

1.4.11 Direct connection

The connection of electrical equipment directly to the source conductors by means of a terminal, stud or other such arrangements.

1.4.12 Electrical equipment

Wiring systems, switchgear, controlgear, accessories, appliances, luminaires and fittings used for such purposes as generation, conversion, storage, transmission, distribution or utilization of electrical energy.

1.4.13 Fixed equipment

Electrical equipment that is fastened to a support or otherwise secured in a specific location.

1.4.14 Inverter

Device that uses semi-conductor devices to transfer power between a d.c. source and an a.c. load.

1.4.15 Isolated inverter

Inverter with protection by electrical separation, using double insulation or reinforced insulation between input circuits and output circuits and between output circuits and accessible conductive parts.

1.4.16 Permanent wiring

Wiring that forms part of the permanent electrical installation of a building or site.

1.4.17 Portable socket-outlet assembly (PSOA)

A Class H portable residual current device (PRCD) socket-outlet assembly fitted with an integral 30 mA RCD, integral MCB overcurrent protection, and two or more single-phase or three-phase socket-outlets complying with AS/NZS 3112, AS/NZS 3123 or IEC 60309-2.

Each socket-outlet has individual multi-pole switches operating in all live (active and neutral) conductors.

NOTES:

- 1 In Australia and New Zealand, a PSOA is required to have regulatory approval and to be marked with a Regulatory Compliance Mark (RCM) or approval number.
- 2 A PSOA complying with AS/NZS 3190 may be marked as complying with this Standard.

1.4.18 Qualified person

A person licensed to carry out electrical installation work.

1.4.19 RCD protected inverter (RCDP inverter)

Inverter that is fitted with a residual current device (RCD) in the output circuit and with equipotential bonding of the earthing terminal of the a.c. output connector with input circuits and the accessible conductive parts and with polarized output circuits achieved by connecting of the earthing terminal of the a.c. output connector to either the—

- (a) upstream side of the RCD on the pole that is connected to the neutral terminal of the a.c. output connector; or
- (b) centre tap of the output circuit supply on the upstream side of the RCD.

NOTES:

- 1 This type of inverter may have accessible conductive parts that are separated from the output circuits by double or reinforced insulation—these parts do not need to be bonded.
- 2 Where the d.c. input circuit is such that the input terminals are effectively connected together by a low impedance (e.g. internal impedance of a secondary battery), equipotential bonding of a single input terminal is considered to satisfy the requirement for all such input terminals.

1.4.20 Residual current device (RCD)

A device intended to isolate supply to protected circuits, socket-outlets or electrical equipment in the event of a current flow to earth that exceeds a predetermined value.

NOTE: RCDs are classified in AS/NZS 3190, AS/NZS 61008.1 and AS/NZS 61009.1.

1.4.21 Shall

Indicates a statement is mandatory.

1.4.22 Should

Indicates a recommendation.

1.4.23 Transportable structures

Both vehicles and structures 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.

NOTE: These structures include temporary site offices, cloakrooms, meeting offices, dormitories, canteens, toilets, workshops, site huts or other facilities provided on construction and demolition sites.

SECTION 2 INSTALLATION

2.1 SUPPLY

2.1.1 Construction wiring

Construction wiring shall be supplied from—

- (a) an electricity distributor's main;
- (b) an existing switchboard in the permanent installation of the premises;
- (c) a low voltage generating set complying with and installed in accordance with AS/NZS 3010; or
- (d) an inverter complying with the requirements of AS/NZS 4763.

2.1.2 Appliances, luminaires and electrical equipment

All appliances, luminaires and other electrical equipment shall be supplied from—

- (a) a final sub-circuit of the construction wiring, provided with overcurrent protection in accordance with Clause 2.4.5.2 and additional protection in accordance with Clause 2.4.6.1;
- (b) permanent wiring, provided with additional protection in accordance with Clause 2.4.6.2; or
- (c) a stand-alone power source, provided, where necessary, with additional protection in accordance with Clause 2.4.6.3 or Clause 2.4.6.4, as applicable.

2.1.3 Identification of source of supply

Where there is more than one switchboard on site, each directly connected appliance shall be legibly and indelibly marked to identify the switchboard at which its final sub-circuit originates [see also Clause 2.3.2.1(f)].

Exception: This requirement does not apply to appliances connected by means of a plug and socket or to luminaires.

2.1.4 Connection devices

All plugs, socket-outlets and appliance couplers shall comply with AS/NZS 3112, AS/NZS 3123 or IEC 60309-2 as applicable and shall have an IP rating appropriate for the environment. Devices for interconnection of sub-mains shall be designed to prevent inadvertent disconnection under load.

NOTE: For further guidance on IP ratings refer to AS/NZS 3000.

2.1.5 Polarization

All plugs, fixed socket-outlets and cord extension sockets of single and multiphase shall be connected so the polarity of the single phase complies with the requirements of AS/NZS 3000. The phase sequence of multiphase shall be the same for all fixed socket-outlets and cord extension sets on a construction or demolition site.

2.1.6 Separate circuit requirements

One or more separate circuits shall be provided for each of the following specific types of electrical equipment:

- (a) Socket-outlets.
- (b) Lighting points.
- (c) Permanently connected welding equipment.

- (d) Other specific electrical equipment as required by AS/NZS 3000.
- (e) Transportable structures (see also Clause 2.9 and AS/NZS 3001).
- (f) Auxiliary socket-outlet panels.

2.2 MAXIMUM DEMAND

The maximum demand of mains and sub-mains of construction wiring shall be determined by one of the methods specified in AS/NZS 3000.

2.3 SWITCHBOARDS INSTALLED FOR THE PURPOSE OF CONSTRUCTION AND DEMOLITION

2.3.1 Location

2.3.1.1 General

All switchboards shall be installed in accordance with AS/NZS 3000.

All switchboards shall be readily accessible and protected from damage during the course of the construction or demolition work.

Every switchboard or part of a switchboard that is supplied from a separate source of supply shall be legibly and indelibly marked to identify the source of supply from which it originates.

NOTE: If the source of supply is a generating set, a unique identifier such as the plant number of the generating set satisfies this requirement.

2.3.1.2 Multi-level buildings

In multi-level buildings, switchboards shall be positioned in a manner that eliminates the need for flexible cords or cables to be run between levels.

Exception: This requirement need not apply to work in lift shafts, stairwells, service shafts, formwork, external staging or sub-mains of construction wiring or a single domestic residence as detailed in Appendix A.

2.3.2 Switchboard construction

2.3.2.1 General requirements

All switchboards, including those described in Clause 2.3.2.2, shall be constructed to comply with the following requirements:

- (a) Robust construction and materials to withstand mechanical damage from environment or other external influences that may be expected at the location.
- (b) The enclosure shall have a degree of protection appropriate for the environment in which it is installed subject to a minimum degree of protection of IP23.
- (c) Live parts shall be effectively protected at all times against contact by personnel operating equipment located on the switchboard, including the connection or disconnection of plugs to socket-outlets.
- (d) Where the switchboard is provided with a socket-outlet, means to prevent strain at connections or terminations, such as an insulated or covered tie bar, shall be provided for the anchorage of external cables and flexible cords.
- (e) Where provided with a door or lid to maintain a degree of protection, the door or lid shall—
 - (i) require the use of a tool for removal;
 - (ii) be fitted with a facility for locking;
 - (iii) be fitted with a means of retention in the open position;

- (iv) not damage leads and allow the safe entry of leads if the switchboard is provided with socket-outlets;
 - (v) display a clearly visible and legible sign fixed on the external surface, e.g. words to the effect of 'KEEP CLOSED—RUN ALL LEADS THROUGH BOTTOM'; and
 - (vi) be kept closed except when access is required.
- (f) Where there is more than one switchboard on the site, marking shall be provided, by means of numbers, letters or both, to distinguish one switchboard from another.
- (g) Switchboards shall be marked in accordance with Appendix C to indicate the presence of live parts.

NOTE: Some regulatory jurisdictions require provision to be made on construction and demolition switchboards supplying more than one final sub-circuit, for the fitting of a lockable or sealable cover over circuit-breakers and RCDs associated with these circuits or other devices that would control the resetting of circuit-breakers and RCDs, but does not prevent access to isolation switches.

2.3.2.2 Assemblies for construction sites (ACS) switchboard construction

ACS switchboards shall comply with AS/NZS 3439.4 or AS/NZS 61439.4 and the additional requirements of Appendix I.

NOTE: Switchboards complying with AS/NZS 3439.4 or AS/NZS 61439.4 are deemed to comply with Clause 2.3.2.1 Items (a), (b) and (c).

2.3.3 Mounting of switchboards

Switchboards shall be securely attached to a pole, post, wall, floor or other structure of a stable, freestanding design that takes into account any external forces that may be exerted on the switchboard, e.g. by flexible cords.

2.3.4 Socket-outlets

Socket-outlets provided on switchboards for the connection of portable appliances and other electrical equipment shall be rated at not less than 10 A.

NOTE: Where required all switchboards should be fitted with at least one 15 A or one 16 A, single phase, socket-outlet. For example, such socket-outlets may be required to supply welders and floor sanders.

2.3.5 Support of cables entering switchboards

At each switchboard, a fixed secure and stable means shall be provided to prevent mechanical damage to flexible cords and cables and prevent the transfer of mechanical strain to the cable connections (see Clause 2.5.3).

NOTE: An example of such a means is to support flexible cords and cables above the floor or ground on stands, cross-arms or similar, covered with material that is non-conducting.

2.3.6 Arrangement of switchboards, wiring and equipment

- A1 | A guide to the arrangement of switchboards, wiring and equipment can be found in Appendix H.

2.4 CONTROL AND PROTECTION

2.4.1 Control

Each switchboard shall be provided with one isolating switch marked in accordance with Clause 2.4.3 and complying with the requirements for isolating switches in AS/NZS 3000. This switch shall interrupt supply to all final sub-circuits and sub-mains originating from the switchboard, including circuits supplying socket-outlets mounted on the switchboard.

Exceptions:

- 1 *One additional switch may be provided, marked in accordance with Clause 2.4.3, for the control of all final sub-circuits intended to operate out of normal working hours.*
- 2 *Additional switches controlling safety services, where required by AS/NZS 3000, shall be provided and clearly identified, all in accordance with AS/NZS 3000.*

NOTE: Consideration should be given to generator supplies to ensure that the isolating switch provides isolation from all incoming supplies

2.4.2 Securing of isolating switch

Isolating switches shall be provided with a means to prevent electrical equipment from being inadvertently energized. The means of isolation shall be such that a deliberate action in addition to the normal method of operation is required to energize the circuit.

One of the following methods shall be regarded to satisfy this requirement:

- (a) Provision for the fitting of a padlock.
- (b) Location within a lockable space or enclosure.

NOTES:

- 1 Warning tags or notices alone are not acceptable, but may be used in conjunction with Item (a) or Item (b) above.
- 2 Short-circuiting and earthing should be used only as a supplementary measure.

2.4.3 Marking of isolating switches

All isolating switches controlling the portions of the installation included in Clause 2.4.1 shall be marked in accordance with AS/NZS 3000 and as follows:

- (a) 'MAIN SWITCH'—on main switchboards.
- (b) 'DISTRIBUTION BOARD ISOLATING SWITCH'—on distribution boards.
- (c) 'ISOLATING SWITCH AFTER HOURS SUPPLY—DO NOT SWITCH OFF'—for circuits supplying electrical equipment operating out of normal working hours.

Main switches for safety services shall be identified in accordance with AS/NZS 3000.

2.4.4 Size of marking

Letters used for marking in accordance with Clause 2.4.3 shall not be less than 6 mm high and of a contrasting colour to the background material.

2.4.5 Overload protection**2.4.5.1 Sub-mains**

Devices for protection against overload and short-circuit currents in sub-mains shall be one of the following types:

- (a) Enclosed fuse-links complying with the appropriate Standard(s) in the IEC 60269 series and be rated IP2X.
- (b) Miniature overcurrent circuit-breakers complying with AS/NZS 3111 or AS/NZS 60898.1.
- (c) Moulded-case circuit-breakers complying with AS/NZS IEC 60947.2.
- (d) Circuit-breakers complying with AS/NZS IEC 60947.2.

2.4.5.2 Final sub-circuits

Devices for protection against overload and short-circuit currents in final sub-circuits shall be one of the following types:

- (a) Miniature overcurrent circuit-breakers complying with AS/NZS 3111 or AS/NZS 60898.1.
- (b) Moulded-case circuit-breakers complying with AS/NZS IEC 60947.2.
- (c) Where supplying fixed appliances rated at 50 A per phase or greater, enclosed fuse-links complying with the IEC 60269 series of Standards and having a degree of protection of at least IP2X when the removal carrier is inserted or removed.

2.4.6 Additional protection—Basic protection and fault protection

2.4.6.1 Final sub-circuits of construction wiring

All final sub-circuits of construction wiring shall be protected at the switchboard where the final sub-circuits originate by residual current devices, with a maximum rated residual current of 30 mA, that operate in all live (active and neutral) conductors. The final sub-circuits shall be arranged—

- (a) where the number of RCDs installed exceeds one; and
- (b) where more than one lighting circuit is installed.

The lighting circuits shall be distributed between RCDs.

NOTE: This arrangement is intended to minimize the impact of the operation of a single RCD.

Exceptions: Additional protection by an RCD need not apply to any of the following types of final sub-circuit:

- 1 *Final sub-circuits supplying electrical equipment where safe mechanical operation is at risk, e.g. electric cranes or personnel lifts.*
- 2 *Final sub-circuits where all appliances, luminaires and other electrical equipment are supplied from a directly connected SELV or PELV source in accordance with the requirements of AS/NZS 3000 for extra low-voltage supply.*
- 3 *Final sub-circuits where all appliances, luminaires and other electrical equipment are supplied from a directly connected safety isolating transformer complying with AS/NZS 61558.2.23, supplying a separated circuit for electrical equipment installed in accordance with the electrical separation requirements of AS/NZS 3000 and with each winding supplying not more than one item of Class I (earthed conductive parts) electrical equipment.*

NOTE: This description includes a single winding supplying one or more items of Class II (double insulated) electrical equipment and a single winding supplying one item of Class I (earthed conductive parts) electrical equipment plus one or more items of Class II (double insulated) electrical equipment.

- 4 *In New Zealand only, A 110 V centre-tapped transformer to the requirements of AS/NZS 61558.2.23 providing a reduced low voltage source of supply, and circuits connected to the transformer shall be fitted with plugs and sockets that are not interchangeable with other systems of supply (refer to AS/NZS 3000).*

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2.4.6.2 Appliances, luminaires and other electrical equipment supplied by final sub-circuits of permanent installation wiring

Where appliances, luminaires and other electrical equipment are supplied from a final sub-circuit of the permanent installation, the equipment shall be protected by an RCD with a maximum rated residual current of 30 mA as follows:

- (a) A residual current circuit-breaker (RCCB) or residual current circuit-breaker with overcurrent protection (RCBO) located at the switchboard at the origin of the final sub-circuit.
- (b) A socket residual current device (SRCD) incorporated into the socket-outlet supplying the electrical equipment.

- (c) A portable socket-outlet assembly (PSOA) incorporated in accordance with Clause 2.6.10.

NOTE: This provision allows for construction or demolition work in existing premises that involves the use of plug-in equipment, such as tools and task lighting, to be carried out using existing socket-outlets that are in the vicinity of the construction work. When the construction work is more significant in terms of duration, scale or equipment, arrangements should be made to have construction wiring and equipment installed that comply with the requirements of this Standard.

2.4.6.3 *Electrical equipment supplied by low-voltage generators*

LV generators shall be connected in accordance with AS/NZS 3010 and the following additional requirements:

NOTE: LV is any voltage exceeding 50 V a.c. or 120 V d.c. but not exceeding 1000 V a.c. or 1500 V d.c.

Typical arrangements shall be one of the following:

(a) *Small portable generating sets*

Small portable generating sets may be used to directly supply portable tools and appliances without connection to a construction wiring system.

(i) *Separated (isolated) winding generating sets*

Each generating set shall supply not more than one item of Class I (earthed conductive parts) electrical equipment.

Separated (isolated) winding generating sets containing 2 socket outlets, connected in accordance with Figure 2.2, may be used on construction and demolition sites to supply a separated (isolated) supply for electrical equipment to the electrical separation requirements of AS/NZS 3000 Section 7.

NOTES:

- 1 In some jurisdictions, the use of isolated winding generators is not permitted on construction and demolition sites.
- 2 One or more items of Class II (double insulated) electrical equipment may be connected to a separated (isolated) winding generator.
- 3 The 2 pole switching shown in Figure 2.2 is required as both conductors are considered to be live—neither is earthed in normal operation.
- 4 The connection of the small portable generating set bonding system to the general mass of earth through an earth electrode is not required or recommended when directly supplying electrical equipment. See Item (c) below.

(ii) *RCD protected generating sets*

RCD protected generating sets containing up to 2 socket outlets, providing an electrical supply with RCD protection with a maximum rated residual current of 30 mA, operating in all live (active and neutral) conductors, and connected in accordance with Figure 2.3, may be used to supply an RCD protected supply to multiple items of equipment.

NOTES:

- 1 The RCD protected system allows the use of multiple Class I (metal frame with a bonding conductor) items as the first fault causes a residual current device to trip.
- 2 The connection of the generating set bonding system to the general mass of earth through an earth electrode is not required or recommended when directly supplying electrical equipment. See Item (c) below.

(iii) *Generating sets provided with a self-contained switchboard*

Generating sets provided with a self-contained switchboard to provide more than 2 socket outlets. All socket outlets shall be fitted with RCD protection having a maximum rated residual current of 30 mA, operating in all live (active and neutral) conductors, and connected in accordance with Figure 2.4 may be used to supply an RCD protected supply to multiple items of equipment.

NOTE: The connection of the generating set bonding system to the general mass of earth through an earth electrode is not required or recommended when directly supplying electrical equipment. Refer to Item (c) below.

(b) *Generating sets used to supply a directly connected site construction switchboard*

Generating sets used to supply a directly connected site construction switchboard, all sub-mains and final sub-circuits originating at that switchboard shall be protected in accordance with Clauses 2.4.5 and 2.4.6.1, as shown in Figure 2.1.

(c) *Provision of an earth electrode for portable generating sets*

The provision of an earth electrode for a portable generating set when supplying electrical equipment connected by a plug and socket outlet on the generating set is not a requirement of this Standard.

NOTE: Refer to AS/NZS 3010:2017 Appendix A and Appendix B for further details.

(d) *Provision of earthing connections for generating sets connected to a construction wiring system*

The earthing system of an alternative supply shall be identical to that of the normal supply (e.g. TN-C-S (MEN)).

The connection to earth of the neutral and earthing connections of the generating set shall use the same earthing and neutral bonding connection points in the construction wiring system.

The construction wiring system main switchboard shall have an earthing system with an earth electrode to complying with the requirements of AS/NZS 3000.

The installation of an additional earth electrode at the generating set is not required or recommended.

The connection of the generating set neutral to the neutral busbar of the construction wiring system switchboard and the generating set earth connection to the main switchboard with a MEN link shall be the only neutral and earth connection permitted. Details are shown in Figure 2.1.

NOTE: Refer to AS/NZS 3010:2017 Appendix A and Appendix B for further details.

(e) *Welding generators*

Welding generators with auxiliary circuits supplying 115 V a.c. that do not originate from an isolated winding are required to be RCD protected in accordance with Clause 2.4.6.3(b).

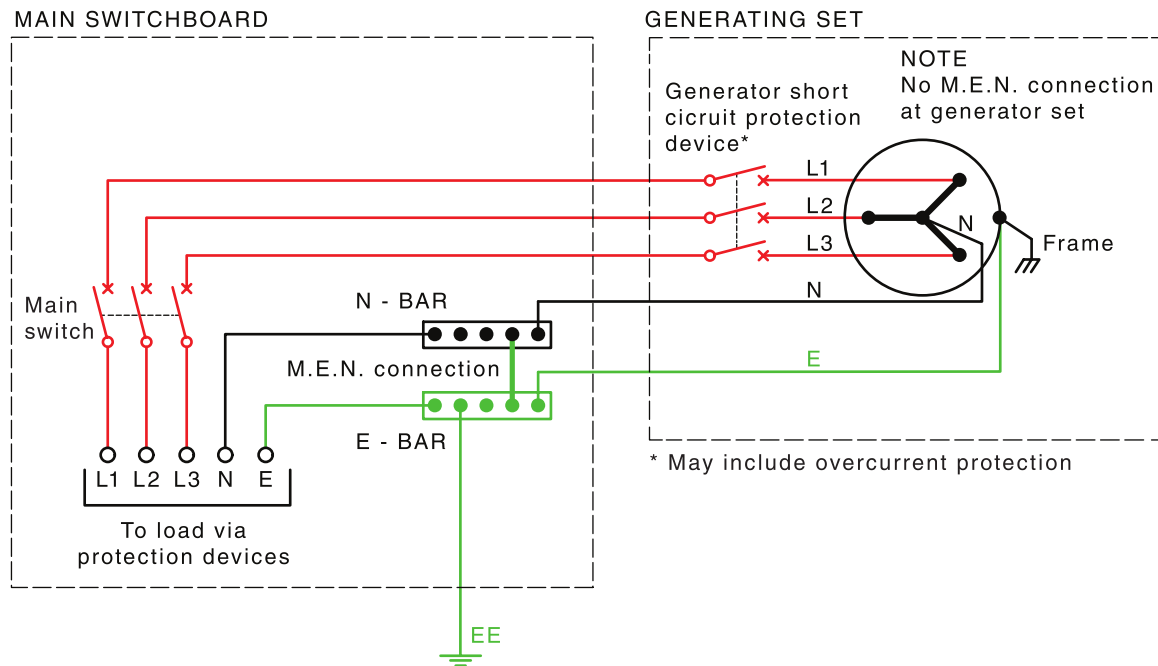


FIGURE 2.1 TYPICAL ARRANGEMENT FOR A SINGLE THREE-PHASE GENERATING SET INSTALLED AS SITE SUPPLY TO THE MAIN SWITCHBOARD WITH A MEN LINK INSTALLED

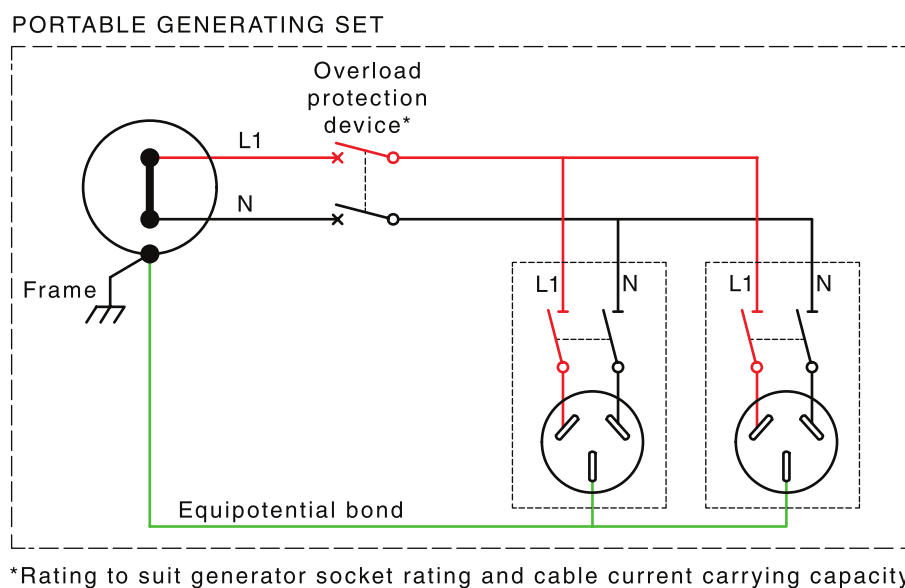


FIGURE 2.2 ISOLATED OUTPUT SINGLE-PHASE GENERATING SET

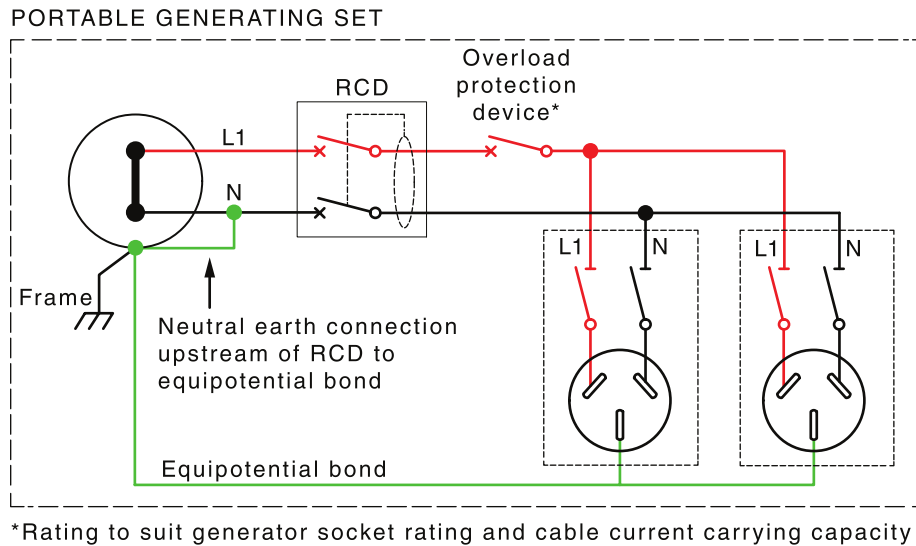


FIGURE 2.3 RCD PROTECTED SINGLE-PHASE GENERATING SET

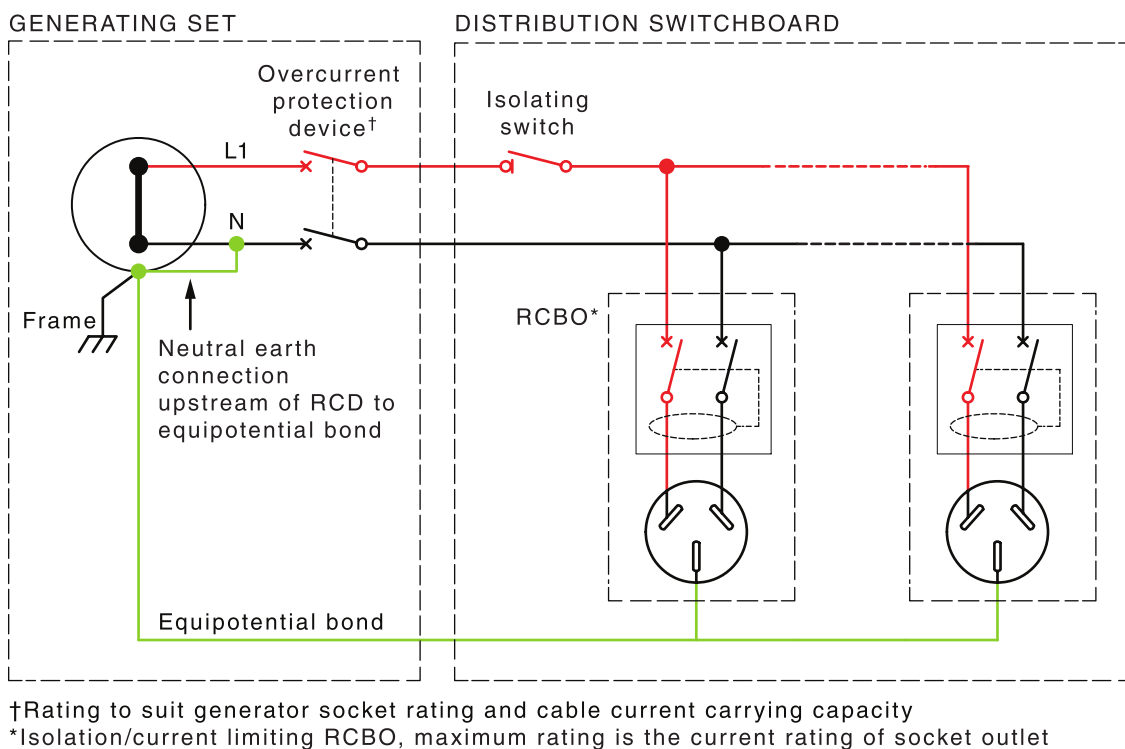


FIGURE 2.4 ISOLATED OUTPUT GENERATING SET CONNECTED TO A DISTRIBUTION SWITCHBOARD

2.4.6.4 Electrical equipment supplied by inverters

Inverters used on construction and demolition sites shall comply with the requirements of AS/NZS 4763 and be one of the following types:

- An RCD protected inverter (RCDP Inverter) with a maximum rated residual current of 30 mA.
- An isolated inverter.

Isolated inverters shall only be used on construction and demolition sites to supply a separated circuit for electrical equipment, installed in accordance with the electrical separation requirements of AS/NZS 3000. Each winding shall supply not more than one item of Class I (earthed conductive parts) electrical equipment.

NOTES:

- 1 AS/NZS 4763 requires identification of the classification, by the means given in Clause F1.
- 2 One or more items of Class II (double insulated) electrical equipment may be connected to an isolated winding inverter.
- 3 Wiring of dedicated battery storage systems for inverters should comply with AS/NZS 3000. Battery storage systems should comply with AS 4086.2.

2.4.6.5 *Permanent wiring located where construction or demolition work may be carried out*

Permanent wiring located where construction or demolition work may be carried out shall be regarded to be energized until proven otherwise by inspection and testing.

All energized permanent wiring located where construction or demolition work may be carried out shall be identified and assessed for the risk of electric shock or mechanical or environmental damage from construction or demolition activities. Where a risk of electric shock or damage exists, such wiring shall be appropriately labelled to highlight the danger of energized parts. Where required, all energized permanent wiring shall be protected in accordance with Clause 2.5.3.

NOTE: Particular care should be taken with permanent wiring, including wiring from supplementary or alternative supplies installed in locations such as the following:

- (a) Ceiling spaces.
- (b) Within masonry or stud walls.
- (c) Concrete floor slabs.
- (d) Wiring fed from another location, e.g. adjoining building.

2.4.7 Switching of single-phase socket-outlets

Every single-phase socket-outlet in the following situations shall be individually controlled by a switch operating in all live (active and neutral) conductors:

- (a) Portable generators of the isolated winding type fitted with integral socket-outlets.
- (b) Portable inverters of the isolated type fitted with socket-outlets.
- (c) Portable socket-outlet assemblies.
- (d) In Australia only, on or in transportable structures that are connected to supply by a flexible cord and plug. A
- (e) Socket-outlets on equipment that is supplied by means of a plug and socket.

NOTE: Socket-outlets may be either the type with a manual switch or an integral switch that switches on when the plug top is inserted and switches off when it is removed.

2.5 CONSTRUCTION WIRING

2.5.1 Cables and fittings

Cables and fittings used in construction wiring shall comply with the requirements of AS/NZS 3000.

NOTE: The requirements of AS/NZS 2802 apply to trailing cables used for surface wiring.

2.5.2 Installation of cables

Cables shall be installed in accordance with AS/NZS 3000 except as modified in Clauses 2.5.3 to 2.5.8 below. Construction wiring shall not be—