

LICENCE

for

AS/NZS 3012 : 2019 : EN PDF

Licensee: Narelle Jack

Date: 10/11/2022

Infostore Licence Agreement

This is an agreement between the end user of the Product ("Licensee") and SAI Global Australia Pty Ltd ABN 14 144 974 087, Level 37, 680 George Street, Sydney NSW 2000 AUSTRALIA ("Licence Agreement").

1. Definitions and Interpretations

Concurrent Users means the maximum number of people able to access the Product at any one time, and is limited to the number of Licences purchased.

Internal Use means use of the Product within the Licensee's organization.

Licence means the right to access and use the Product.

Licensee means the purchaser and user of the Product.

Product means Standards and other publications related material and content ordered and purchased through the Infostore in hard copy format or downloaded as electronic PDF files.

SA Licensed Material means Publications published by Standards Australia Limited.

2. Product Availability

2.1. The Product is available via the World Wide Web through the use of a web browser. Documents are provided as hard copy prints or PDF files, viewable through the use of the latest version of Adobe Reader®.

3. Licence Agreement

3.1. By using the Product, the Licensee agrees to be bound by this Licence Agreement for the Product.

To read the full licence agreement, simply click within the red box above and scroll through with your cursor

- Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation
- Know when a Standard has changed
- Visit our store to find more Publications

AS/NZS 3012:2019
(Incorporating Amendment No. 1)

Copyrighted material licensed to SAI Global for NRG Industrial.
No further reproduction or distribution permitted. Printed / viewed by:narelle@nrgindustrial.com.au @s162:10302N/SV

Australian/New Zealand Standard™

**Electrical installations—Construction
and demolition sites**



AS/NZS 3012:2019

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-001, Wiring Rules. It was approved on behalf of the Council of Standards Australia on 23 July 2019 and by the New Zealand Standards Approval Board on 2 October 2019.

This Standard was published on 4 November 2019.

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
Electrical Workers Registration Board
ElectroComms and Energy Utilities Industries Skills Council
Energy Networks Australia
Engineers Australia
Institute of Electrical Inspectors
Master Electricians Australia
National Electrical and Communications Association
National Electrical Switchboard Manufacturers Association
New Zealand Manufacturers and Exporters Association
Wellington Electrical Association
WorkSafe New Zealand

Additional Interests:

B & R Enclosures
Coates Hire
Focused Quality Systems
Housing Industry Association
Jackson Electrical, New Zealand
Master Builders Association of NSW
SafeWork NSW
WorkSafe Victoria

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Site at www.standards.org.au or Standards New Zealand web site at www.standards.govt.nz and looking up the relevant Standard in the on-line catalogue.

For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of Standards Australia or the New Zealand Standards Executive at the address shown on the back cover.

This Standard was issued in draft form for comment as DR AS/NZS 3012:2018.

AS/NZS 3012:2019
(Incorporating Amendment No. 1)

Copyrighted material licensed to SAI Global for NRG Industrial.
No further reproduction or distribution permitted. Printed / viewed by:narelle@nrindustrial.com.au @ 10/11/2022

Australian/New Zealand Standard™

Electrical installations—Construction and demolition sites

Originated in Australia as AS 3012—1990.
Jointly revised and redesignated as AS/NZS 3012:1995.
Third edition 2003.
Previous edition 2010.
Fifth edition 2019.
Reissued incorporating Amendment No. 1 (March 2020).

COPYRIGHT

© Standards Australia Limited

© The Crown in right of New Zealand, administered by the New Zealand Standards Executive

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Australia) or the Copyright Act 1994 (New Zealand).

ISBN 978 1 76072 618 8

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.

CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE.....	5
1.2 APPLICATION	6
1.3 NORMATIVE REFERENCES	6
1.4 DEFINITIONS.....	7
SECTION 2 INSTALLATION	
2.1 SUPPLY	11
2.2 MAXIMUM DEMAND.....	12
2.3 SWITCHBOARDS INSTALLED FOR THE PURPOSE OF CONSTRUCTION AND DEMOLITION	12
2.4 CONTROL AND PROTECTION	13
2.5 CONSTRUCTION WIRING	20
2.6 FLEXIBLE CORDS, CORD EXTENSION SETS, FLEXIBLE CABLES AND ACCESSORIES	22
2.7 LIGHTING AND LUMINAIRES	26
2.8 LIFT SHAFTS	32
2.9 TRANSPORTABLE STRUCTURES	33
SECTION 3 VERIFICATION	
3.1 APPLICATION	35
3.2 FREQUENCY OF VERIFICATION	35
3.3 CONSTRUCTION WIRING AND TRANSPORTABLE STRUCTURES.....	36
3.4 RCDS.....	37
3.5 OTHER ELECTRICAL EQUIPMENT ON SITE	37
3.6 CONNECTION BETWEEN GENERATOR WINDINGS, FRAME AND EQUIPOTENTIAL BONDING SYSTEM.....	38
3.7 ACTIONS RESULTING FROM INSPECTION AND TEST	38
3.8 PORTABLE GENERATOR SETS AND INVERTERS.....	39
3.9 DOCUMENTATION.....	39
APPENDICES	
A ELECTRICAL INSTALLATIONS IN THE DOMESTIC HOUSING CONSTRUCTION INDUSTRY	40
B VOID.....	41
C MARKING OF SWITCHBOARDS TO INDICATE THE PRESENCE OF LIVE PARTS.....	42
D RECOMMENDED COLOURS FOR TAGS ON TESTED EQUIPMENT	43
E ELECTRICAL VERIFICATION OF GENERATORS WITH RCD PROTECTION IN ACCORDANCE WITH AS/NZS 3012 AND AS/NZS 3760	44
F ELECTRICAL VERIFICATION OF PORTABLE INVERTERS.....	45
G NEW ZEALAND ONLY ASSESSMENT FORM FOR CONSTRUCTION AND DEMOLITION SITES.....	48
H GUIDE TO ARRANGEMENT OF SWITCHBOARDS, CONSTRUCTION WIRING AND EQUIPMENT.....	50
I ASSEMBLIES FOR CONSTRUCTION SITES (ACS) FOR CONSTRUCTION AND DEMOLITION SITES.....	51
J CONSTRUCTION POWER SUPPLY ARRANGEMENTS FOR DOMESTIC HOUSING SITES (NEW ZEALAND ONLY)	58
BIBLIOGRAPHY.....	66

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).*

NZ

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).

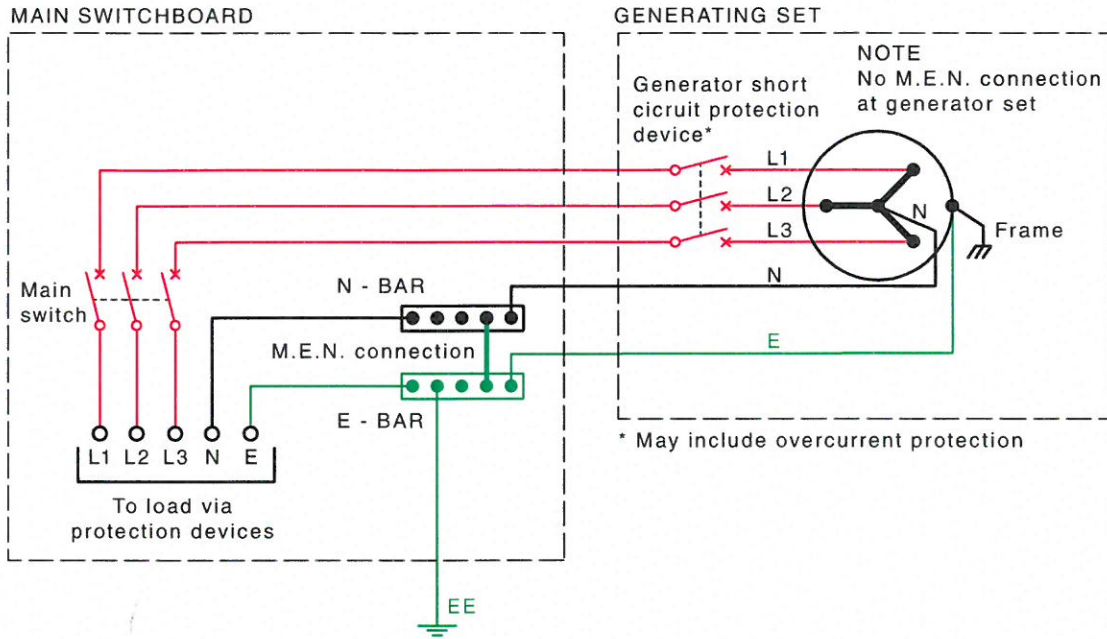


FIGURE 2.1 TYPICAL ARRANGEMENT FOR A SINGLE THREE-PHASE GENERATING SET INSTALLED AS SITE SUPPLY TO THE MAIN SWITCHBOARD WITH A MEN LINK INSTALLED

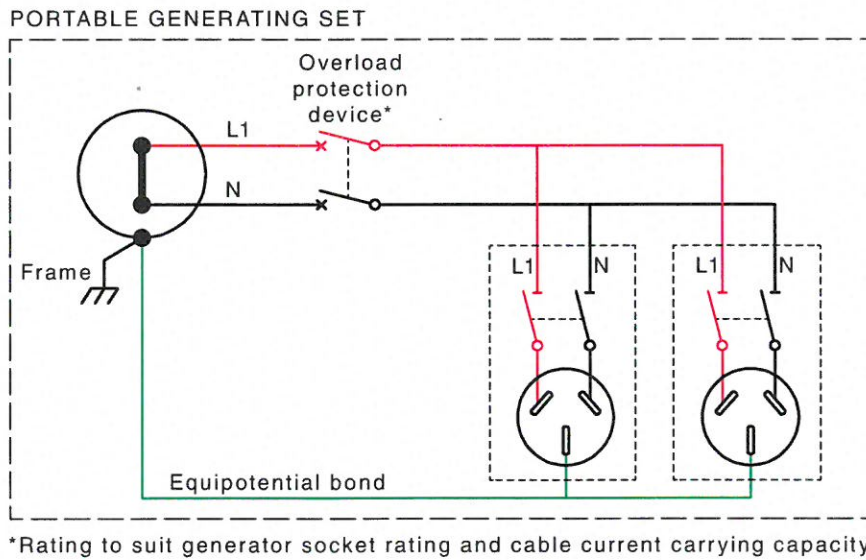


FIGURE 2.2 ISOLATED OUTPUT SINGLE-PHASE GENERATING SET

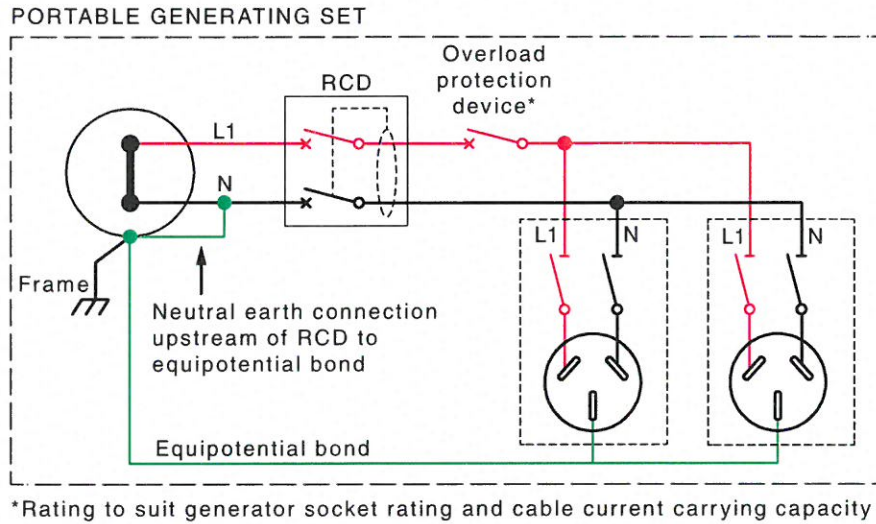


FIGURE 2.3 RCD PROTECTED SINGLE-PHASE GENERATING SET

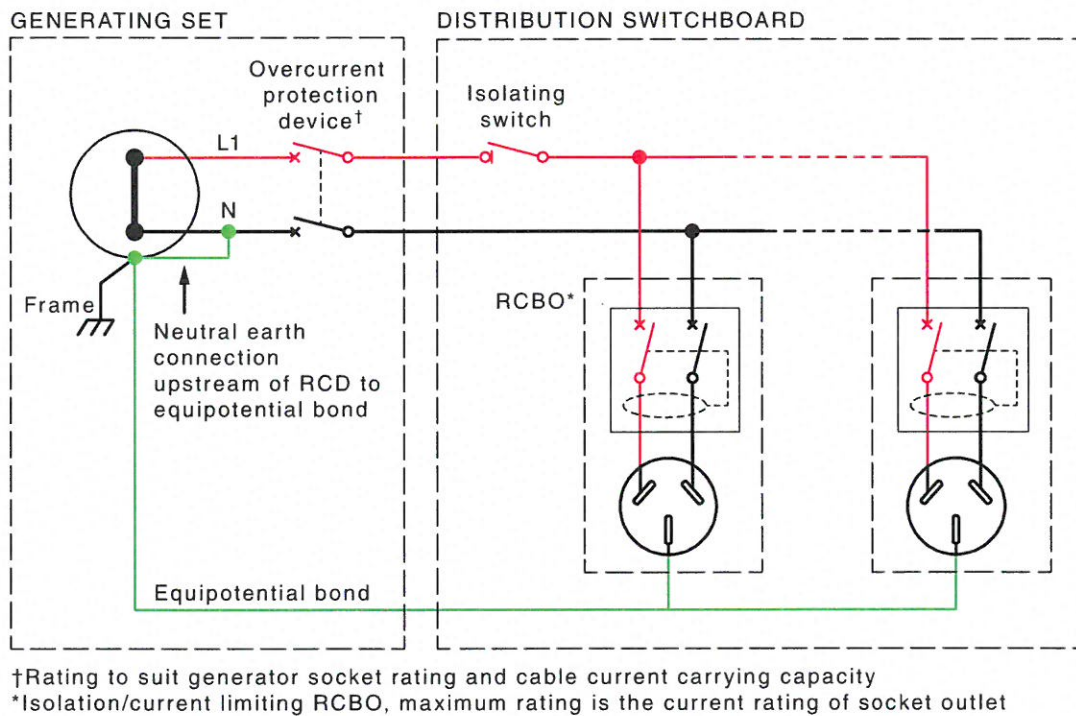


FIGURE 2.4 ISOLATED OUTPUT GENERATING SET CONNECTED TO A DISTRIBUTION SWITCHBOARD

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—

- (a) tied, bundled or grouped with permanent wiring; nor
- (b) attached to free-standing fencing.

2.5.3 Protection against mechanical damage

A risk assessment should be undertaken, prior to the installation of cables or whenever a change occurs, as to the likelihood of the cables being exposed to mechanical damage.

Where the risk assessment identifies a risk of damage to cables, and the cables cannot be relocated to an alternative position, they shall be protected by a suitable enclosure or barrier not less effective than—

- (a) medium duty rigid or corrugated conduit of insulating material;
- (b) heavy-duty rigid or corrugated conduit of insulating material;
- (c) flexible electrical hose;
- (d) armoured cable; or
- (e) other means that provide equivalent protection against mechanical damage.

NOTE: For further guidance refer to AS/NZS 3000 Appendix H.

Where a risk assessment is not undertaken, protection against mechanical damage by the use of a suitable enclosure or barrier not less effective than Items (a) to (e) above shall be provided.

NOTE: The following are typical examples of situations where cables require mechanical protection:

- (a) Construction wiring installed on any surface within 2.5 m of the floor or ground level.
- (b) Construction wiring installed on any surface and within 150 mm of, or attached to, scaffolding.
- (c) Construction wiring consisting of sub-mains and final sub-circuits located on formwork decks.
- (d) Construction wiring slung under a concrete ceiling slab more than 150 mm away from the juncture of the ceiling slab and a wall or beam that would otherwise provide protection.
- (e) Construction wiring installed within 150 mm of unearthed metal structures being installed as part of the construction process, e.g. sheet metal ducts and hydraulic piping.
- (f) Construction wiring installed across the top of transportable structures, storage containers, shipping containers or the like.
- (g) Construction wiring installed across or over metallic roofs or edges.
- (h) Construction wiring installed in adverse environments.

2.5.4 Marking

Construction wiring shall be readily distinguishable from permanent wiring by using cable sheaths of a different colour or by attaching iridescent yellow tape spaced at intervals not exceeding 5 m and marked with the words 'CONSTRUCTION WIRING'. If live permanent wiring is located where construction activity is occurring it, or its location, shall be marked with the words 'LIVE WIRING' at intervals not exceeding 5 m. Live permanent wiring shall be readily distinguishable from construction wiring.

NOTE: Unidentified wiring is deemed to be live.

2.5.5 Use of unarmoured cables

Unarmoured cables shall not be installed on metallic roofs or similar structures unless adequately protected against mechanical damage in accordance with the requirements of AS/NZS 3000.

2.5.6 Location and marking of overhead wiring (including aerial and catenary wiring)

Overhead wiring should be positioned to avoid crossing roadways or access ways where cranes, high loads or heavy machinery may travel.

Where it is not possible to avoid access ways, an effective means shall be provided to minimize the risk of vehicular contact with the overhead wiring system.

This condition may be satisfied by the placement of flagged catenary wires or cables of suitable material across the access way—

- (a) 6 m on either side of the overhead wiring; and
- (b) 0.6 m below the lowest point of the overhead electrical cables or lower.

2.5.7 Type of aerial conductor

All aerial conductors installed on construction and demolition sites shall be insulated.

NOTES:

- 1 Where underground or bare aerial conductors owned by the electricity distributor are located on or near the site it is recommended the electricity distributor be consulted about de-energizing, providing adequate safety clearances, or insulating the conductors, as applicable.
- 2 Local regulations may prohibit the use of aerial conductors in bushfire-prone areas.

2.5.8 Cables supported by a catenary

Cables supported by means of a catenary shall be stranded or flexible cables affording double insulation or the equivalent of double insulation.

Cables supported by a catenary shall maintain clearances in accordance with AS/NZS 3000.

NOTE: Local regulations may prohibit cables supported on catenaries in bushfire-prone areas.

2.6 FLEXIBLE CORDS, CORD EXTENSION SETS, FLEXIBLE CABLES AND ACCESSORIES

2.6.1 General

Clause 2.6 applies to the following:

- (a) Flexible cords.
 - Exception: This Clause does not apply to flexible cords that are—*
 - (i) *permanently attached to electrical equipment; or*
 - (ii) *5 m or less in length.*
- (b) Cord extension sets.
- (c) Flexible cables.
- (d) Accessories used to connect electrical equipment to switchboards.

Cord extension sets shall comply with AS/NZS 3199 except as modified by Clauses 2.6.2 to 2.6.9. All cords shall be wired identically.

2.6.2 Minimum conductor size and core configuration

The minimum cross-sectional area of each conductor in a flexible cord shall be 1.0 mm². Flexible cords shall contain an earthing conductor in addition to the live conductors.

2.6.3 Type of flexible cord and cable

Flexible cords used in cord extension sets shall be heavy-duty and sheathed. The flexible cord shall comply with AS/NZS 3191. Flexible cable shall comply with the AS/NZS 5000 series.

2.6.4 Colour

The sheath of a flexible cord shall not contain the colour green.

NOTE: This is to avoid potential confusion with individual earthing conductors.

2.6.5 Current-carrying capacity

Every conductor shall have a current-carrying capacity not less than the current it is expected to carry.

This current-carrying capacity shall be determined in accordance with—

- (a) in Australia, AS/NZS 3008.1.1; or
- (b) in New Zealand, AS/NZS 3008.1.2.

A

NZ

NOTE: AS/NZS 3000 gives details on simplified protective device selection.

2.6.6 Accessories for connection

Cord extension sets shall be fitted with the following accessories for connection:

- (a) A plug in accordance with—
 - (i) AS/NZS 3112;
 - (ii) AS/NZS 3123; or
 - (iii) IEC 60309-2.
- (b) A cord extension socket in accordance with—
 - (i) AS/NZS 3120;
 - (ii) AS/NZS 3123; or
 - (iii) IEC 60309-2.

Double adaptors and 3-pin plug adaptors (piggyback) or similar fittings shall not be used on construction and demolition sites.

2.6.7 Maximum length

The maximum length of a flexible cord, for a given conductor cross-sectional area, shall comply with Table 1.

TABLE 1
MAXIMUM LENGTHS OF FLEXIBLE CORDS AND FLEXIBLE CABLES

1	2	3	4	5	6
Rated current A	Conductor area mm ²	Maximum length of flexible cords and cables			
		General use (length based on 5% voltage drop at rated current)		Specific use for circuits where the safety of personnel utilising the equipment is dependent on the reliable starting of motors (length based on 3% voltage drop at rated current)	
		Single phase 3 core cable (L, N, E)	Three phase 4 core cable (L1, L2, L3, E)	Single phase 3 core cable (L, N, E)	Three phase 4 core cable (L1, L2, L3, E)
		m	m	m	m
10	1.0	25	50	15	30
	1.5	35	70	20	40
	2.5	60	120	35	70
	4.0	100	200	60	120
15/16	1.5	25	50	15	30
	2.5	40	80	25	50
	4.0	65	130	40	80
	6.0	100	200	60	120
	10.0	170	340	100	200
20	2.5	30	60	20	40
	4.0	50	100	30	60
	6.0	75	150	45	90
	10.0	130	260	75	150

NOTES:

- The lengths for 4 core cables above assume a balanced three phase load.
- Examples of equipment covered in Columns 3 and 4 are tools including saws, grinders and drills.
- Examples of equipment covered in Columns 5 and 6 are trailing cables for suspended scaffolds, swing stages and false cars.
- The percentage voltage drops given are in addition to the 5% maximum voltage drop allowed in the installation to the point of connection.

2.6.8 Limitations on the use of cord extension sets

Cord extension sets shall—

- (a) when used in multi-level buildings, be confined to the level of the switchboard from which they originate; and

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.

NOTE: Within each level, switchboards (or auxiliary socket-outlet panel boards) should be positioned to ensure that the maximum permitted length of flexible cords is not exceeded.

- (b) not be joined such that the total length of any such combination exceeds the relevant maximum value specified in Clause 2.6.7.

NOTE: It is recommended that a single cord extension set be used.

Flexible extension cords should not be used while in a coiled or reeled configuration.

2.6.9 Protection of flexible cords or cables

Flexible cords and cables shall not be subject to mechanical damage, damage by liquids or damage by high temperatures.

Where flexible cords or cables supplying electrical equipment are more than 4 m in length or are not in view of the personnel using the electrical equipment, they shall be—

- (a) provided with suitable protection against, or located where they are not subjected to, mechanical damage, damage by liquids or high temperature; or
- (b) supported off the floor or ground on stands or hangers covered with material that is non-conducting and will prevent mechanical damage to the cable.

2.6.10 Portable socket-outlet assemblies (PSOAs)

A PSOA, as defined in Clause 1.4.17, shall comply with the relevant requirements of AS/NZS 3190.

PSOAs shall incorporate the following features:

- (a) Class II (double insulated) construction.
- (b) Supplied by a flexible cord of the heavy-duty sheath type complying with AS/NZS 3191 with a maximum length of 2 m and fitted with a plug complying with AS/NZS 3112, AS/NZS 3123 or IEC 60309-2.
- (c) Incorporate overload protection by means of a miniature circuit breaker not exceeding the rating of the supply plug and flexible cord.
- (d) Protected by a RCD with maximum residual current of 30 mA that operates in all live (active and neutral) conductors.
- (e) Selected according to operating and geographical location to prevent the ingress of dust or moisture. The assembly shall be protected against mechanical damage and have a minimum IP rating of IP33.
- (f) Marked with the following words: 'Complies with AS/NZS 3190 and AS/NZS 3012'.
- (g) 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.
- (h) In New Zealand only, the RCD type shall be a type that provides protection against electric shock that complies with the requirements of a Type A RCD in accordance with IEC 61008-1 or IEC 61009-1. NZ

2.6.11 Auxiliary socket-outlet panels

Auxiliary socket-outlet panels shall be constructed to comply with the following general requirements:

- (a) The panel shall be—
 - (i) constructed with materials strong enough to withstand mechanical damage from the environment or other external influences that may be expected at the location;
 - (ii) located at a height of between 1.2 m to 2 m above the floor and mounted securely to a permanent structure or a temporary structure that has been specifically designed for the purpose;
 - (iii) provided with an isolating switch controlling the incoming supply, with the switch clearly marked to indicate its function unless the function of the switch is obvious;
 - (iv) supplied by a dedicated final sub-circuit protected at the switchboard where the final sub-circuit originates by an RCD, with a maximum rated residual current of 30 mA, that operates in all live (active and neutral conductors) in accordance with Clause 2.4.6.1, and a circuit-breaker in accordance with Clause 2.4.5.2;

- (v) provided with means to prevent mechanical damage to outgoing cables and relieve strain on plug and socket-outlet connections of flexible cords; and
NOTE: A typical means of achieving this is by providing a support (e.g. tie bar, hanger, cross arm or stand) covered with a non-conductive material to which the cables can be anchored.
- (vi) labelled in accordance with Clause 2.1.3 to indicate the source of supply.
- (b) The panel shall have a degree of protection appropriate for the environment in which it is installed subject to a minimum degree of protection IP23.
- (c) Socket-outlets mounted on the panel shall—
 - (i) comply with AS/NZS 3112, AS/NZS 3123 or IEC 60309-2;
 - (ii) be protected against damage by extended sides or covers; and
 - (iii) be rated at not less than 10 A and be individually controlled by a switch operating in all live (active and neutral) conductors.
- (d) The cable from the switchboard to the panel shall be construction wiring and be—
 - (i) a minimum cross-sectional area of 4 mm² for active and neutral conductors and corresponding 2.5 mm² earth conductors;
 - (ii) when used in multi-level buildings, confined to the level of the switchboard from which they originate, except in lift shafts, service shafts, mezzanine levels, stairwells, formwork or external staging;
 - (iii) in accordance with the AS/NZS 5000 series;
 - (iv) identified in accordance with Clause 2.5.4; and
 - (v) protected, where required, from mechanical damage in accordance with Clause 2.5.3.
- (e) In New Zealand only, the RCD type shall be a type that provides protection against electric shock that complies with the requirements of a Type A RCD in accordance with IEC 61008-1 or IEC 61009-1. NZ

2.6.12 Electrical portable outlet devices (EPODS)

Electrical portable outlet devices in accordance with AS/NZS 3105 (e.g. domestic type power boards) do not comply with the requirements of Clause 2.6.10 or Clause 2.6.11 and shall not be used on construction and demolition sites.

2.7 LIGHTING AND LUMINAIRES

2.7.1 General lighting

Minimum lighting levels should be 40 lx for walkways and 160 lx for general areas.

2.7.2 Mechanical protection

Lamps in luminaires shall be protected against mechanical damage.

2.7.3 Emergency lighting

2.7.3.1 General

Emergency lighting shall be provided in designated access and egress paths and directly above and in front of switchboards, on all demolition and construction sites where the general lighting requirements cannot be met using natural lighting. Such lighting shall allow safe access to and egress from the site. The emergency lighting shall provide the levels specified in Item (a) or Item (b) or Item (c) below.

Emergency lighting shall, in the required areas—

- (a) provide an average of 20 lx at 900 mm above floor level along the centre line of the corridor containing the emergency luminaires; or
- (b) be installed using luminaires complying with the luminaire classification, mounting height and spacing, as specified in Tables 2, 3, 4 and 5; or
- (c) be installed based on calculations of illuminance complying with the requirements of AS 2293.1 and using a minimum horizontal illuminance of 3 lx.

The emergency lighting level shall be provided for a minimum of 1 hour following loss of normal lighting in the area.

Where a circuit contains detachable connections for emergency lighting, those detachable connections shall prevent unauthorized disconnections (e.g. installation couplers).

NOTES:

- 1 Compliance using the spacing tables requires the selection of emergency luminaires classified from Class A to Class E in accordance with AS 2293.3. Manufacturer's information provides the classification which is then applied under the relevant installation mounting height to determine the maximum spacing between fittings. Typical examples are—
 - (a) 36 W T8 linear fluorescent wire guarded having a classification of D 40 (C_0 plane) mounted at 3 m would provide under Table 5 a spacing of up to 5.7 m;
 - (b) 28 W T5 linear fluorescent enclosed having a classification of D 25 (C_0 plane) mounted at 2.7 m would provide under Table 5 a spacing of up to 4.3 m; and
 - (c) 2×1 W LED circular having a classification of D 50 (C_0 and C_{90} plane) mounted at 3.6 m would provide under Table 5 a spacing of up to 6.6 m.
- 2 AS/NZS 2293 series specifies requirements for the design, installation and operation of emergency lighting including the testing and classification of emergency luminaires and exit signs.
- 3 AS/NZS 1680 series specifies requirements for the calculation or measurement of luminaire performance.

Internally illuminated emergency evacuation signage may be integrated into an existing lighting system provided that system of lighting incorporates battery backup light fittings capable of illuminating the exit signage and providing clear direction on the safe means of egress from the workplace in the event of power failure.

NOTE: AS/NZS 2293.1 and AS/NZS 2293.3 provide detailed information.

2.7.3.2 Verification

The emergency lighting level shall be verified by—

- (a) Clause 2.7.3.1(a)—measurement, using an appropriate light level meter; or
- (b) Clause 2.7.3.1(b)—installation of luminaire types complying with the luminaire classification, mounting height and spacing, as specified in Tables 2, 3, 4 and 5; or
- (c) Clause 2.7.3.1(c)—measurement, using an appropriate light level meter.

TABLE 2
MAXIMUM SPACINGS FOR CLASS A LUMINAIRES

Classification	Mounting height m															
	2.1	2.4	2.7	3	3.3	3.6	4	4.5	5	6	7	8	9	10	15	20
A 16	2.2															
A 20	2.5	2.4														
A 25	2.8	2.8	2.7													
A 32	3.1	3.2	3.2	3.1												
A 40	3.4	3.5	3.6	3.6	3.5	3.4										
A 50	3.7	3.8	3.9	4	4	4	3.8									
A 63	3.9	4.1	4.3	4.4	4.5	4.5	4.5	4.3								
A 80	4.2	4.5	4.7	4.8	5	5	5.1	5	4.9							
A 100	4.5	4.8	5	5.2	5.4	5.5	5.6	5.7	5.6							
A 125	4.8	5.1	5.4	5.6	5.8	6	6.2	6.3	6.4	6.2						
A 160	5.1	5.4	5.7	6	6.3	6.5	6.7	7	7.1	7.2	6.9					
A 200	5.3	5.7	6.1	6.4	6.7	7	7.3	7.6	7.8	8	8	7.7				
A 250	5.6	6.1	6.4	6.8	7.1	7.4	7.8	8.1	8.4	8.8	9	8.9	8.6			
A 320	5.9	6.4	6.8	7.2	7.6	7.9	8.3	8.8	9.1	9.7	10.1	10.2	10.1	9.8		
A 400	6.2	6.7	7.2	7.6	8	8.4	8.8	9.3	9.8	10.5	11	11.3	11.4	11.3		
A 500	6.5	7.1	7.5	8	8.4	8.9	9.4	9.9	10.4	11.3	11.9	12.4	12.7	12.8		
A 630	6.8	7.4	7.9	8.4	8.9	9.3	9.9	10.5	11.1	12.1	12.8	13.4	13.9	14.2		
A 800	7.1	7.8	8.3	8.9	9.4	9.9	10.5	11.1	11.8	12.9	13.8	14.6	15.2	15.6	15.8	

NOTES:

- 1 Maximum spacings for mounting heights between the values given in Table 2 may be obtained by interpolation.
- 2 Refer to AS 2293.3 for details regarding classification of luminaires.

TABLE 3
MAXIMUM SPACINGS FOR CLASS B LUMINAIRES

Classification	Mounting height m															
	2.1	2.4	2.7	3	3.3	3.6	4	4.5	5	6	7	8	9	10	15	20
B 16	2.4															
B 20	2.8	2.7														
B 25	3.1	3.1	3													
B 32	3.4	3.5	3.5	3.4												
B 40	3.8	3.9	3.9	3.9	3.8	3.7										
B 50	4.1	4.2	4.3	4.4	4.4	4.3	4.2									
B 63	4.4	4.6	4.8	4.9	4.9	4.9	4.9	4.7								
B 80	4.7	5	5.2	5.3	5.5	5.5	5.6	5.5	5.3							
B 100	5	5.3	5.6	5.8	6	6.1	6.2	6.2	6.2							
B 125	5.4	5.7	6	6.2	6.5	6.6	6.8	6.9	7	6.8						
B 160	5.7	6.1	6.4	6.7	7	7.2	7.5	7.7	7.8	7.9	7.6					
B 200	6.1	6.5	6.9	7.2	7.5	7.8	8.1	8.4	8.6	8.8	8.8	8.4				
B 250	6.4	6.9	7.3	7.6	8	8.3	8.7	9	9.3	9.7	9.9	9.8	9.3			
B 320	6.8	7.3	7.7	8.2	8.5	8.9	9.3	9.8	10.2	10.7	11.1	11.2	11.1	10.7		
B 400	7.1	7.7	8.2	8.6	9.1	9.4	9.9	10.5	10.9	11.6	12.1	12.4	12.5	12.4		
B 500	7.5	8.1	8.6	9.1	9.6	10	10.5	11.1	11.7	12.5	13.2	13.7	13.9	14		
B 630	7.9	8.5	9.1	9.6	10.1	10.6	11.2	11.8	12.4	13.5	14.3	14.9	15.3	15.6		
B 800	8.3	9	9.6	10.2	10.7	11.2	11.9	12.6	13.3	14.4	15.4	16.2	16.8	17.2	17.3	

NOTES:

- 1 Maximum spacings for mounting heights between the values given in Table 3 may be obtained by interpolation.
- 2 Refer to AS 2293.3 for details regarding classification of luminaires.

TABLE 4
MAXIMUM SPACINGS FOR CLASS C LUMINAIRES

Classification	Mounting height m															
	2.1	2.4	2.7	3	3.3	3.6	4	4.5	5	6	7	8	9	10	15	20
C 16	2.9															
C 20	3.3	3.2														
C 25	3.7	3.7	3.5													
C 32	4.2	4.2	4.2	4.1												
C 40	4.6	4.7	4.7	4.7	4.6	4.4										
C 50	5	5.2	5.3	5.3	5.2	5.2	4.9									
C 63	5.5	5.7	5.8	5.9	5.9	5.9	5.8	5.5								
C 80	5.9	6.2	6.4	6.5	6.6	6.7	6.7	6.6	6.3							
C 100	6.4	6.7	6.9	7.1	7.3	7.4	7.5	7.5	7.3							
C 125	6.8	7.2	7.5	7.7	8	8.1	8.3	8.4	8.4	8						
C 160	7.4	7.8	8.1	8.4	8.7	8.9	9.2	9.4	9.5	9.4	8.9					
C 200	7.9	8.3	8.7	9.1	9.4	9.7	10	10.3	10.5	10.6	10.4	9.9				
C 250	8.4	8.9	9.3	9.7	10.1	10.4	10.8	11.2	11.5	11.8	11.9	11.6	11			
C 320	9	9.5	10	10.5	10.9	11.3	11.7	12.2	12.6	13.1	13.4	13.4	13.2	12.6		
C 400	9.5	10.1	10.7	11.2	11.7	12.1	12.6	13.1	13.6	14.3	14.8	15	15	14.7		
C 500	10.1	10.8	11.4	11.9	12.4	12.9	13.5	14.1	14.7	15.5	16.2	16.6	16.8	16.8		
C 630	10.7	11.4	12.1	12.7	13.3	13.8	14.4	15.1	15.8	16.8	17.6	18.2	18.6	18.8		
C 800	11.4	12.2	12.9	13.5	14.2	14.7	15.4	16.2	17	18.2	19.2	20	20.6	21	20.5	

NOTES:

- 1 Maximum spacings for mounting heights between the values given in Table 4 may be obtained by interpolation.
- 2 Refer to AS 2293.3 for details regarding classification of luminaires.

TABLE 5
MAXIMUM SPACINGS FOR CLASS D LUMINAIRES

Classification	Mounting height m															
	2.1	2.4	2.7	3	3.3	3.6	4	4.5	5	6	7	8	9	10	15	20
D 16	3.5															
D 20	4.1	3.9														
D 25	4.6	4.5	4.3													
D 32	5.3	5.2	5.1	4.9												
D 40	5.9	5.9	5.9	5.7	5.5	5.3										
D 50	6.5	6.6	6.6	6.6	6.5	6.3	5.9									
D 63	7.2	7.3	7.4	7.4	7.4	7.3	7.1	6.6								
D 80	7.9	8.1	8.3	8.4	8.4	8.4	8.3	8	7.6							
D 100	8.7	8.9	9.1	9.3	9.3	9.4	9.4	9.2	9							
D 125	9.5	9.8	10	10.2	10.3	10.4	10.5	10.5	10.3	9.7						
D 160	10.4	10.7	11	11.3	11.5	11.6	11.8	11.9	11.9	11.5	10.8					
D 200	11.3	11.7	12	12.3	12.6	12.8	13	13.2	13.3	13.2	12.7	11.9				
D 250	11.5	12.7	13.1	13.4	13.7	14	14.3	14.6	14.7	14.9	14.7	14.1	13.3			
D 320	11.5	13.1	14.3	14.7	15.1	15.4	15.8	16.1	16.4	16.8	16.8	16.6	16	15.2		
D 400	11.5	13.1	14.8	16	16.4	16.8	17.2	17.7	18	18.6	18.8	18.8	18.5	18		
D 500	11.5	13.1	14.8	16.4	17.8	18.2	18.7	19.3	19.7	20.4	20.8	21	21	20.7		
D 630	11.5	13.1	14.8	16.4	18.1	19.7	20.4	21	21.6	22.5	23.1	23.4	23.6	23.6		
D 800	11.5	13.1	14.8	16.4	18.1	19.7	21.9	23	23.6	24.7	25.5	26.1	26.4	26.6	24.8	

NOTES:

- 1 Maximum spacings for mounting heights between the values given in Table 5 may be obtained by interpolation.
- 2 Refer to AS 2293.3 for details regarding classification of luminaires.

2.7.4 Hand-held luminaires

Hand-held luminaires shall comply with AS/NZS 60598.2.8.

2.7.5 Edison screw type lampholders

Where a neutral conductor is required for the connection of an Edison screw lampholder, that neutral conductor shall be connected to the outer contact.

2.7.6 Festoon lighting

Temporary protected lighting as defined in AS/NZS 60598.2.20 shall not be regarded as festoon lighting.

The following requirements apply to festoon lighting:

- (a) Festoon lampholders shall be permanently moulded to their supply cable. The lampholders shall be provided with a non-conductive mechanical guard for the lamp.
- (b) The maximum permitted operating voltages for festoon lighting are—
 - (i) in Australia, extra-low voltage, e.g. ≤ 50 V a.c.; or
 - (ii) in New Zealand, low voltage (e.g. 230 V a.c.), provided the circuit is protected by 30 mA RCDs, as specified in Clause 2.4.6.

A

NZ

- (c) Festoon lighting shall be supported at least 2.5 m above any floor, ground, platform or working area or be installed immediately below a ceiling.

Exception: This requirement need not apply in stairwells, lift shafts, and service shafts where support that prevents sagging of conductors shall be provided.

2.7.7 Portable luminaires

Portable luminaires shall be provided with the following:

- (a) A minimum degree of protection IP2X in accordance with AS 60529.
- (b) A mechanical guard for the lamp.
- (c) Adequate stability.

2.8 LIFT SHAFTS

2.8.1 General

Construction wiring dedicated to the installation of lift shaft equipment shall consist of a separate final sub-circuit protected in accordance with Clause 2.4.6.1.

Circuit breakers shall be locked and tagged to prevent inadvertent isolation of supply to the lift shaft by others on the site.

Lift shaft lighting shall be supplied from either construction wiring or permanent wiring and should comply with the following minimum requirements:

Luminaires should be—

- (a) at a minimum lighting level equivalent to that provided by a 36 W fluorescent and guarded against mechanical damage;
- (b) connected to supply via a plug and socket arrangement; and
- (c) installed at intervals not exceeding 6 m with the uppermost fixture installed within 1 m of the top of the lift shaft.

2.8.2 Multiple lift shafts

Where a lift shaft will contain more than one lift, the vertical space provided for one lift should be provided with effective illumination from the vertical space provided for the immediately adjacent lift.

2.8.3 Emergency lighting

Emergency lighting at a minimum level of 20 lx shall be provided for a minimum duration of 1 h following loss of normal lighting to allow safe egress from the lift shaft.

NOTE: AS/NZS 1680.0 may provide further guidance.

Emergency lighting shall be positioned so that personnel can exit at each egress point from the lift shaft.

2.8.4 False-car (guided work platform)

Where false-cars are installed for the purpose of the installation of lift shaft equipment, construction wiring for electrical supply to the false-car should comply with the following requirements:

- (a) Be supplied from a minimum 230 V, 20 A socket-outlet on a separate final sub-circuit protected by a 30 mA residual current device that operates in all live (active and neutral) conductors. The supply should be provided for the sole purpose of providing adequate power to the climbing hoist, including task lighting and power for the use of electrical tools when working from the false-car working platform.

- (b) The flexible cord or cable should be—
- (i) secured at the top of the lift shaft and at the point of attachment to the false-car by suitable means to prevent mechanical damage;
 - (ii) suspended in the lift shaft in a manner that will ensure adequate running clearance between the false-car and the lift shaft to prevent fouling or mechanical damage to the cord or cable; and
 - (iii) of sufficient length to allow for free travel of the false-car throughout the length of the lift shaft.

Electrical wiring providing supply to the false-car working platform shall be heavy-duty, double insulated, flexible cord or cable with a minimum conductor size of 4 mm².

2.9 TRANSPORTABLE STRUCTURES

Electrical installations of transportable structures and their site supplies shall comply with AS/NZS 3001 and the following:

- (a) Transportable structures shall be supplied by one of the following methods:
- (i) Sub-mains originating at a circuit-breaker on a switchboard and installed as construction wiring.
 - (ii) Final sub-circuits originating at a circuit-breaker on a switchboard and installed as construction wiring.
 - (iii) Flexible cord and plug connected to a final sub-circuit via a socket-outlet in accordance with the requirements of AS/NZS 3001 including—
 - (A) each socket-outlet shall have a degree of protection not less than IPX4, both when the plug is inserted and when it is not;
 - (B) each socket-outlet shall be individually protected by a circuit-breaker;
 - (C) the circuit-breaker shall not have a rating greater than that of the socket-outlet, except where a 16 A circuit-breaker is protecting a 15 A socket-outlet; and
 - (D) each socket-outlet shall be protected by an RCD with an operating current not exceeding 30 mA that operates in all live conductors (active and neutral).

NOTES:

- 1 A separate RCD should be provided for each socket-outlet to minimize the impact of the operation of a single RCD.
- 2 The requirements of Items (B), (C) and (D) may be combined into a single item by use of a RCBO.

In New Zealand only, the RCD type shall be a type that provides protection against electric shock that complies with the requirements of a Type A RCD in accordance with IEC 61008-1 or IEC 61009-1. NZ

Supply shall not be taken from a socket-outlet associated with one transportable structure to supply another transportable structure except where Item (e) applies.

- (b) Where supplied by flexible cord the minimum cross-sectional area of the flexible cord shall be 2.5 mm². The maximum length of flexible cord shall be 15 m.
- (c) Socket-outlets installed inside transportable structures shall—
 - (i) be protected by RCDs, with a maximum rated residual current of 30 mA, that operate in all live (active and neutral) conductors;

- (ii) be used only to supply electrical equipment and lighting within that transportable structure; and
 - (iii) in Australia, where the structure is supplied by flexible cord and plug, be controlled by switch operating in all live (active and neutral) conductors. A
- (d) Socket-outlets installed on the outside of transportable structures shall—
- (i) be protected by 30 mA RCD that operates in all live (active and neutral) conductors;
- Exceptions: This requirement need not apply to the following:*
- 1 Supply to other transportable structures as described in Clause 2.9(d)(iv).
 - 2 Sub-main (interconnecting cable) supply systems complying with Appendix I.
- (ii) be used only to supply electrical equipment and lighting located immediately adjacent to the structure;
 - (iii) be controlled by switches that operate in all live (active and neutral) conductors, where the structure is supplied by flexible cord and plug; and
 - (iv) only supply power to other transportable structures when the socket-outlet is part of an interconnecting system in accordance with Item (e) below.
- (e) All components of an interconnecting supply system for transportable structures shall be of equal or greater current carrying capacity than the protective devices that protect the interconnecting system at the point of connection to the supply.

NOTE: Overcurrent devices incorporated in the interconnecting system may be used to provide overcurrent protection to individual cables.

NOTE: In New Zealand, some caravans may include a link between neutral and earth. In order to avoid inappropriate operation of any upstream RCD, caravans that are fitted with such a link should be modified to comply with the requirements in AS/NZS 3001. NZ

SECTION 3 VERIFICATION

3.1 APPLICATION

This Section describes the verification (i.e. assessment, inspection and testing) procedures and frequency to be followed on all components of the electrical installations of construction and demolition sites. It applies to—

- (a) construction wiring;
- (b) switchboards;
- (c) RCDs and RCD type;
- (d) transportable structures;
- (e) the connection between generator windings and the equipotential bonding system on generators fitted with an RCD;
- (f) the connection between the frame and the equipotential bonding system of an isolated winding generator;
- (g) inverters; and
- (h) any other electrical equipment used on construction and demolition sites.

3.2 FREQUENCY OF VERIFICATION

The frequency of verification is determined by examination of the actual environment where the equipment is being used rather than the type of equipment in use. The frequency is based on the level of hazard/risk and the degree of misuse to which the equipment is exposed. This consideration should be based on the specific conditions immediately effecting the particular item of equipment and not on general site conditions.

NOTE: Regulatory authorities, other Standards, workplace safety requirements or manufacturer's instructions may specify shorter intervals appropriate to particular industries or specific types of equipment.

Construction wiring and electrical equipment shall be verified as follows:

- (a) *New equipment* Prior to the initial introduction into service.
- (b) *Repaired or serviced equipment* Prior to the return to service after a repair or servicing that could have affected the electrical safety.
- (c) *Hire equipment* Inspection prior to each hire and testing at not greater than monthly intervals. If hire equipment remains on site then Table 6 applies.
- (d) *All equipment* Intervals not exceeding those specified in Table 6.

TABLE 6
PERIODIC VERIFICATION INTERVALS

1	2	3	4	5	6	7
Environment	Transportable structures, Class I (earthed conductive parts) and Class II (doubled insulated) electrical equipment		Residual current devices (RCDs)			
	Transportable structures ¹ , fixed and transportable equipment ² and construction wiring ³ including switchboards	Portable equipment ⁴	Pushbutton test (by user)		Operating time (RCD tester)	
			Portable ⁵	Non-portable fixed ⁶	Portable ^{5,7}	Non-portable fixed ⁶
Construction and demolition sites in accordance with Clause 1.1	6 months	3 months	After connection to a socket or before connection of equipment, and at least once every day in use.	1 month	3 months	12 months

NOTES:

- 1 In New Zealand, verification intervals for transportable structures do not apply.
- 2 Transportable structures and fixed and transportable electrical equipment (see Clause 3.6).
- 3 Construction wiring including switchboards (see Clause 3.3).
- 4 Portable equipment—appliances, flexible cords, cord extension sets, PSOAs, generators, inverters, (see Clause 3.5) excluding hire equipment [see Clause 3.2(c)].
- 5 Portable RCD includes RCDs on portable equipment, or RCDs associated with portable generators (see Clause 3.5) or RCD protected inverters.
- 6 See Clause 3.5 for details of the required test.
- 7 Includes connection between generator winding and equipotential bonding system (see Clause 3.6).

NZ

3.3 CONSTRUCTION WIRING AND TRANSPORTABLE STRUCTURES

3.3.1 Initial verification

All construction wiring, including switchboards, fixed RCDs and transportable structures, shall be inspected and tested, by a qualified person to verify they are in accordance with AS/NZS 3000 following initial installation.

3.3.2 Periodic verification

Construction wiring (including switchboards and transportable structures) shall be visually inspected by a qualified person to verify compliance with AS/NZS 3000 for the installation at intervals not exceeding those specified in Table 6. RCDs shall be tested in accordance with Clause 3.4. Faults shall be rectified in accordance with Clause 3.7.1.

In New Zealand only, the low voltage installation of a construction and demolition site, including switchboards shall be assessed and RCDs shall be tested at the intervals specified in Table 6. A Record of Assessment in the form prescribed in Appendix G shall be completed after the periodic assessment detailed in this Clause.

NZ

Faults shall be rectified in accordance with Clause 3.7.1.

3.4 RCDS

RCDs shall be—

- (a) successfully operated by means of their in-built test facility (push-button); and
- (b) subject to and comply with a test for operating time of RCDs in accordance with AS/NZS 3760; and
- (c) tested by a competent person.

In New Zealand only, check that the RCD is labelled as a type providing protection against electric shock that complies with the requirements of a Type A RCD in accordance with IEC 61008-1 or IEC 61009-1. NZ

NOTES:

- 1 An RCD tester may be used for this test.
- 2 Fixed RCDs include switchboard types and socket-outlet types.
- 3 Portable RCDs include RCDs on portable equipment.

3.5 OTHER ELECTRICAL EQUIPMENT ON SITE

3.5.1 General

All other electrical equipment on site, including power tools, flexible cords, cord extension sets and portable socket-outlet assemblies, shall be tested by a competent person in accordance with Clauses 3.5.2 and 3.5.3, as appropriate, and inspected in accordance with the methods of AS/NZS 3760, before being put into service and thereafter at intervals not exceeding those listed in Table 6 of this Standard.

3.5.2 Protective earthing continuity

All Class I (earthed conductive parts) electrical equipment shall have the continuity of the protective earthing conductor from the plug earth pin or supply point to exposed conductive parts tested in accordance with the requirements of AS/NZS 3760.

The measured earthing conductor resistance values shall be less than the maximum values given in AS/NZS 3760.

NOTE: In accordance with AS/NZS 3760, equipment should not be dismantled to perform these tests.

3.5.3 Insulation resistance or leakage current

The insulation resistance or leakage current of Class I (earthed conductive parts) and Class II (double insulated) electrical equipment shall be tested in accordance with the method in AS/NZS 3760. The exception to the method in AS/NZS 3760 is for fixed equipment, where the insulation resistance shall be measured from the earth terminal of the equipment rather than the earth pin of a plug.

The insulation resistance values measured shall be not less than the minimum values given in AS/NZS 3760.

3.5.4 Arc welding equipment

Where arc welders are incorporated into generating sets, tests shall be conducted to ensure that the insulation resistances are not less than those given in Table 7.

TABLE 7
MINIMUM INSULATION RESISTANCE

Parts to be tested			Minimum insulation resistance MΩ
Input circuit (including control circuits connected to it)	to	Welding circuit (including control circuits connected to it)	5
All circuits	to	Exposed conductive parts	2.5
Welding circuit (including control circuits connected to it)	to	Any auxiliary circuit that operates at a voltage exceeding extra-low-voltage	10
Welding circuit (including control circuits connected to it)	to	Any auxiliary circuit that operates at a voltage not exceeding extra-low-voltage	1
Separate welding circuit	to	Separate welding circuit*	1

* In the case of multiple welding circuit outlets.

3.6 CONNECTION BETWEEN GENERATOR WINDINGS, FRAME AND EQUIPOTENTIAL BONDING SYSTEM

Connections shall be tested and verified as follows:

- Where an RCD is used with, or connected to, a generator, the integrity of the connection between the generator windings and the equipotential bonding system on the generator (see Figure 2.3) shall be verified in accordance with Appendix F Clause F2.3.1, by a competent person.
- Where, in accordance with Clause 2.4.6.3(a)(i), an isolated winding generator is used, the continuity of the connection from the frame to the equipotential bonding system (see Figure 2.2) shall be tested by a qualified person. The resistance of this connection shall be less than 1 Ω. In addition, the insulation resistance between the generator winding and the frame shall be greater than 1 MΩ.

3.7 ACTIONS RESULTING FROM INSPECTION AND TEST

3.7.1 Construction wiring

Where a visual inspection identifies damage or non-compliance with this Standard, that part of the installation shall be isolated, repaired or replaced and tested as required.

3.7.2 Non-compliant equipment

Where inspection or testing identifies equipment that fails to comply with the criteria given in this Standard, the equipment shall be—

- withdrawn from service immediately, have an out-of-service tag attached to it warning against further use; and
- sent for repair, disposal or destruction by an authorized repair agent or service personnel.

3.7.3 Compliant equipment

New equipment, after inspection and tests, shall be fitted with a durable, non-reusable, non-metallic tag. Construction wiring, switchboards, fixed RCDs, fixed and transportable electrical equipment need not be tagged.

Following periodic verification, compliant equipment shall be re-tagged. The items covered in Clause 3.3.2 need not be tagged.

The tag, which may be colour coded to identify the period in which the test was performed, shall include the—

- (a) name of the person who performed the tests; and
- (b) test and re-test dates.

NOTE: Appendix D gives a recommended colour coding schedule for tags on compliant equipment.

3.8 PORTABLE GENERATOR SETS AND INVERTERS

Electrical verification of portable generator sets shall be carried out in accordance with Appendix E.

Electrical verification of portable inverters shall be carried out in accordance with Appendix F.

3.9 DOCUMENTATION

Records of inspection and tests shall be kept, with the following information included as a minimum:

- (a) A register of all equipment.
- (b) A record of formal inspection and tests.
- (c) A register of repairs.
- (d) A record of all faulty equipment.
- (e) Records of construction wiring that include the following information as a minimum:
 - (i) Visual inspection—date, checklist (in accordance with AS/NZS 3000 checklist).
 - (ii) Continuity of earthing system—values obtained for main earth, bonding earth and protective earth.
 - (iii) Insulation resistance value.
 - (iv) Polarity—checklist.
 - (v) Correct circuit connections—checklist.
 - (vi) RCD—values for trip time.

NOTE: Electronic records are acceptable.

Where an item is not tagged, in accordance with Clause 3.7.3, records shall be available on site for audit or made available for audit on the next working day.

In addition, electrical regulators may require further documentation for compliance of the installation and electrical work.

NOTE: The existing state regulatory requirements for certification of electrical work may be used for the documentation required in Clause 3.9(e) subject to the recording of values. Copies of the certification are retained by the qualified person and the builder or owner/occupier.

APPENDIX A

ELECTRICAL INSTALLATIONS IN THE DOMESTIC HOUSING CONSTRUCTION INDUSTRY

(Normative)

A1 GENERAL

Conditions in the domestic housing construction industry differ to those experienced during commercial construction. This Appendix has been added to identify areas where this Standard may be modified for certain types of domestic housing construction.

These types of domestic housing construction are defined as one of the following:

- (a) In Australia only, refer to National Construction Code Classes 1, 2 and 10. A
- (b) In New Zealand only, refer to New Zealand Building Code, Clause A1 — Classified uses, Subclause 2.0 Housing, and Subclause 7.0 Outbuildings. Variations are listed in Clause A2, with any clarification or alternative arrangements. NZ

A2 SPECIFIC CLAUSE VARIATIONS

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 Section 2 of this Standard may be varied as listed below for the following clauses:

Clause	Variation
2.3.1.2	<p><i>Delete</i> text, including exception, and <i>replace</i> with the following:</p> <p>For domestic residences defined in Clause A1, the requirement of Clause 2.3.1.2 for a distribution switchboard on each level need not apply.</p> <p><i>Exception: This requirement need not apply to work in lift shafts, stairwells, service shafts, formwork, external staging or sub-mains of construction wiring.</i></p>
2.6.8	<p><i>Delete</i> text and <i>replace</i> with the following:</p> <p>Cord extension sets shall be as follows:</p> <ul style="list-style-type: none"> (a) For domestic residences defined in Clause A1, the cord extension sets shall be confined to not more than one level up or down from the level of the switchboard from which they originate and be mechanically protected in accordance with AS/NZS 3000 at the transition between levels and in places where damage is likely to occur. <p style="margin-left: 20px;">NOTE: Within each level, switchboards (or auxiliary socket-outlet panel boards) should be positioned to ensure that the maximum permitted length of flexible cords is not exceeded.</p> (b) Cord extension sets shall not be joined such that the total length of any such combination exceeds the relevant maximum value specified in Clause 2.6.7.

Flexible extension cords should not be used while in a coiled or reeled configuration.

APPENDIX B

VOID

This page is left blank intentionally.

APPENDIX C

MARKING OF SWITCHBOARDS TO INDICATE THE PRESENCE OF LIVE PARTS

(Normative)

Where access to live parts is required, a symbolic electric shock risk sign (see Figure C1) shall be displayed in locations where additional attention is required in the removal of covers, e.g. covers for switchboards or cable junctions.



FIGURE C1 ELECTRIC SHOCK RISK SIGN

In addition, a danger sign with an additional message (see Figure C2), e.g. indicating the presence of live parts within, shall be conspicuously displayed on the enclosure of the ASSEMBLY to alert personnel to the hazard.



FIGURE C2 DANGER SIGN WITH SPACE FOR ADDITIONAL MESSAGE

APPENDIX D
RECOMMENDED COLOURS FOR TAGS ON TESTED EQUIPMENT
(Informative)

This Appendix gives a recommended colour coding schedule for tags on tested equipment. The tag should indicate by its colour the period in which the test was performed in accordance with the following schedule:

- (a) *Red* December–February.
- (b) *Green* March–May.
- (c) *Blue* June–August.
- (d) *Yellow* September–November.

NOTES:

- 1 Some construction sites will not allow the use of equipment on site unless the tag colour readily indicates the required retest date in accordance with Table 6.
- 2 The colours shown above apply to 3-month requirements.

APPENDIX E

ELECTRICAL VERIFICATION OF GENERATORS WITH RCD PROTECTION
IN ACCORDANCE WITH AS/NZS 3012 AND AS/NZS 3760

(Normative)

E1 PRIOR TO INTRODUCTION TO SERVICE ON SITE AND AT INTERVALS IN ACCORDANCE WITH CLAUSE 3.2

Inspection shall be performed in accordance with the relevant requirements of AS/NZS 3760.

Testing of earth continuity and equipotential bonding shall be performed in accordance with AS/NZS 3760, with the generator not running. The resistance shall not exceed 1Ω from the socket E, to the stator, to the frame and to the socket N, with the RCD closed.

NOTE: Insulation resistance is not tested, due to the neutral-earth connection.

The RCD operation and correct connection shall be verified in accordance with Clause 3.4 and the relevant requirements of AS/NZS 3760 with the generator running. The following requirements shall be met:

- (a) When the test button is pushed, the RCD shall trip without undue delay.
- (b) When tested at 30 mA, the RCD shall trip within 300 ms.

E2 PRIOR TO EACH USE AND AT LEAST ONCE PER DAY

With the generator running, the test button shall be pushed and the RCD shall trip without delay.

APPENDIX F
ELECTRICAL VERIFICATION OF PORTABLE INVERTERS
(Normative)

F1 MARKING AND DOCUMENTATION

All inverters that meet AS/NZS 4763 requirements shall be marked to identify the applicable installation situation as follows:

- (a) Isolated inverters shall be identified by the words 'ISOLATED INVERTER' or with the diagram in Figure F1 placed on the inverter:

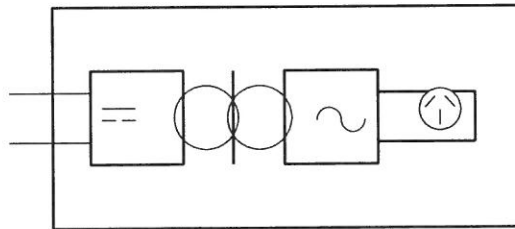


FIGURE F1 ISOLATED INVERTER

- (b) RCD protected inverters shall be identified by identification and documentation as follows:
- (i) RCD protected inverters shall be identified by the words 'RCDP INVERTER' or with the diagram in Figure F2 placed on the inverter:

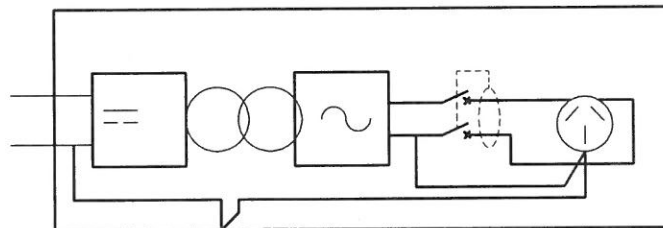


FIGURE F2 RCDP INVERTER

- (ii) Inverters retrofitted with an RCD shall have documentation verifying compliance with AS/NZS 4763 as follows:
- (A) *Clause 3.1.5* Bonding connections (see Clause F2).
- (B) *Clause 15.12* The RCD is integral (cannot be removed without the use of a tool) and the RCD has been tested for both a.c. and d.c. pulse residual current.
- (C) *Clause 16.10* In New Zealand only, the RCD type shall be a type that provides protection against electric shock that complies with the requirements of a Type A RCD in accordance with IEC 61008-1 or IEC 61009-1. NZ

F2 VERIFICATION OF INVERTER SEPARATION AND RCD OPERATION

F2.1 General

This Clause (F2) details tests for the verification of the electrical separation in isolated inverters and for verification of the bonding and RCD operation in RCD protected inverters.

All tests shall be performed prior to the introduction of all inverters into service and at intervals as specified in Clause F3.

F2.2 Electrical separation for isolated inverters

The inverter shall be connected to the rated supply voltage with no load and then with a load connected to the output circuit.

A true r.m.s. reading voltmeter, along with a parallel resistor, shall be connected from the battery negative terminal to each of the following:

- (a) The socket-outlet active contact.
- (b) The socket-outlet neutral contact.

The voltage shall not exceed 25 V.

NOTE: The parallel resistor is to ensure the voltages are from a source with a sufficiently low value of impedance that is capable of delivering a perception current to a person, e.g. in the range 1.5 k Ω to 15 k Ω .

F2.3 Bonding and RCD operation for RCD protected inverters

F2.3.1 Bonding test

The continuity shall be measured to ensure the battery negative, the inverter frame and the socket-outlet earth contact are connected together.

The value of resistance shall not exceed 1 Ω .

F2.3.2 RCD test

The inverter shall be connected to the rated supply voltage with no load and then with a load connected to the output circuit.

- (a) *Functional test with the RCD test button* The button is pushed to initiate a trip of the RCD. The RCD shall trip without delay. The test shall be repeated 5 times.
- (b) *Residual current rating* Operation at the rated residual current using a test resistor and verification that the neutral-earth (or centre tap) connection is upstream of the RCD.

A resistor in series with a switch is connected from the socket-outlet active terminal to the socket-outlet earth terminal. The RCD is closed and then the test switch is closed.

The RCD shall trip without delay. The test shall be repeated 5 times.

NOTES:

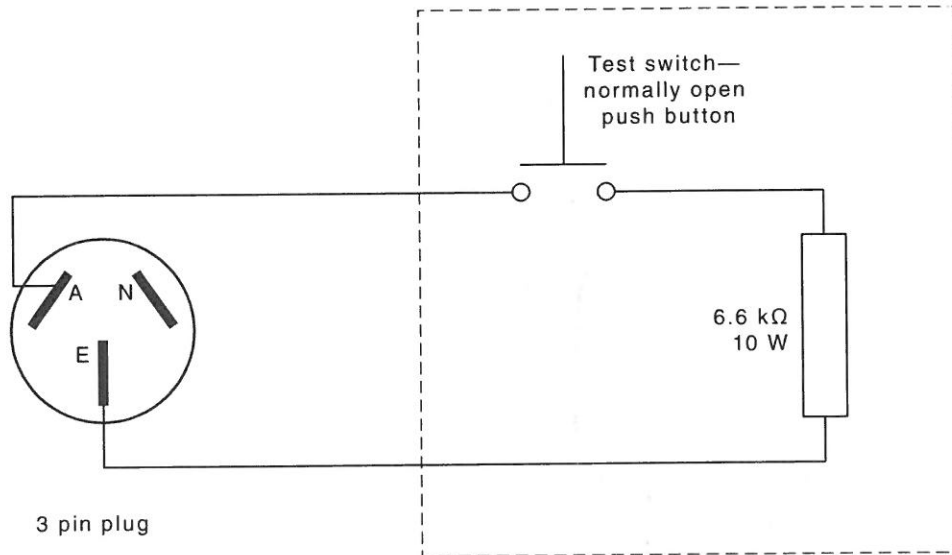
- 1 The resistor is sized to give the rated residual current. For example, with a 230 V true r.m.s. output with a rated residual current of 30 mA, the resistor should be 6.6 k Ω .
- 2 If an RCD tester is used it needs to be verified by the supplier as suitable for the output waveform of the inverter.

F3 PERIODIC TESTING INTERVALS

Testing intervals shall be in accordance with Clause 3.2 and Table 6.

Isolated inverters and equipotentially bonded inverters shall be tested at intervals as specified in Table 6 for Class II portable devices.

RCD protected inverters shall be tested at intervals as specified in Table 6 for portable RCDs.



If the test box is metallic it should be connected to earth

NOTE: The 6.6 kΩ, 10 W resistor consists of two 3.3 kΩ, 5 W resistors in series.

FIGURE F3 EXAMPLE OF RESIDUAL CURRENT TEST BOX
(RESISTOR SIZED FOR 230 V r.m.s.)

APPENDIX G

NEW ZEALAND ONLY ASSESSMENT FORM FOR CONSTRUCTION
AND DEMOLITION SITES

(Informative)

G1 ASSESSMENT

There are mandated requirements in the New Zealand *Electricity (Safety) Regulations 2010* for the assessment of construction and demolition sites at the intervals detailed in Table 6 to the requirements of AS/NZS 3000 and the additional requirements of AS/NZS 3012 (this Standard).

The New Zealand Electrical Workers Registration Board should be consulted for the competency requirements for those personnel carrying out inspections.

Distribution of completed assessment forms is detailed in the New Zealand *Electricity (Safety) Regulations 2010*.

This Appendix provides an example of a form for this assessment. This form may be copied for production of forms.

G2 ASSESSMENT FORM

The following page presents a record of assessment form, which is free of copyright and may be reproduced.

RECORD OF ASSESSMENT



Construction and demolition site details:

Client:

Location of construction or demolition site:
.....
.....

This Record of Assessment relates to the fixed installation and RCDs of the construction site/demolition site:

Items assessed:

.....
.....
.....

Defects:

.....
.....
.....
.....
.....

and as attached (..... pages attached)

Declaration:

I have carried out a periodic assessment of the above site in accordance with AS/NZS 3012 and

- I consider that the construction wiring assessed is suitable for continued use.
- The defects noted above should be remedied by the date(s) indicated.

Name of person who carried out inspection:

Registration type and number:

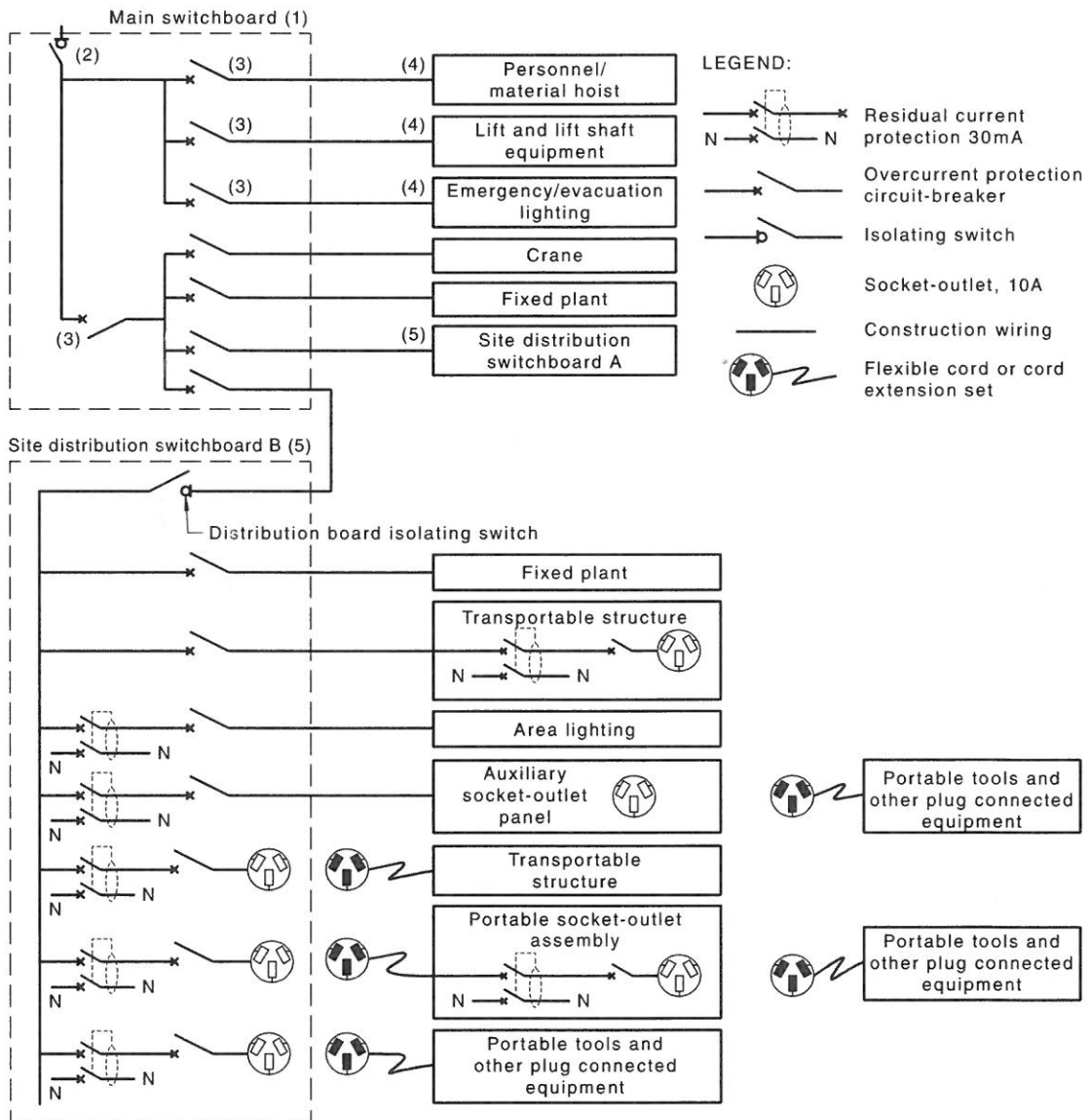
Signature:

Date: / /

NOTE: Periodic assessment must be carried out at intervals no greater than 6 months.

The next periodic assessment is required by: / /

APPENDIX H
GUIDE TO ARRANGEMENT OF SWITCHBOARDS, CONSTRUCTION WIRING
AND EQUIPMENT
 (Informative)



NOTES:

- 1 AS/NZS 3000 applies to safety services.
- 2 If safety services are supplied downstream of this switch, lock this switch in the ON position and mark it 'Isolating switch—operation by authorized persons only'. If there are no safety services, this is the main switch.
- 3 Main switch if switch (2) is not provided.
- 4 Final sub-circuits for safety services, where installed.
- 5 Only the main switchboard may supply safety services.
- 6 The numbers in parentheses in the figure [i.e. (1), (2), (3), (4), (5)] refer to the corresponding note numbers.

APPENDIX I

ASSEMBLIES FOR CONSTRUCTION SITES (ACS) FOR CONSTRUCTION
AND DEMOLITION SITES

(Normative)

11 SCOPE

This Appendix specifies additional requirements for the use of assemblies for construction sites (ACS) complying with AS/NZS 3439.4 or AS/NZS 61439.4 as an alternative supply system for construction and demolition sites.

This Appendix provides further information to supplement that covered in Clause 2.3.2.2.

NOTE: This Appendix uses the AS/NZS 3439.4 or AS/NZS 61439.4 term 'assemblies for construction sites'.

12 SUPPLY SYSTEM—INSTALLATION AND VERIFICATION

The following personnel shall be required for the installation and verification of supply systems:

- (a) Australia and New Zealand require a qualified person for the installation and verification of direct connected sub-mains and equipment.
- (b) Australia requires a qualified person for the installation and verification of sub-mains (interconnecting cable) for plug and socket connected ACSs. A
- (c) New Zealand requires a competent person for the installation and verification of sub-mains (interconnecting cable) for plug and socket connected ACSs. NZ

13 GENERAL REQUIREMENTS AND FUNCTIONS OF ASSEMBLIES FOR CONSTRUCTION SITES (ACS)**13.1 General**

All ACS shall comply with the requirements of AS/NZS 3439.4 or AS/NZS 61439.4 and the relevant requirements of this Standard.

13.2 ACS description

An ACS system consisting of an incoming ACS unit and several outgoing ACS units is shown in Figure I1. Safety services for ACS systems shall be installed to the requirements of AS/NZS 3000.

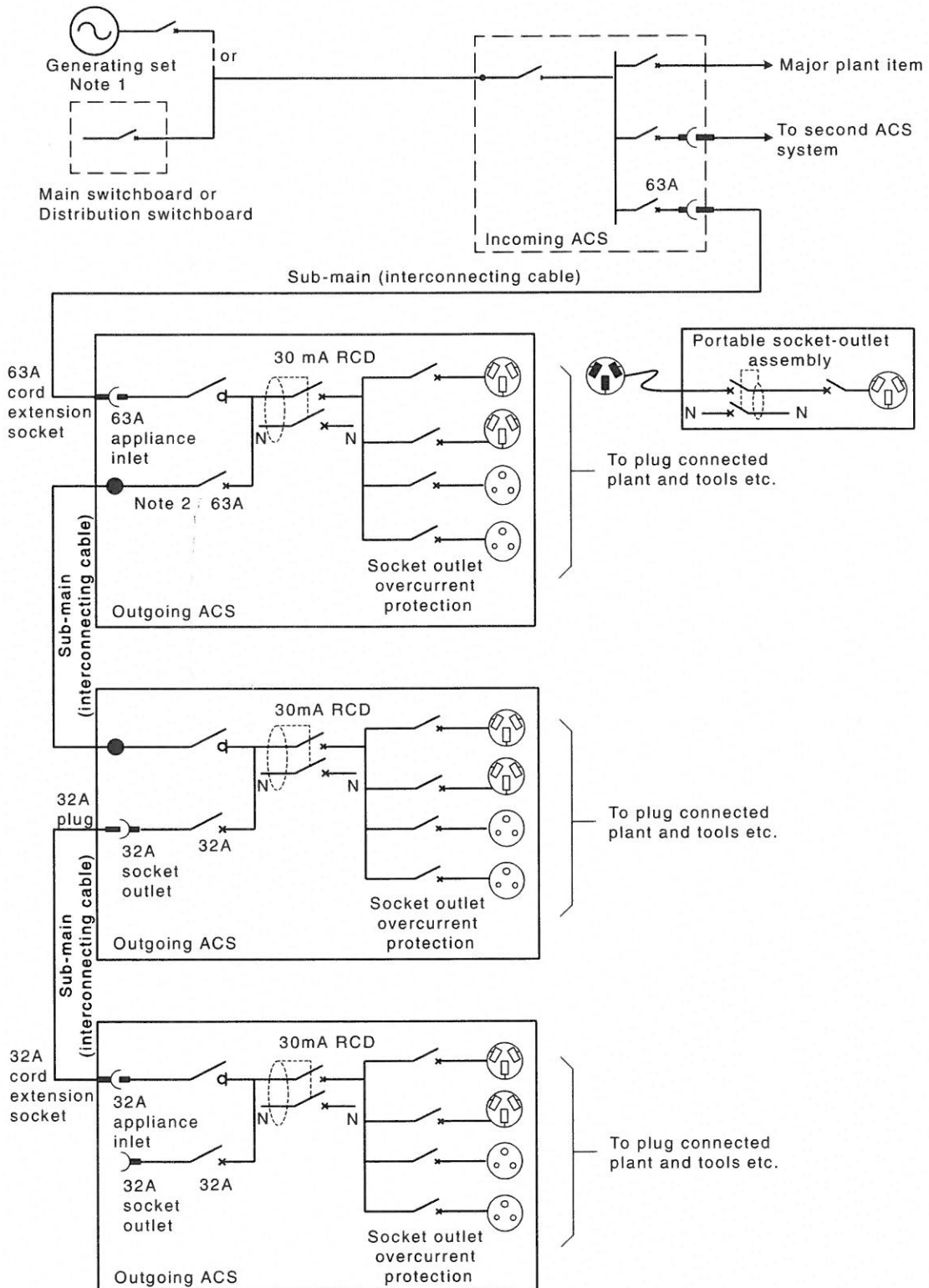
The interconnecting cables shall be classified as sub-mains and may use direct or detachable connections. The circuits within the units supplying socket-outlets and/or major items of plant shall be classified as final sub-circuits.

Incoming and outgoing ACS units may incorporate additional units such as—

- (a) metering units;
- (b) transformer units with low voltage to extra low voltage (LV/ELV) transformers to provide SELV or PELV supplies; and
- (c) transformer units with low voltage to low voltage (LV/LV) transformers to provide separated (isolated) LV supplies.

An outgoing ACS unit may provide a supply to—

- (i) other ACS outgoing units;
- (ii) lighting;
- (iii) machines or electric tools; or
- (iv) other construction site equipment.



NOTES:

- 1 A generator set shall have the alternator star point connection bonded to the equipotential earthing system of ACS assemblies to ensure correct RCD operation.
- 2 This connection is shown as a direct connection for explanatory purposes only, see Clause I5 for details.

FIGURE I1 ARRANGEMENT OF SWITCHBOARDS, USING ASSEMBLIES FOR CONSTRUCTION SITES (ACS) COMPLYING WITH AS/NZS 3439.4 OR AS/NZS 61439.4

13.3 ACS installation system

A number of compatible ACS assemblies may be interconnected to form a complete installation, or part of an installation. ACS assemblies shall provide basic protection (protection against direct contact) from electric shock and, where possible, discrimination by suitable selection of protective devices, e.g. the breaking capacity, current rating and operating time under fault conditions.

In Australia only, on the incoming supply function unit for each level of a multi-level construction the detachable incoming supply connections (both ends) shall be fitted with a device requiring a key or tool for disconnection (detachment) and all other ACS units connected to this unit shall be limited to that level. A

Exception: This requirement need not apply to work in lift shafts, stairwells, service shafts, formwork or external staging.

13.4 Assembly characteristics

The various assembly characteristics shall be determined by taking into account the nature of supply and/or distribution network and relevant installation requirements. The details may be the subject of an agreement between manufacturer and user. A single ACS assembly may incorporate a number of functions.

14 GENERAL CLASSIFICATION OF ACS ASSEMBLIES

14.1 Transportable ACS unit

Transportable ACS assemblies are intended for use in a place where they are not permanently fixed and the location may vary during work on the site. When the transportable ACS is to be moved to another location, it shall be disconnected from the supply.

14.2 Mobile ACS unit

Mobile ACS assemblies are capable of being moved as work advances on the site. These may not require disconnection from the supply when being relocated.

14.3 Incoming ACS unit

Incoming ACS assemblies shall be as follows:

- (a) The cable connection facilities, terminals, connecting devices, connectors, or plug and socket-outlet accessories shall be compatible with the current rating of the ACS assembly.
- (b) Incoming and outgoing isolating and over-current protective devices shall be provided. There shall be means for securing these devices in the open position. The protection shall be sized to ensure that, with the maximum earth fault loop impedance to a socket-outlet on the most distant ACS, automatic disconnection of supply occurs within 400 ms in accordance with AS/NZS 3000, i.e. fault protection is ensured.
- (c) The cabling to an incoming ACS shall be by direct connection.
- (d) The connection to major items of plant shall be by direct connection from an incoming ACS unit.

NOTE: The incoming ACS assembly is typically a transportable ACS unit.

14.4 Metering ACS unit

Metering ACS assemblies shall be as follows:

- (a) The metering ACS assembly shall be designed by or in agreement with the electricity distributor requirements if it is intended to use the metering device(s) to measure the energy consumed for the purposes of payment for the energy consumed.

- (b) The sub-main cabling to a metering ACS shall be by direct connection.

NOTE: The metering ACS assembly is typically a transportable ACS unit.

I4.5 Transformer ACS unit

I4.5.1 General

The transformer ACS unit shall include a low-voltage to extra low-voltage (LV/ELV) transformer and/or a low-voltage to low-voltage transformer (LV/LV).

I4.5.2 LV/ELV ACS unit

LV/ELV ACS assemblies shall be as follows:

- (a) The LV/ELV ACS unit shall provide either a SELV or PELV supply complying with AS/NZS 3000 requirements.
- (b) Each LV/ELV ACS unit shall consist of—
- (i) the protective and control devices in the transformer primary circuit;
 - (ii) a ELV safety transformer complying with the requirements of AS/NZS 61558.2.23; and
 - (iii) the protective devices, control switches and connection methods required for the ELV output circuits as specified in AS/NZS 3000.

NOTE: The LV/ELV ACS unit is typically a mobile ACS unit.

I4.5.3 LV/LV ACS unit

LV/LV ACS assemblies shall be as follows:

- (a) The LV/LV ACS unit shall provide a separated (isolated) LV supply complying with AS/NZS 3000 requirements.
- (b) Each LV/LV ACS unit shall consist of—
- (i) the protective and control devices on the transformer primary circuit;
 - (ii) an LV/LV transformer, which shall be an isolating transformer complying with AS/NZS 61558.2.23; and
 - (iii) the protective and control devices for the output circuit(s) and socket-outlets shall be to AS/NZS 3000 requirements.
- (c) The equipotential bonding of socket-outlet earth connections supplied by a common isolating transformer secondary winding shall be in accordance with AS/NZS 3000 requirements.

NOTE: The LV/LV ACS unit is typically a mobile ACS unit.

I4.5.4 Outgoing ACS unit

Outgoing ACS assemblies shall be as follows:

- (a) The outgoing ACS unit shall consist of one incoming and a number of outgoing circuits.
- (b) There shall be over-current protection, suitable for isolation, for the incoming and outgoing supply.

Exception: The incoming over-current protection may be omitted if the ACS assembly is directly connected to an upstream ACS assembly that is able to provide the overcurrent protection required for the downstream ACS assembly. However, a load break isolator on the incoming supply is still required.

- (c) The input isolation switch device shall be easily accessible without the use of a key or tool.

- (d) The input isolation switch shall operate simultaneously on all poles and switch all active conductors.
- (e) Additional protection of final sub-circuits shall comply with Clauses 2.3.6 and 2.9.

NOTES:

- 1 To avoid unwanted tripping because of leakage currents and transient disturbances, care should be taken to ensure the sum of the leakage currents of electrical equipment on the load side of an RCD is significantly less than its rated residual current. RCDs may operate at any value of residual current in excess of 50% of the rated residual current.

The loading of the circuit should be such that the leakage current does not exceed one third of the tripping current.

- 2 To avoid excessive leakage current causing unwanted tripping where socket-outlets are protected by one RCD having a rated residual current not greater than 30 mA, consideration should be given to the number of socket-outlets protected and the nature of electrical equipment likely to be connected to the socket-outlets.
- 3 Where RCDs are used, consideration should be given to the nature of the load, e.g. the supply waveform shape and the presence of high frequency and/or d.c. components for the selection of the correct type of RCD.

- (f) In New Zealand only, all RCDs shall be a type that provides protection against electric shock that complies with the requirements of a Type A RCD in accordance with IEC 61008-1 or IEC 61009-1. NZ

- (g) Final sub-circuits supplying socket-outlets shall be provided with overcurrent protection rated suitable for that final sub-circuit.

NOTES:

- 1 An overcurrent protective device may protect more than one socket-outlet.
- 2 Consideration should be given to effects of unintended tripping, when an overcurrent protective device protects multiple socket-outlets.
- 3 The outgoing ACS unit is typically a mobile ACS unit.

15 INTERCONNECTING CABLES

15.1 General

The sub-mains (interconnecting cables) of an ACS system are construction wiring and the requirements of Clause 2.5.3 for the provision of additional mechanical protection shall apply.

In addition, detachable sub-mains (interconnecting cables) of an ACS system shall also be screened cables, with the screen being earthed.

NOTE: This provides protection against physical mechanical damage from sharp objects, or in the case of the interconnecting cable being mechanically damaged by crushing or being cut, provides additional protection by the automatic disconnection of the supply by operation of the protective device protecting the cable.

15.2 Connections

Direct or detachable connections may be used for sub-mains (interconnecting cables) (see Clause I2).

15.3 Detachable sub-main, plugs, cord connectors and appliance inlets

Detachable sub-main plugs, cord connectors and appliance inlets shall comply with IEC 60309-2 or AS/NZS 3123.

NOTE: The relevant Standard may be agreed by the manufacturer and the user.

Devices for interconnection of sub-mains shall be rated at 32 A or above and be designed to prevent inadvertent disconnection under load.

15.4 Distinction of sub-main sockets from other socket-outlets

The use of plug and socket-outlet systems commonly used on the site to supply electrical equipment shall not be used for the detachable connection of sub-mains.

15.5 Overcurrent protection socket-outlets for detachable sub-mains

All socket-outlets used for the connection of detachable sub-mains shall be provided with overcurrent protection rated at equal to or less than the rating of the socket-outlets.

15.6 Labelling

Fixed socket-outlets or cord extension sockets used for interconnecting cabling systems shall be identified as construction wiring and not suitable for electrical supply to hand-held tools. The ACS units shall be clearly marked with instructions to isolate the unit before connection or disconnection of the sub-mains.

16 INSTALLATION OF ACS ASSEMBLIES

16.1 General

All ACS assemblies shall comply with Clause 2.3 and other requirements in relevant Standards. Detachable interconnecting cables shall be earth screened or armoured cables.

16.2 Openings

Openings in ACS assemblies for cable entries, cover plates, etc. shall be such that, when the interconnecting cables, including their anchoring devices, are properly installed, the protective measures against contact with live parts and stated degree of IP protection is maintained.

16.3 Interconnecting cables

Interconnecting cables shall be installed and protected to comply with Clause 2.5.

16.4 Strain relief

Cables to and from ACS assemblies and connection facilities shall be restrained to prevent undue stress on the interconnecting cable connections (see Clause 2.3.5).

17 INITIAL AND PERIODIC VERIFICATION

17.1 Initial verification

All ACS units and the detachable sub-main cabling systems, including fittings (if provided) shall be inspected, tested and tagged prior to use in accordance with Section 3 of this Standard.

Following completion of the assembly of the ACS system, the requirements for initial verification of construction wiring in Section 3 of this Standard shall apply.

17.2 Periodic verification

The requirements of Section 3 for periodic verification shall apply.

APPENDIX J
 CONSTRUCTION POWER SUPPLY ARRANGEMENTS FOR DOMESTIC
 HOUSING SITES
 (NEW ZEALAND ONLY)
 (Normative)

NZ

J1 SCOPE

In New Zealand only, this Appendix gives additional requirements and information for the provision of construction power supply arrangements at low voltage, 32 A maximum single phase, for domestic housing sites (as specified in Appendix C), where an electricity supply and switchboard are installed specifically for the duration of the domestic housing construction period.

NOTE: This was previously known as 'builder's temporary supply' or 'builder's box'.

J2 SUPPLY ARRANGEMENTS

The construction power supply arrangement through a site switchboard shall be by one of the following:

- (a) Supply by an underground cable from the electricity distributor's supply pillar.
- (b) Supply by an overhead aerial cable from the electricity distributor's aerial distribution system.

Exceptions:

- 1 *If the power supply for the construction power supply is to be obtained from an existing electrical installation the requirements of Clause J2(a) and (b) do not apply.
The requirements of Clause 2.4.6.2 apply.*
- 2 *If the power supply for the construction period is to be obtained by plug and socket outlet connection(s) on a generating set(s), the requirements of Clause J2(a) and (b) do not apply.
The requirements of Clause 2.4.6.3 and Appendix B of AS/NZS 3010:2017 apply.*
- 3 *If the power supply for the construction period is to be obtained by plug and socket outlet connection(s) on inverter(s), the requirements of Clause J2(a) and (b) do not apply.
The requirements of Clause 2.4.6.4 and AS/NZS 4763 apply.*

J3 CONNECTION REQUIREMENTS

The construction power supply switchboard shall be provided within the site boundary and in accordance with Clause 2.3. Additionally, the construction power supply switchboard shall provide all of the following:

NOTES:

- 1 The requirement of the switchboard within the site boundary is to prevent extension cords to the building site from crossing road reserve.
- 2 A typical arrangement for a small construction switchboard is shown in Figure J4.

- (a) The system of supply shall be TN-C-S (MEN) single phase.
- (b) The provision of a 16 A socket outlet complying with IEC 60309-2 for the connection and supply of a transportable structure (connectable installation in New Zealand) shall be optional.
- (c) All socket outlets shall be protected by an RCD with a residual current rating not exceeding 30 mA which shall be of a type that provides protection against electric shock that complies with the requirements of a Type A RCD in accordance with IEC 61008-1 or IEC 61009-1.
- (d) The construction power supply switchboard, main earth electrode and earthing connections shall be in accordance with the requirements of AS/NZS 3000 Section 5.
- (e) The construction power supply switchboard main switch shall comply with Clause 2.4.1.
- (f) The overcurrent protection shall comply with Clause 2.4.5.
- (g) Any unused conductors present within the switchboard shall be terminated in accordance with the requirements of AS/NZS 3000 Section 1.

NOTE: Typical electrical arrangements are shown in Figure J1.

Examples of unused conductors are where single phase or three-phase consumer mains cable is used for supply to a construction switchboard or pilot wires intended for later use for controlled supplies.

- (h) The switchboard enclosure shall be securely fixed to a vertical pole at a minimum distance of 1200 mm from the ground to the bottom of the switchboard.
- (i) The switchboard mounting pole shall be rigidly maintained in a vertical position by use of a minimum of two stays.
NOTE: Refer to Section J7 for additional information on site specific requirements of switchboard mounting poles.
- (j) Adequate mechanical protection shall be provided for all installation wiring fixed to the switchboard pole by use of heavy duty PVC conduit complying with AS/NZS 2053 or AS/NZS 61386 or other relevant Standards. Adequate ultraviolet protection shall be provided for the PVC conduit requirements of AS/NZS 3000 Section 3.

J4 SUPPLY CABLING REQUIREMENTS

J4.1 Underground supply

The underground consumer mains cable shall be installed to the applicable underground cables requirements of AS/NZS 3000 Section 3.

Any proposed earthworks shall be taken into account during the building and development of the building site. Where necessary, an increased depth of cable burial or additional mechanical protection shall be provided.

NOTE: Refer to Clause J7 and Figure J2 for details of the installation requirements for the switchboard pole and supporting stays.

J4.2 Overhead supply

The aerial consumer mains cable shall be installed to the applicable aerial cables requirements of AS/NZS 3000 Section 3.

Attention is drawn to the increased clearances required for overhead lines where motor vehicles and construction equipment can be reasonably expected to be driven or transported under.

To provide maximum shock and mechanical protection, the aerial cable should be a neutral screened cable.

Any proposed earthworks shall be taken into account during the building and development of the building site. Where necessary, an increase in the aerial cable clearance shall be provided.

NOTE: See Clause J7 and Figure J3 for details of the installation requirements for the switchboard pole and supporting stays and provisions required for making off of the aerial cable.

J5 SYSTEMS USING THE PERMANENT INSTALLATION SUPPLY CONNECTION AND SWITCHBOARD

J5.1 Supply connection

J5.1.1 *Use of permanent consumer mains cable*

Due to the configuration of the electricity distributor's supply network, the initial supply connection to the site may be carried out using the permanent consumer mains cable whether by underground or aerial cabling.

J5.1.2 *Underground cables*

Permanently connected consumer mains cables by underground cables, shall take into account any proposed earthworks during the building and development of the building site. If necessary, an increased depth of cable burial or additional mechanical protection may be required.

J5.1.3 *Aerial cables*

If the permanent connection consumer mains cabling is by the use of aerial cables, the use of an interim pole may be necessary for making off the aerial cables until the building structure is available to provide the aerial cable point of attachment. The construction switchboard may be mounted on the interim pole if required.

J5.2 Switchboard

J5.2.1 *Permanent switchboard or construction switchboard*

The switchboard for use during the construction phase may be the permanent switchboard for the electrical installation and comply with the applicable requirements for switchboards in AS/NZS 3000 Section 2.

Alternatively, a construction switchboard as detailed in Clause J3 may be provided.

J5.2.2 *Permanent switchboard arrangements*

The requirements of Clause J3 shall apply to permanent switchboard arrangements, with the exception of Clause J3(e), (i) and (j) which are modified by the following:

- (a) The permanent switchboard enclosure shall be mounted and fixed to a rigid removable framework in an adjacent position until the permanent building structure can be used as the permanent location of the main switchboard in the electrical installation. The switchboard enclosure shall provide a minimum degree of protection to AS 60529 of IPX23.
- (b) The consumer mains and main earth electrode cabling, including excess cabling, from the underground cable trench to the switchboard shall be provided with adequate mechanical protection.
- (c) Where applicable, the two socket outlets initially required for building operations may be mounted externally to the switchboard enclosure and shall be weatherproof types with a minimum degree of protection to AS 60529 of IP34.

- (d) Where the socket outlets initially required for building operations are mounted internally to the switchboard enclosure, additional mechanical protection shall be provided to prevent damage to the flexible cords connected to the internal socket outlets. The switchboard cover shall remain closed at all times.
- (e) A strain relief bar for flexible cords shall be provided adjacent to the socket outlets whichever arrangement is used.
- (f) When the switchboard enclosure is transferred to the permanent location of the main switchboard in the electrical installation, the sealing of the switchboard enclosure to the building structure shall be to the New Zealand Building Code requirements.

J6 PERIODIC VERIFICATION

J6.1 Intervals

Each switchboard shall receive periodic verification at intervals no greater than six months in accordance with Clause 3.3.2 and Table 7.

J6.2 RCD testing

Fixed-wired RCDs shall be tested at least every month (push-button test) and every 12 months (trip time test) with a purpose made tester.

The construction switchboard should be labelled with the date by which the next verification is due, with provision to record the monthly RCD test dates.

A label should be fixed adjacent to the RCDs with the following wording:

TEST RCDS BEFORE EACH USE AND MONTHLY USING THE TEST BUTTON ON RCBO.

J7 SWITCHBOARD POLE STAYS AND FIXINGS

J7.1 Typical material

Table J1 gives typical material for switchboard pole, stays and fixings.

TABLE J1
TYPICAL SWITCHBOARD POLE, STAY AND FIXING DETAILS

Dimensions in millimetres				
Application	Length of pole	Pole material	Stay material	Peg material
Underground cable mains	3000	100 × 100; or two 100 × 50 spiked together Radiata pine H3 or H4 treated 1 required	100 × 50 Length 3000 Radiata pine H3 or H4 treated 2 required	100 × 50; Length 400 Radiata pine H3 or H4 treated, or, 25 × 25 × 5 angle iron 400 long 2 required
Overhead aerial cable mains	5000	100 × 100; or two 100 × 50 spiked together Radiata pine H3 or H4 treated 1 required	100 × 50 Length 5000 Radiata pine H3 or H4 treated 2 required	100 × 50; Length 400 Radiata pine H3 or H4 treated, or, 25 × 25 × 5 angle iron, 400 long 2 required

NOTES:

- 1 The top ends of the stays to be fixed to the switchboard pole by 10 bolts or coach screws.
- 2 The bottom end of the stays to be fixed to pegs driven into the ground by 10 bolts or coach screws.

J7.2 Switchboard supplied by underground consumer mains

The stays on the 3.0 m switchboard pole shall be positioned behind the switchboard at the top of the pole and the ground with a second stay at 90°.

All woodwork shall be painted with a light colour or fit a barrier for personal tripping protection purposes.

J7.3 Switchboard supplied by overhead consumer mains**J7.3.1 Overhead cable tension**

Both stays on the 5.0 m pole shall be fixed at 1.0 m from the top of the pole and form an angle of 60° (approximately) and positioned so the stays are in tension, which is the opposite side of the pole to the pull from neutral screen consumer mains cable.

Tall woodwork shall be painted with a light colour or fit a barrier for personal tripping protection purposes.

J7.3.2 Aerial cable terminations

A shackle and insulator shall be provided at the top of the pole for the attachment of the consumer mains cable. A mains entry box shall be provided for the electrical termination of the aerial cable.

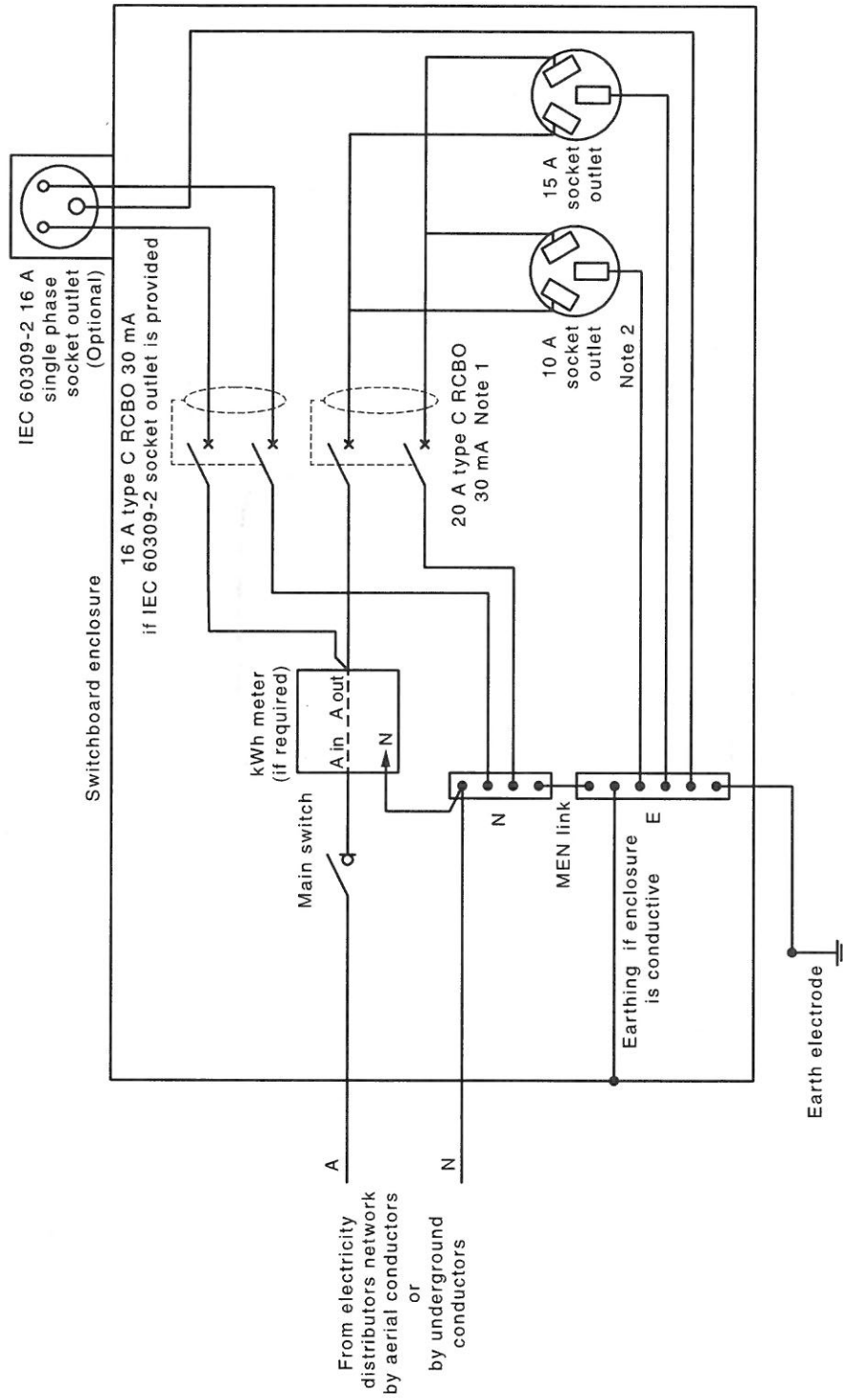
J7.3.3 Aerial cable route

The aerial cable route shall comply with the requirements of AS/NZS 3000 Section 3.

J7.3.4 Overhead cable strain

The switchboard pole stays shall be placed to provide adequate strain fixing to restrain the forces from the incoming aerial supply cable.

NOTE: Typical arrangements of strain fixing stays are shown in Figure J3.



NOTES:

- 1 If additional socket outlets are required, provide additional RCBO and socket outlets.
- 2 One or both socket outlets are required to be 15 A rating.

FIGURE J1 TYPICAL SINGLE-PHASE CONSTRUCTION SWITCHBOARD—UNDERGROUND OR AERIAL SUPPLY CIRCUIT DIAGRAM

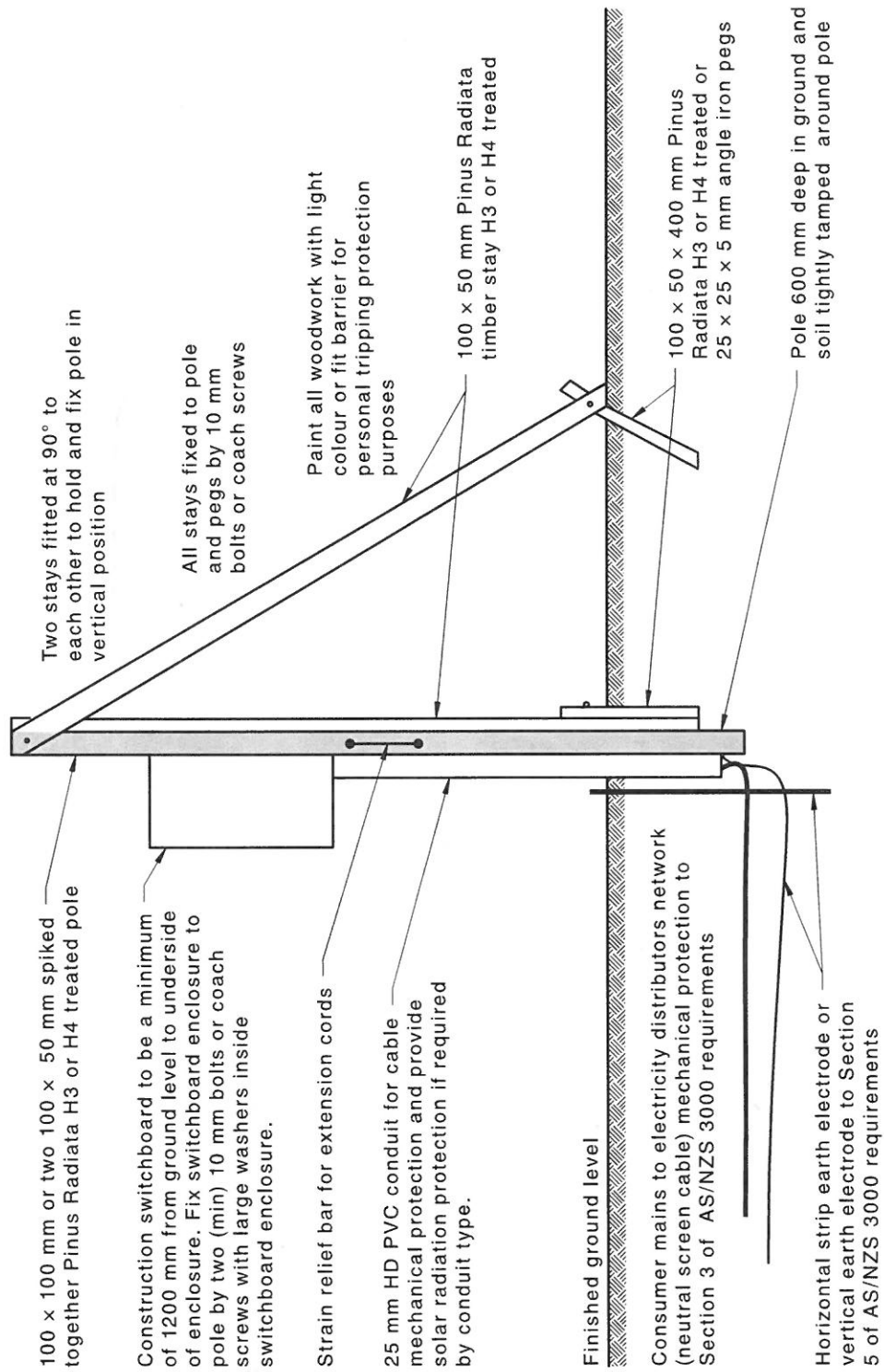


FIGURE J2 TYPICAL CONSTRUCTION SWITCHBOARD MOUNTING ARRANGEMENT WITH UNDERGROUND SUPPLY CONNECTION

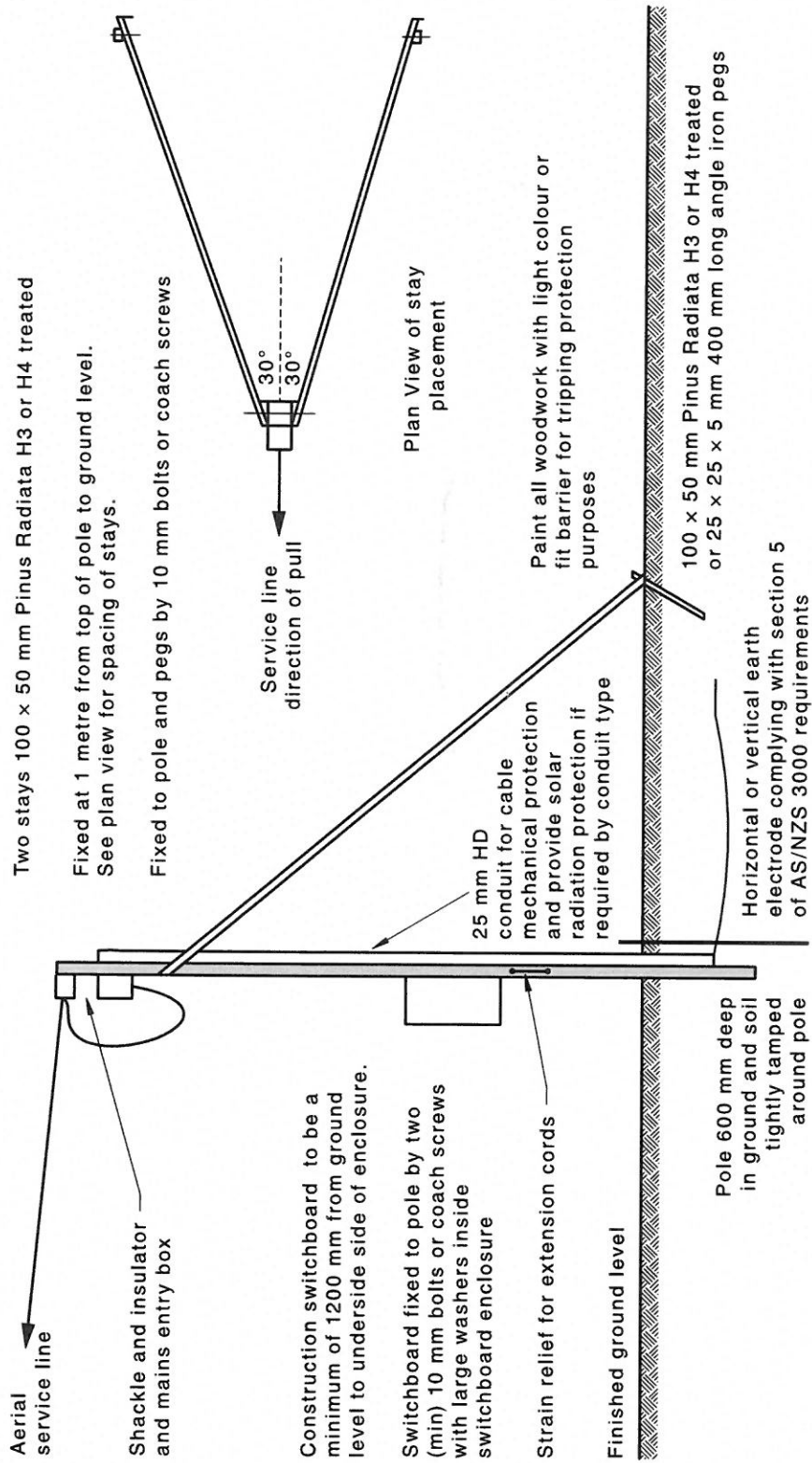


FIGURE J3 TYPICAL CONSTRUCTION SWITCHBOARD MOUNTING ARRANGEMENT WITH OVERHEAD AERIAL SUPPLY

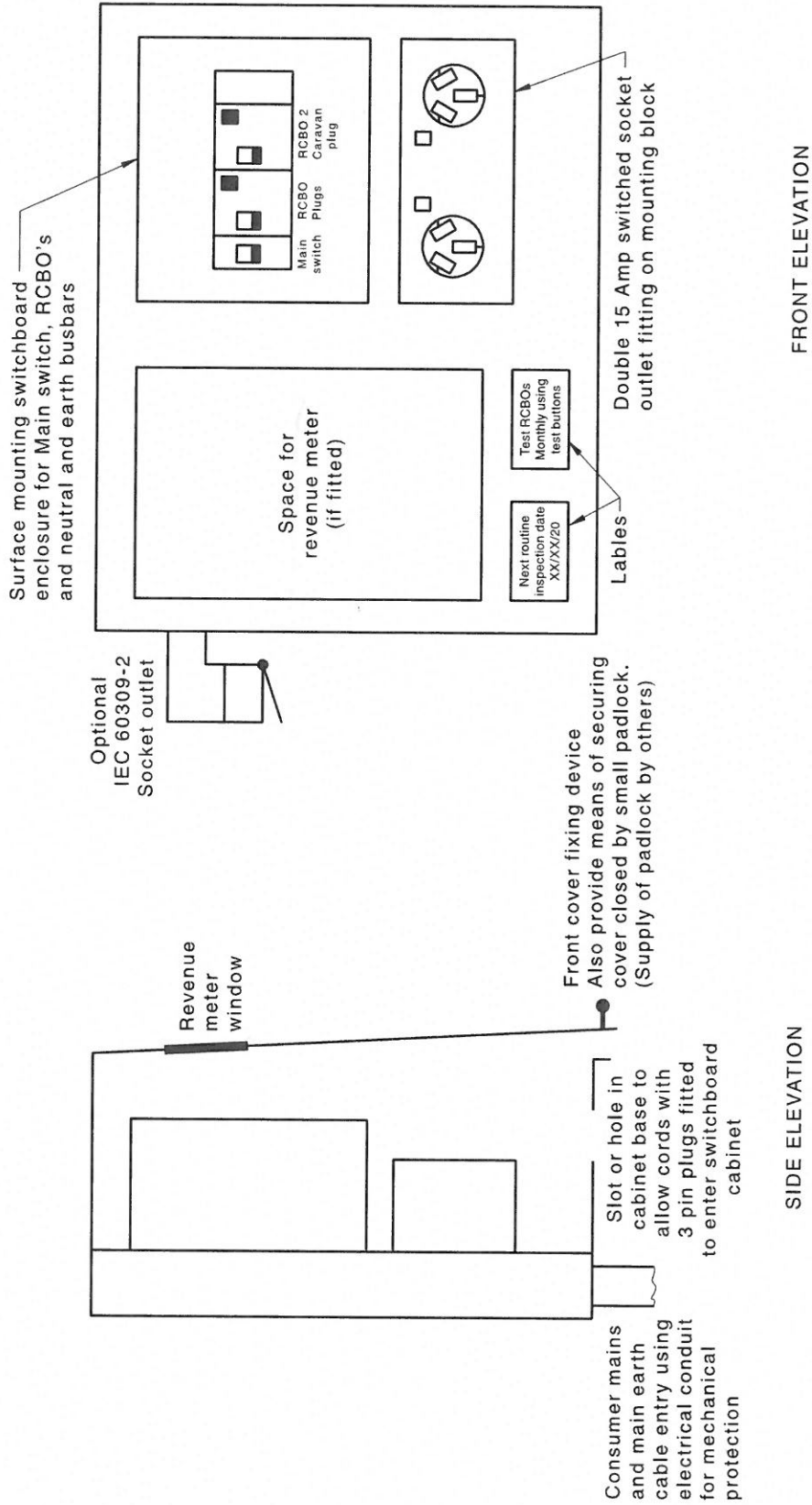


FIGURE J4 TYPICAL CONSTRUCTION SWITCHBOARD LAYOUT

BIBLIOGRAPHY

- AS
- 2293 Emergency escape lighting and exit signs for buildings
2293.3 Part 3: Emergency escape luminaires and exit signs
- 4086 Secondary batteries for use with stand-alone power systems
4086.2 Part 2: Installation and maintenance
- AS/NZS
- 1680 Interior lighting
1680.0 Part 0: Safe movement
- 2802 Electric cables—Reeling and trailing—For mining and general use (other than underground coal mining)
- 4836 Safe working on or near low-voltage electrical installations and equipment
- 61008 Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs)
61008.1 Part 1: General rules (IEC 61008-1, Ed. 3.2 (2013), MOD)
- 61009 Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCCBs)
61009.1 Part 1: General rules (IEC 61009-1, Ed. 3.2 (2013), MOD)

AMENDMENT CONTROL SHEET

AS/NZS 3012:2019

Amendment No. 1 (2020)

CORRECTION

SUMMARY: This Amendment applies to the Preface and Clause 2.3.6.

Published on 20 March 2020.

Standards Australia

Standards Australia is an independent company, limited by guarantee, which prepares and publishes most of the voluntary technical and commercial standards used in Australia. These standards are developed through an open process of consultation and consensus, in which all interested parties are invited to participate. Through a Memorandum of Understanding with the Commonwealth government, Standards Australia is recognized as Australia's peak national standards body.

Standards New Zealand

The first national Standards organization was created in New Zealand in 1932. The New Zealand Standards Executive is established under the Standards and Accreditation Act 2015 and is the national body responsible for the production of Standards.

Australian/New Zealand Standards

Under a Memorandum of Understanding between Standards Australia and Standards New Zealand, Australian/New Zealand Standards are prepared by committees of experts from industry, governments, consumers and other sectors. The requirements or recommendations contained in published Standards are a consensus of the views of representative interests and also take account of comments received from other sources. They reflect the latest scientific and industry experience. Australian/New Zealand Standards are kept under continuous review after publication and are updated regularly to take account of changing technology.

International Involvement

Standards Australia and Standards New Zealand are responsible for ensuring that the Australian and New Zealand viewpoints are considered in the formulation of international Standards and that the latest international experience is incorporated in national and Joint Standards. This role is vital in assisting local industry to compete in international markets. Both organizations are the national members of ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission).

Visit our web sites

www.standards.org.au

www.standards.govt.nz



GPO Box 476 Sydney NSW 2001
Phone (02) 9237 6000
Email mail@standards.org.au
Internet www.standards.org.au



PO Box 1473 Wellington 6140
Freephone 0800 782 632
Phone (04) 498 5990
Email enquiries@standards.govt.nz
Website www.standards.govt.nz