## Building and Construction

# Industry Guideline

For Safe Electrical Practices on Construction and Demolition Sites

Government of South Australia

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Supported by
Office of the Technical Regulator and SafeWork SA

## Disclaimer

Information provided in this publication has been prepared by industry representatives and is designed to address the issues of electrical safety on construction and demolition sites. This publication is correct at the time of printing and is provided as general information only. In utilising general information about workplace health and safety, the specific issues relevant to your workplace should always be considered.

Current electrical standards should always be referenced.

This Industry Guideline is not intended as a replacement for the legislation.

**Note:** Please be aware this is based on the Australian Standard current at the time of printing of this guide.

# Preface

The *Australian/New Zealand Standard AS/NZS 3012: Electrical installations – Construction and demolition sites (AS/NZS 3012)* is referenced in Work Health and Safety (WHS) legislation. As part of an earlier industry initiative to address areas of high risk, an appropriate Industry Guideline for Safe Electrical Practices on Construction and Demolition Sites (the guideline) was developed. Since the guideline was last published, there have been changes to the Australian Standard.

This guideline has been updated to reflect the latest changes. Most of the current contributors were also the original working party members of the first "Safer Industries", which was funded by the WorkCoverSA.

The objectives of this guideline are to:

- appropriately reflect the contents of AS/NZS 3012 in a user-friendly manner;
- provide businesses, employer and employee associations and their members with an industry specific guideline;
- contribute to the development of consistent high standard electrical practices in the construction industry that are conducive to electrical safety best practice at the workplace; and
- reflect the Australian Work Health and Safety Strategy in reducing workplace injuries, particularly in regard to those resulting from electrical incidents.

# Acknowledgements of organisations involved in this revision update

This publication has been developed with the assistance of the following organisations:

- CEPU – Electrical Energy and Services Division
- Master Builders Association South Australia
- National Electrical and Communications Association
- Office of the Technical Regulator
- SafeWork SA.

The MBASA OHS Committee and industry contributors, gratefully acknowledge the use of material from the following organisations in this publication:

- Australian Resuscitation Council
- Merck Medical Manual Online 2010
- SafeWork SA
- Standards Australia.

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# 1 Purpose

The purpose of this guideline is to provide practical guidance on the safety requirements for electrical practices on construction and demolition sites in South Australia in accordance with the requirements of AS/NZS 3012.

# 2 Definitions

For the purpose of this guideline:

**"Assembly for Construction Sites (ACS)"** means switchboards complying with AS/NZS 3439.4 and the requirements of Clause 2.3.2, AS/NZS 3012.

**"Auxiliary socket outlet panel"** means an assembly supplied by a fixed-wired dedicated final sub-circuit of construction wiring

**"Authorised Officer"** means an officer appointed under the *Electricity Act 1996*.

**"Competent Person"** means a person who has acquired, through training, qualification or experience or a combination of these, the knowledge and skill to carry out the task or function safely and in accordance with relevant legislation.

**"Contract for Service"** means the work involves a profession or trade where the contractor has the power to hire and fire, provide their own equipment and has the right to have another person perform the work and the engaging party (principal) does not have direct control over the person performing the work and the business expenses incurred are included in the amount charged/paid.

**"Construction Wiring"** means wiring systems, including flexible cords and cables, installed to provide electricity for construction and demolition work and is not intended to form part of the permanent electrical installation. Construction wiring does not include flexible cords or cables used to connect appliances or luminaires to a socket outlet. This does not exclude parts of the permanent installation being used to support or supply construction wiring provided it satisfies the relevant requirements of AS/NZS 3012.

**"Construction Work"** means construction work as defined in the WHS legislation.

**"Electrical Equipment"** means equipment which consumes converts or generates electricity.

**"Electrical Work"** means the installation, alteration, repair or maintenance of an electrical installation.

**"Electrical Worker"** means a person who personally carries out electrical work.

**"Electrical Workers Registration"** means a registration authorising a person to act as an electrical worker under the *Plumbers, Gasfitters and Electricians Act 1995*.

**"Inspector"** means an inspector appointed under WHS legislation.

**"Permanent Wiring"** means wiring which forms part of the permanent electrical installation of a building or site and meets the requirements for fixed wiring as defined in the AS/NZS 3000 Wiring Rules.

**"Principal Contractor"** means a party requesting another party to perform a task on their behalf under a Contract for Service arrangement.

**"Residual Current Device"** (RCD) means a device intended to isolate supply to protected circuits, socket-outlets or electrical equipment in the event of a current flow to earth; also commonly referred to as a Safety Switch.

## 3 Principal Contractor

The principal contractor is responsible for the application of this guideline during any construction work.

## 4 AS/NZS 3000: Wiring Rules

The requirements of AS/NZS 3000: Wiring Rules and the network operator's Service and Installation Rules prevail unless more rigorous provisions are contained in this guideline.

All electrical wiring installations and equipment used in construction work must be safe for use.

## 5 AS/NZS 3012: Electrical Installations – Construction and Demolition Sites

The requirements of AS/NZS 3012 apply to all construction and demolition sites in addition to the requirements of AS/NZS 3000.

## 6 Existing Permanent Wiring

The existing permanent wiring on a construction site must be retained in accordance with AS/NZS 3000 and when used must comply with the provisions of Clause 8(c) contained therein.

# 7 Installation and Removal of Construction Wiring

All construction wiring work must be performed by an appropriately registered electrical worker as required by the *Plumbers Gasfitters, and Electricians Act 1995* and an Electrical Certificate of Compliance issued in accordance with the *Electricity Act 1996*.

# 8 Residual Current Device (RCD – Safety Switch)

8(a) Every electric supply to which electrical equipment could be connected should incorporate an RCD so as to protect persons who may come into contact with the electrical equipment against electric shock.

8(b) The RCDs should comply with *AS/NZS 3190: Approval and Test Specification – Residual Current Devices (current-operated earth-leakage devices)* or *AS/NZS 61009.1: Residual Current Operated Circuit-Breakers with Integral Overcurrent Protection for Household and Similar Uses (RCBOs) – General rules* and have a rated tripping current not exceeding 30 mA or AS/NZS.61008.1.

8(c) Where construction work supply can only be obtained from permanent wiring, the RCD must be connected at the socket outlet or switchboard from which supply is taken.

8(d) Sub-mains supplying to site sheds should incorporate an RCD having a rated tripping current not exceeding 100 mA.

8(e) Ensure that every non-portable RCD device on the worksite is trip tested by the built-in push button test monthly and performance tested for operation at least once every twelve (12) months in accordance with *AS/NZS 3760: In-service Safety Inspection and Testing of Electrical Equipment* and be subject to an imbalance of current not less than the rated residual current and shall trip in a time not exceeding that specified in AS/NZS 3190 before being put into service and at least once in every calendar year.

8(f) Ensure that every portable RCD device on the worksite is trip tested by the built-in push button test prior to use and each day whilst in use and performance tested for operation at least once every three (3) months in accordance with AS/NZS 3760 and be subject to an imbalance of current not less than the rated residual current and shall trip in a time not exceeding that specified in AS/NZS 3190 before being put into service and at least once in every calendar year.

8(g) Results of RCD tests shall be recorded and kept on site or made available for audit and kept for a minimum period of five (5) years (excluding the daily push button test for portable RCDs).

8(h) Portable RCDs when tested shall be fitted with a durable, non-reusable, non-metallic tag.

The tag shall include the following information:

- the name of the person or company who performed the tests; and
- the test or retest date.

The recommended colour coding for tags on tested equipment indicates the period in which the test was performed.

| | |
|---|---|
| December - February | Red |
| March - May | Green |
| June - August | Blue |
| September - November | Yellow |

**Note: some builders will have their own requirements.**

8(i) RCDs fitted to portable generators must be installed in accordance with Clause 22 of this guideline.

## 9 Personnel Hoists

Personnel hoists used on construction sites shall comply with the following provisions:

9(a) Construction wiring for hoists must be supplied from a separate final sub-circuit originating from the main switchboard; and

9(b) This supply must be suitably identified as being for the operation of the hoist or hoists.

## 10 Temporary Supply Switchboards

All temporary supply switchboards used on building, construction and demolition sites shall comply with AS/NZS 3012. They must be of robust construction and securely attached to a pole, post, wall or other structure which may be of stable, freestanding design and:

10(a) Where installed in outdoor locations, should be constructed and maintained to a minimum of International Protection (IP) rating 23 so that safe operation is not affected by external influences (refer Appendix 1);

10(b) Include support and elevation of cables and flexible extension cords;

10(c) Switchboard enclosures to be provided with an insulated or covered tie-bar or similar arrangement for the anchorage of the cables or flexible cords in order to prevent strain and mechanical damage at the termination of the cables or cords;

10(d) Switchboard enclosures to be provided with door locking facilities and means of retention in the open position. Doors to be designed and attached in a manner that will not damage flexible cords or cables connected to the board, as well as preventing electrical accessories from mechanical damage;

10(e) Lockable covers recommended over circuit-breakers and RCDs associated with outgoing circuits, but these covers must not prevent access to the isolating switches:

1. To avoid confusion as to which switches need to be located behind a lockable cover, do not use the RCD as the isolating switch.
2. This cover requirement also applies to switchboards located in relocatable structures.
3. The lockable cover must be manufactured from plastic or similar non-conductive material and be kept locked during normal hours of operation;

Note: 10(e) is not mandatory in South Australia.

10(f) The door must be provided with signs stating “KEEP CLOSED” – “RUN ALL LEADS THROUGH BOTTOM” and “PRIOR TO RESETTING RCD REMOVE ALL LEADS”;

10(g) Any entry through which leads pass must be insulated;

10(h) Must be attached to a permanent wall or portable or temporary structure in an elevated position suitably designed for the purpose;

10(i) Every switchboard needs to be provided with a clearly labelled main isolating switch, which controls all equipment on; and circuits originating from the board. An additional, labelled switch may be provided for equipment operated out of normal working hours. Additional switches may be required by AS/NZS 3000 for safety services.

10(j) Isolating switches must be provided with a means of isolation requiring a deliberate action to prevent inadvertent energisation of electrical equipment;

10(k) Temporary access lighting, permanently connected welding equipment and socket outlets must be provided with separate final sub-circuits;

10(l) The contractor or nominated persons should ensure that all power circuits are isolated or made inaccessible so as to eliminate the risk of fire, electric shock or other injury to persons after completion of the daily work;

10(m) All temporary supply mains must be protected by a circuit breaker or high rupturing capacity (HRC) fuses;

10(n) A clearance of at least 1.2 metres is recommended to be maintained in front of all switchboards;

10(o) Switchboards should be located to suit the maximum flexible cord lengths set out in Table I (page 15);

10(p) It is recommended that each board should have at least one 15 amp socket outlet;

10(q) All isolating switches to be marked as required by AS/NZS 3000 and as follows:

- "MAIN SWITCH" – on main switchboard;
- "DISTRIBUTION BOARD ISOLATING SWITCH" – on distribution boards;
- "ISOLATING SWITCH AFTER HOURS SUPPLY – DO NOT SWITCH OFF" – for circuits supplying electrical equipment operating out of normal working hours;
- Letters used for such marking to be not less than 6mm high and of a contrasting colour to the background material; and
- Labelling must be performed by a registered electrical worker to clearly identify the outlets or equipment they supply.

10(r) Switchboards need to be legible and indelibly marked with a set of numbers, letters or both which uniquely identify the switchboard from others on a site; and

10(s) Switchboards must be marked to indicate the presence of live parts in accordance with the following:

| | |
|---|---|
| | Where access to live parts is required, the illustrated (left) symbolic electric shock risk sign must be displayed in locations where additional attention is required to be given to the removal of covers and the like. |
| | In addition, a DANGER sign as illustrated (left), with an additional message of appropriate wording, should be conspicuously displayed on the enclosure of the ASSEMBLY to alert persons to the hazard. |

Diagram 1 below shows generalised examples of single phase and three phase switchboards appropriate for a commercial construction site.

**Note: Additional RCDs may be required to meet the requirements of AS/NZS 3012.**

## Diagram 1

### Three Phase

### Single Phase

### Legend

Single Phase Isolator
Din Rail Mounted
Eg. Clipsal 4PSW180

Three Phase Isolator
Din Rail Mounted
Eg. Clipsal 4PSW380

Single Phase RCD
Eg. Clipsal RCD 263/30

Three Phase RCD
Eg. Clipsal RCD 463/30

Single & Three Phase 6kA
Minature Circuit Breakers
Eg. Clipsal 4CB116/6

Single Phase Three Pin 15A
Socket Outlet
Eg. Clipsal 10MDP15

Three Phase Flush Surround
Switch Socket Outlet
Eg. Clipsal 56C432

Label – Written

Label – Number

## 11 Sub-Mains

Protect all sub-mains with circuit breakers or HRC fuses.

Circuit breakers on sub-mains must be able to be locked in the open position and tagged. This is to ensure that it cannot be accidentally closed if isolated by an inspector or a registered electrical worker.

## 12 Final Sub-Circuits

Final sub-circuits must be protected against overload and short circuit by a circuit breaker RCD protection with a maximum rated residual current of 30 mA, which operates in both the active and neutral conductors, must also be provided.

Isolate all power final sub-circuits, other than those supplying portable equipment, at the completion of work each day, except for sub-circuits for amenities and equipment which operate outside normal working hours.

## 13 Socket Outlets

Ensure that every 240V, three pin socket outlet is:

13(a) Rated at 10 amperes minimum and protected by a dedicated and clearly identified circuit breaker; and

13(b) Switched by a double pole device which operates in both the active and neutral conductors.

It is recommended that each board should have at least one 15 amp socket outlet.

Socket outlets should be used within site sheds only to supply power to equipment and lighting within or immediately adjacent to the shed, and shall be protected by an RCD. Socket outlets should not be used to supply power to any other part of the building, structure or construction work site.

## 14 Portable Socket Outlet Assemblies (PSOAs)

PSOAs need to comply with the requirements of a Class H portable residual current device to AS/NZS 3190 and have regulatory approval. It must incorporate overload protection and RCD protection with a maximum residual current of 30 mA.

It may be single phase or three phase connected to fixed wiring through a flexible cord no greater than 2 metres long, and plug. These units should be of robust, double insulated construction with a minimum rating of IP33.

Double adapters, 3 pin plug adapters (piggyback type), domestic type power boards and similar type fittings are not to be used on construction or demolition sites.

## 15 Construction Wiring

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

15(b) Cables shall be installed in accordance with AS/NZS 3000 except as varied in subclauses (c) and (f) below. Construction wiring shall not be tied, bundled or grouped with permanent wiring.

15(c) A risk assessment should be undertaken prior to any installation or rework of cables to determine the likelihood of cables being exposed to mechanical damage. Where cables cannot be relocated they must be provided appropriate mechanical protection.

15(d) Construction wiring shall be readily distinguishable from permanent wiring by using cable of a different colour or by attaching iridescent yellow tape spaced at intervals not exceeding 5 metres and stamped with the words 'construction wiring'. If live, permanent wiring is located where construction activity is occurring it must be marked as live at intervals not exceeding 5 metres with the words 'live wiring' and be readily distinguishable from construction wiring.

15(e) Unarmoured cables must not be installed on metallic roofs or similar structures unless suitably protected against mechanical damage.

15(f) 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 minimise the risk of vehicular contact with the aerial wiring system.

This condition may be satisfied by the placement of flagged catenary wires or cables of suitable material across the access way 6 metres on either side of the overhead wiring and 0.6 metres below the lowest point of the overhead electrical cables or lower.

15(g) All aerial conductors installed on construction and demolition sites shall be insulated.

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

15(i) Construction wiring including switchboards and transportable structures must be inspected and tested following installation and at intervals not exceeding six (6) months.

# 16 Extension Cords and Fittings

16(a) Ensure that 3-pin plugs and cord extension sockets used on flexible extension cords and portable power tools are either a non-rewirable (moulded) or transparent type. Female type plugs shall include a raised shield to prevent items coming between the plugs when connected.

16(b) Fit 3-pin plugs to flexible extension cords in the manner described in the AS/NZS 3000 Wiring Rules. To avoid confusion, cables that are normally used for fixed wiring should not be used as flexible extension cords.

16(c) Do not locate flexible extension cords with plug socket connections in wet places or places where they may be subject to damage by liquids.

16(d) The sheath of a flexible cord should not contain the colour green. Bright colours are preferred as they provide good visibility.

16(e) Locate flexible extension cords above any work area or passageway to ensure that clear access is provided beneath.

16(f) When locating extension cords, plastic hooks and stands should be used to avoid running cords over metal parts which might damage the cord and become live.

16(g) Ensure that fittings for flexible cables or flexible extension cords are wired identically and that the identity of actives, neutral and earth connections are preserved in a like manner.

16(h) Confine flexible extension cords used in multi-storey construction to the same floor as the power source. This clause does not apply to:

(i) formwork;

(ii) external staging;

(iii) lift or service shafts [see Clauses 19(c) and 20];

(iv) roofs of single-storey construction; and

(v) stairwells.

Where used in single domestic residences, extension cords shall be confined to not more than one storey above or below the location of the switchboard and be mechanically protected where they transition between storeys and in places where damage is likely to occur. Refer to s2.6.8 of AS/NZS3012 for further information.

Ensure that all 240V flexible extension cords are heavy duty sheathed types which comply with *AS 3199: Approval and Test Specification, Cord Extension Sets*. The maximum length of a 240V cord extension set is shown in Table 1 (p15).

## Maximum Lengths of Flexible Cord

Do not extend 240V flexible extension cords, which are at the maximum length by more than 5 metres by the attachment of electrical equipment.

Where non-portable electrical equipment of fixed loading is installed, determine the length of the flexible cord used in line to solely supply power in accordance with the loading of the equipment.

It is recommended that only one extension cord be used. Cords are not to be joined if doing so means they will exceed the total allowable length in Table 1 (p15).

## Diagram 2

Maximum lengths of extension cords and PSOAs must not exceed length given in Table 1 below.

**Table 1:** Maximum Lengths of Flexible Cords and Flexible Cables

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| Rated current | Conductor cable | Maximum length of flexible cords and cables, in metres | | | |
| | | 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) |
| **(A)** | **(mm2)** | **(m)** | **(m)** | **(m)** | **(m)** |
| 10 | 1.0<br>1.5<br>2.5<br>4.0 | 25<br>35<br>60<br>100 | 50<br>70<br>120<br>200 | 15<br>20<br>35<br>60 | 30<br>40<br>70<br>120 |
| 15/16 | 1.5<br>2.5<br>4.0<br>6.0<br>10.0 | 25<br>40<br>65<br>100<br>170 | 50<br>80<br>130<br>200<br>340 | 15<br>25<br>40<br>60<br>100 | 30<br>50<br>80<br>120<br>200 |
| 20 | 2.5<br>4.0<br>6.0<br>10.0 | 30<br>50<br>75<br>130 | 60<br>100<br>150<br>260 | 20<br>30<br>45<br>75 | 40<br>60<br>90<br>150 |

**Notes:**

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

# 17 Electrical Equipment in Service Testing

Electrical equipment should be inspected and tested in accordance with the following:

17(a) When any equipment inspected or tested in accordance with sub-clauses (d) and (e) is found to be unsatisfactory, it shall be withdrawn from service immediately and have a label attached to it, warning against further use.

17(b) Electrical equipment found to be unsatisfactory shall not be returned to service until it has been repaired and retested, by **the authorised service agent, or qualified service personnel, or for simple electrical equipment a licensed electrical worker or person who has been trained to repair specific equipment. (from AS/NZS 3012 and AS/NZS 3760)**

17(c) The inspection and testing specified in this section must be carried out by a competent person. A licensed electrical worker is a competent person for the purpose of electrical inspection and testing and general electrical equipment repair works.

17(d) Movable electrical equipment that is hand held or portable during operation or moved between operations and is subject to damage or harsh environment shall be examined and tested every three (3) months and in accordance with AS/NZS 3760. A visual safety check should be carried out before each use.

17(e) All other electrical equipment used for construction purposes shall be inspected and tested in accordance with AS/NZS 3760 at intervals not exceeding six (6) months.

17(f) The results of the inspection and testing of electrical equipment must be recorded and kept on site or made available for audit. Information recorded includes:

- A register of all equipment
- A record of formal inspection and tests
- A repair register
- A record of all faulty equipment showing details of services or corrective actions.

For construction wiring:

- Visual inspection — date, checklist (as per AS/NZS 3000 checklist)
- Continuity of earthing system — values obtained for main earth, bonding earth and protective earth
- Insulation resistance value
- Polarity — checklist
- Correct circuit connections — checklist
- RCD — values for trip time.

17(g) Portable equipment and fixed equipment when tested shall be fitted with a durable, non-reusable, non-metallic tag.

The tag must include the following information:

- the name of the person or company who performed the tests
- the test or retest date.

The tag should be colour coded to identify the period in which the test was performed.

The recommended colour coding for tags on tested equipment [refer to section 8(h)] should indicate by its colour the period in which the test was performed.

## 18 Electrical Equipment Inspections

When inspecting electrical equipment, ensure that:

18(a) The equipment is free from external damage;

18(b) The outer sheath of electrical cords are not damaged to an extent that reveals the insulation of the inner conductor;

18(c) The sheath of all electrical cords is secured at the ends;

18(d) Rewirable plugs and extension sockets are satisfactorily connected and are serviceable; and

18(e) Covers, guards and the like are secured in the manner intended by the manufacturer or supplier, safety facilities and devices are in good working order, and that ventilation inlets and exhausts are unobstructed.

## 19 Lighting and Luminaires

19(a) Access/Egress and General Lighting

Install minimum lighting levels of 40 lux for walkways and 160 lux for general areas.

Lamps in luminaires must be protected against mechanical damage.

Luminaires installed as part of the permanent electrical installation in site accommodation do not require further mechanical protection.

19(b) Emergency Evacuation Lighting

Install sufficient battery powered lighting in stairways and passageways and adjacent to switchboards to allow safe access and egress from the area if there is insufficient natural lighting. If there is a loss of supply to the normal lighting in the area ensure that battery powered emergency lighting of at least 20 lux operates for a minimum of one hour to allow persons to exit the building safely.

Temporary wiring supplying lighting circuits should be connected to the designated lighting circuits of the switchboard.

19(c) Portable Luminaires and Task Lighting

Portable luminaires shall be provided with the appropriate IP rating in accordance with *AS 60529: Degrees of Protection Provided by Enclosures (IP Code)*.

**(Refer Appendix 1 for IP Rating diagrams)**

For example, in indoor dry locations a minimum rating of IP2 is required, and in wet areas a minimum rating of IP23 is required, and

- a mechanical guard for the lamp
- adequate stability.

19(d) Lift and Service Shaft Lighting

Lift and service shaft lighting may have either construction wiring or permanent wiring. Use fluorescent lighting at a minimum of 36 watts suitably guarded against mechanical damage. Locate the lights on the floor above or below the work area. If there is a loss of supply to the normal lighting in the area ensure that battery powered emergency lighting of at least 20 lux operates for a minimum of one hour to allow persons to exit the area safely. Emergency lighting must be positioned so that persons can exit at each egress point from the lift shaft.

## 20 Lift and Service Shafts

Construction wiring for lift and service shafts shall be supplied from a separate final sub-circuit protected by an RCD. This supply should only be used for installing lift and service shaft equipment and should be locked**: and tagged** to prevent inadvertent isolation by others.

For further information refer to AS/NZS 3012 clause 2.8.

## 21 Transportable Construction Buildings (Site Sheds)

Ensure that transportable construction buildings are wired in compliance with AS/NZS 3000 and/or *AS/NZS 3001: Electrical Installations – Relocatable Premises (including caravans and tents) and their Site Installations*.

Ensure that electrical installations to transportable construction buildings comply with the following requirements:

21(a) If supply is by means of a flexible cord, do not take it from one transportable building to another transportable building;

21(b) The flexible cord supplying a transportable building must not be more than 15 metres in length, must be treated as construction wiring, and all components or an interconnecting system must be of equal or greater current carrying capacity of the device protecting the system;

21(c) Connect each amenities building supplied by a flexible cord to a final sub-circuit protected by an RCD device with a rated tripping current not exceeding 30 mA;

21(d) Protect flexible cords from mechanical damage;

21(e) Power outlets in site sheds should be used to supply power to equipment and lighting within the shed only; and

21(f) Socket-outlets installed on the outside of transportable buildings shall be used only to supply power to the following:

(i) Electrical equipment and lighting immediately adjacent to those transportable buildings.

(ii) Other transportable buildings when the socket-outlet is part of an interconnecting system and the flexible cord supplying those transportable buildings has a maximum length of 15 metres.

## 22 Electrical Equipment Supplied by Generators

All portable generators must:

22(a) Comply with *AS 2790: Electricity Generating Sets – Transportable (up to 25 kW)*; or

22(b) Be fitted with core balance earth leakage protection having a rated tripping current not exceeding 30 mA; and

22(c) Be appropriately wired to ensure the correct operation of the RCD.

# 23 Isolation and Lock Out Process

All electrical work shall:

23(a) be carried out by a licensed electrician; and

23(b) be carried out isolated from live power (excludes testing).

Isolation and lock out process:

23(c) Some principal contractors may require electricians to complete a permit before conducting isolations to avoid unplanned disruption to client services; and

23(d) Isolation and lock out of live electrical must be conducted:

- (i) Test the circuit to be isolated, if it is live; or
- (ii) Test a known live source to ensure the meter is working; then
- (iii) Locate and isolate the source for the circuit to be isolated; then
- (iv) Isolate and place a Danger Tag and lock on the circuit at the isolation point; then
- (v) Test the circuit again to see that it is dead; then
- (vi) Test a known live source again to ensure the meter is still working
- (vii) A lock must be attached for each electrical worker; and
- (viii) The lock used must be of individual keyed type; and
- (ix) The Danger Tag must indicate the circuit that is isolated and the name of the worker/s who placed it; and

**If the isolation is to remain on for more than a day, the Danger Tag should indicate the period of the isolation.**

# 24 Testing and Commissioning

Prior to placing an electrical installation in service it shall be verified that the installation is safe to energise, and will operate correctly in accordance with AS/NZS 3000.

The installation shall be:

- inspected as far as is practicable; and
- tested in accordance with clause 8.3 of AS/NZS 3000.

The following mandatory tests are to be carried out:

- Continuity of the earthing system
- Insulation resistance
- Polarity
- Correct circuit connections
- Verification of earth fault loop impedance
- Operation of RCDs.

Where risk assessment requires a safety observer, then a safety observer must be provided. Please refer to SafeWork SA Fact Sheet on Electrical Testing and Safety Observer as Appendix 2.

It is a requirement of the *Electricity Act 1996* that electrical work is carried out in accordance with AS/NZS 3000 (or standards called up in AS/NZS 3000), that it complies with the rules of the operator of the distribution network, and that a Certificate of Compliance is issued to the owner/occupier within 30 days of energisation.

# 25 Electrical Incidents

Electrical incidents are required to be reported to these regulatory agencies, dependent on the type of incident:

(i) **Office of the Technical Regulator**
Electrical incidents resulting in electric shock or electrical burns.

(ii) **SafeWork SA**
Electric shock, as well as a short circuit or malfunction that results in an injury **or** immediate and significant risk of injury.

Both agencies have 24-hour contact numbers listed on their websites for serious incidents. Both agencies have report forms available on their websites.

If in any doubt about reporting, it is always best to request advice from the relevant agency, as soon as possible.

# 26 First Aid

ELECTRIC SHOCK MAY CAUSE INJURY OR DEATH.
**DIAL 000 FOR EMERGENCIES.**

The human body conducts electricity. If any part of the body receives an electric shock, the electricity will flow through the tissues with little obstruction.

Just as electricity is not seen, injuries resulting from electric shock are not seen. Injuries resulting from electricity (e.g. shocks, zaps, burns) can affect the heart and internal organs, dependent on the amperage and field strength.

## What to Do

Danger: do not expose yourself or others to a risk of electric shock when helping an injured person.

- **Call the site First Aid Officer or nearest first aid person for immediate first aid treatment of any injuries at the time they occur.**
- **All victims of electric shock should be referred promptly for medical assessment. This is the established protocol as published by the Australian Resuscitation Council. (Guideline 9.3.1)**

Someone affected by an electrical shock needs a doctor or hospital to conduct further examinations to rule out any possible internal injury. Internal damage will often not be seen or known until it is too late.

Provide as much information as possible to emergency services personnel to help them perform their job.

# Appendix 1

## IP Rating Diagrams

**International Protection Rating IP2** (for dry areas)

Protected against solid objects larger than 12mm (e.g. finger of the hand) from being inserted into the light fitting.

**International Protection Rating IP23** (for wet areas)

Protected against solid objects larger than 12mm (e.g. finger of the hand) from being inserted into the light fitting.

+

Protected against splashing water from all directions

# Appendix 2

# Electrical Testing and Safety Observers

## Work health and safety requirements

Government of South Australia

SafeWork SA

**South Australia's work health and safety laws, effective 1 January 2013, introduced a new approach to a number of key areas, including high risk construction work, working on energised electrical equipment, safety observers and testing.**

To understand how these changes affect your business, you should read the relevant sections of the *Work Health and Safety Regulations 2012* (SA) [the WHS Regulations] that relate to working on energised electrical equipment. This fact sheet provides guidance on those requirements.

### High risk construction work

WHS Regulation 291 defines high risk construction work, which includes construction work that is carried out on or near energised (live) electrical installations or services.

Regulations 299-303 discuss the requirement for a Safe Work Method Statement (SWMS) for any work identified as high risk construction work.

Given that working on or near energised (live) installations, services or equipment is defined as high risk construction work, an SWMS is required.

### Working on energised electrical equipment

Regulation 154 prohibits work on energised electrical equipment in all cases, unless (as permitted under Regulation 157):

- it is necessary in the interests of health and safety e.g. life saving equipment, or
- it is necessary for the work to be carried out properly, or
- it is necessary for the purposes of testing, or
- there is no reasonable alternative means of carrying out the work.

Regulation 158(1) requires a documented risk assessment with control measures in place prior to any work on energised equipment.

Regulation 161 describes how any work on energised electrical equipment is to be carried out, and requires:

- a competent person who has tools, testing equipment and personal protective equipment (PPE) that are appropriate, tested and maintained, and
- an SWMS prepared for the work, and
- a competent and qualified safety observer present (if this has been determined as necessary by your risk assessment).

### Electrical testing

Testing can include fault finding and troubleshooting, which can be conducted without a safety observer where the risks are negligible. However, a risk assessment must always be undertaken prior to testing to formally determine the level of risk.

The risk assessment can be outlined in an SWMS or other document. The risk assessment should consider:

- the complexity of the test
- the likelihood of the electrician coming into contact with live parts
- exposed equipment issues
- fault levels and electrical fault protection systems.

**Note for consideration:** the provision of an electrical fault protection system must not be relied upon to replace a risk assessment or an SWMS.

Where serious risks are identified and assessed for testing work, a safety observer must be considered within the control measures of the SWMS or risk assessment document.

For typical and repetitive testing activities, an SWMS covering the repeated test or fault finding work can be used as a template, and modified for different locations, site specific hazards and associated risks.

## Safety observer

Regulation 161 requires the safety observer to be competent:

- to implement control measures in an emergency, and
- to rescue and resuscitate the worker who is carrying out the work.

It is a requirement that rescue and resuscitation assessment is undertaken annually in accordance with Subregulation 161(4) and Regulation 68 of the *Electricity (General) Regulations 2012*. This requires persons who carry out, or help in carrying out, electrical work to be suitably trained in rescue and resuscitation in accordance with the requirements of the Technical Regulator.

Under Subregulation 161(5), a safety observer is not required if:

- the work consists only of testing; and
- the person conducting the business or undertaking has conducted a risk assessment that shows there is no serious risk associated with the proposed testing work.

## Residential construction – BCA Class 1 dwellings

There should not be any work on live installations in residential construction of Class 1 dwellings under the Building Code of Australia (BCA).

All electrical power should be isolated before workers enter high risk areas such as roof and underfloor spaces.

## Further information

A copy of the WHS Regulations can be downloaded from the SafeWork SA website at **safework.sa.gov.au**.

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# Notes

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MASTER BUILDERS SOUTH AUSTRALIA

MOSSOP CONSTRUCTION +INTERIORS

neca national electrical and communications association