



The Building Construction Industry

Productivity through Safety

*Industry Guideline
Electrical practices for
construction & demolition sites
Version II*

Preface

Safer Industries is a South Australian WorkCover Corporation initiative created to involve industry stakeholders in a forum for the improvement of health and safety at the workplace.

As part of the Building Construction Industry OHS&W Committee's strategy to address areas of high risk it was agreed that an appropriate industry guideline for safe electrical practices on Construction and Demolition Sites was required.

To further enhance industry acceptance of the principles contained in the Guideline processes have commenced to legislate compliance with the new Australian Standard AS/NZS3012:2003 – Electrical installations-Construction and demolition sites.

To compliment this action it was deemed appropriate by the Working Party to review the Guideline to accurately reflect the requirements of AS/NZS3012:2003.

The objectives of this Industry Guideline are to:

- appropriately reflect the contents of Australian Standard AS/NZS3012:2003 – Electrical installations-Construction and demolition sites in a user friendly manner;
- provide employers, 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 is conducive to electrical safety best practice at the workplace; and
- reflect the Building Construction OHS Committee's Strategic Plan in reducing workplace injuries particularly in regard to those resulting from electrical incidents.

Acknowledgements

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

- ◆ National Electrical & Communications Association
- ◆ Baulderstone Hornibrook Pty. Ltd.
- ◆ Office of the Technical Regulator
- ◆ Workplace Services DAIS
- ◆ Master Builders Association
- ◆ CEPU – Electrical Division
- ◆ WorkCover Corporation

The Building Construction Industry OHS Committee, South Australia gratefully acknowledges the use of material from the following organisations in this publication;

Standards Australia - Australian/New Zealand Standard 3012: 2003 Electrical Installations - Construction and Demolition Sites.

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 demolitions 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.

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

Building Construction - Industry Guideline

Electrical Practices For Construction & Demolition Sites

Edition II – March 2004

Table of Contents

No.	Clause	Page No.
1.	Purpose	2
2.	Definitions	2
3.	Principal Contractor	3
4.	AS/NZS 3000 Wiring Rules	3
5.	AS/NZS 3012:2003 Electrical Installations – Construction & Demolition Sites	3
6.	Existing Permanent Wiring	4
7.	Installation and Removal of Construction Wiring	4
8.	Residual Current Device (RCD – Safety Switch)	4
9.	Personnel Hoists	5
10.	Temporary Supply Switchboards	5
11.	Sub – Mains	10
12.	Sub – Circuits	10
13.	Socket Outlets	10
14.	Portable Outlet Devices	10
15.	Construction Wiring	11
16.	Extension Cords and Fittings	11
17.	Electrical Plant in Service Testing	13
18.	Electrical Plant Inspections	14
19.	Lighting	14
20.	Lift and Service Shafts	16
21.	Transportable Construction Buildings (Site Sheds)	16
22.	Portable Generators	17

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 Australian Standard AS/NZS3012:2003.

2. Definitions

For the purpose of this Guideline:

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

"Competent Person" means a person who is suitably qualified (whether by experience, training or both) 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 the purpose of construction and demolition work and 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.

"Construction Work" means construction work as defined in the Occupational Health, Safety & Welfare Regulations 1995.

"Electrical Contractor" means a person, partnership or company who carries on the business of performing electrical work for others under a "Contract for Service" arrangement.

"Electrical Contractor's License" means a license authorising a person to carry on business as an electrical contractor under the Plumbers, Gas Fitters and Electricians Act 1995 (PGE Act).

"Electrical Plant" means plant, 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 PGE Act.

"Inspector" means an inspector appointed under the Occupational Health, Safety & Welfare Act 1986.

"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/ANZ 3000 Wiring Rules.

"Plant" means any machinery, equipment, appliance, implement or tool and any component, fitting, connection, mounting or accessory used in or in conjunction with any of the above.

"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" shall prevail unless more rigorous provisions are contained in this Guideline.

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

5. AS/NZS 3012:2003 Electrical Installations-Construction & Demolition Sites

The requirements of AS/NZS 3012 shall apply to all Construction & 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 herein.

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 Gas Fitters and Electricians Act 1995 and an Electrical Certificate of Compliance (ECC) issued in accordance with the Electricity Act 1996.

8. Residual Current Device (RCD - Safety Switch)

- (a) Every electric supply to which electrical plant could be connected should incorporate an RCD so as to protect persons who may come into contact with the electrical plant against electric shock.
- (b) The RCDs should comply with AS 3190, AS/NZS 3175 or AS/NZS 61009.1 and have a rated tripping current not exceeding 30 mA.
- (c) Where construction work supply can only be obtained from a permanent wiring socket outlet connect the RCD at the socket outlet.
- (d) Sub-mains supplying site sheds should incorporate an RCD having a rated tripping current not exceeding 100 mA.
- (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 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 3190 before being put into service and at least once in every calendar year.
- (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 3190 before being put into service and at least once in every calendar year.
- (g) Results of RCD tests shall be recorded and kept on site or made available for audit and kept for a minimum period of 5 years (excluding the daily push button test for portable RCDs).

- (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 plant, which is prescribed below should indicate by its colour the period in which the test was performed.

January – March	<i>Red</i>
April – June	<i>Green</i>
July – September	<i>Blue</i>
October – December	<i>Yellow</i>

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

9. Personnel Hoists

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

- (a) Construction wiring for hoists shall be supplied from a separate final sub-circuit originating from the main switchboard; and
- (b) Suitably identify this supply as being for the operation of the hoist or hoists.

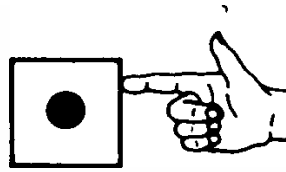
10. Temporary Supply Switchboards

All temporary supply switchboards used on building, construction and demolition sites shall be of robust construction and either securely attached to a pole, post wall or other structure which may be of stable freestanding design and:

- (a) Where installed in outdoor locations, should be constructed and maintained to IP23 rating so that safe operation is not affected by the weather;

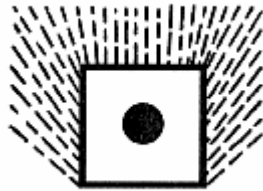
International Protection Rating IP23

(For Wet Areas)



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

+



Protected against splashing water from all directions.

- (b) Should incorporate the support and elevation of cables and flexible extension cords;
- (c) Switchboard enclosures shall 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;
- (d) Should be provided with a door and locking facility. The doors should be designed and attached in a manner that will not damage any flexible cord connected to the board and should protect the switches from mechanical damage;
- (e) The door should be provided with signs stating “KEEP CLOSED” – “LEADS THROUGH BOTTOM” and "PRIOR TO RESETTING RCD REMOVE ALL LEADS";
- (f) Should have an insulated slot in the bottom for the passage of leads;
- (g) Should be attached to a permanent wall or suitable portable or temporary structure in an elevated position and suitably designed for the purpose;
- (h) Every sub-board should be provided with a clearly labeled main isolating switch;
- (i) Temporary access lighting should be provided with a separate final sub circuit and protected by an RCD;

- (j) 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;
- (k) All temporary supply mains should be protected by a circuit breaker or high rupturing capacity (H.R.C.) fuses;
- (l) A clearance of at least 1.2 metres should be maintained in front of all switchboards;
- (m) Switchboards should be located to suit the maximum flexible cord lengths set out in Table 1 (page 13);
- (n) It is recommended that each board should have at least one 15 amp socket outlet;
- (o) All isolating switches shall be marked as required by AS/NZS 3000 and as follows:-

“MAIN SWITCH” – on main switch board;

“DISTRIBUTION BOARD ISOLATING SWITCH” – on distribution boards;

“ISOLATING SWITCH AFTER HOURS SUPPLY – DO NOT SWITCH OFF” – for circuits supply electrical equipment operating out of normal working hours;

Letters used for such marking shall be not less than 6mm high and of a contrasting colour to the background material; and

Labelling shall be performed by a registered electrical worker to clearly identify the outlets or equipment they supply.

- (p) Switchboards shall be legibly and indelibly marked with a set of numbers or letters or both which uniquely identify the switchboard from others on a site; and
- (q) Switchboards shall be marked to indicate the presence of live parts in accordance with the following drawing.

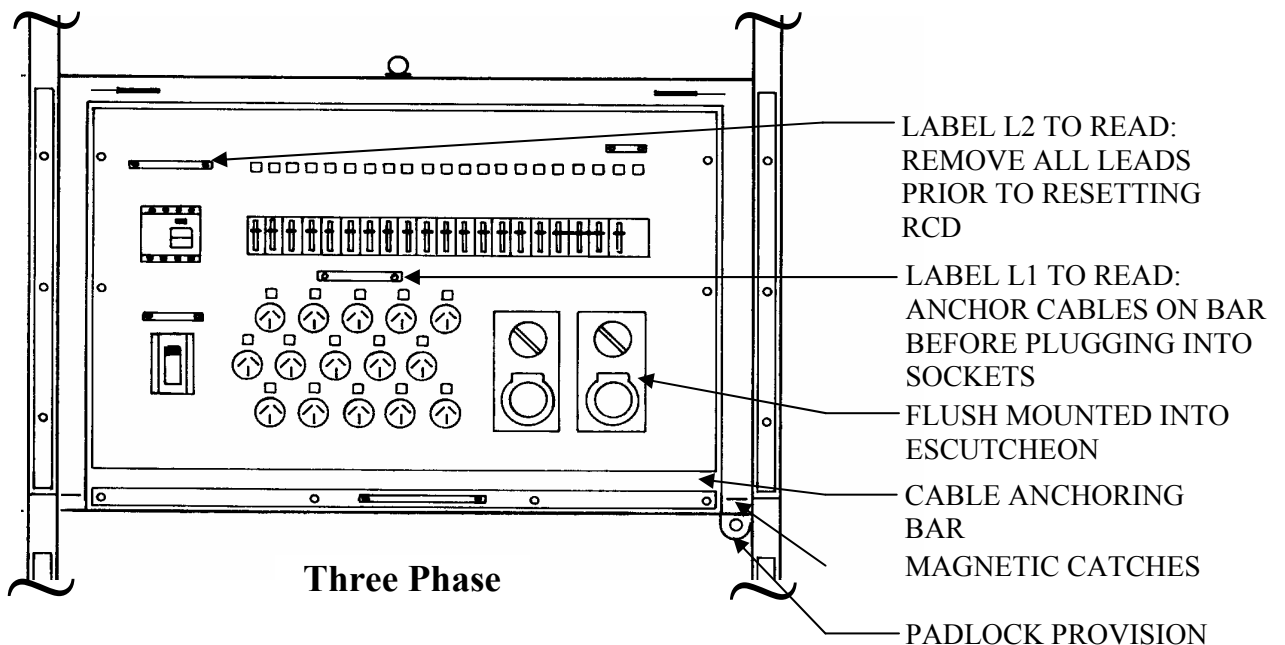
Where access to live parts is required, the following symbolic electric shock risk sign shall be displayed in locations where additional attention is required to be given to the removal of covers and the like.

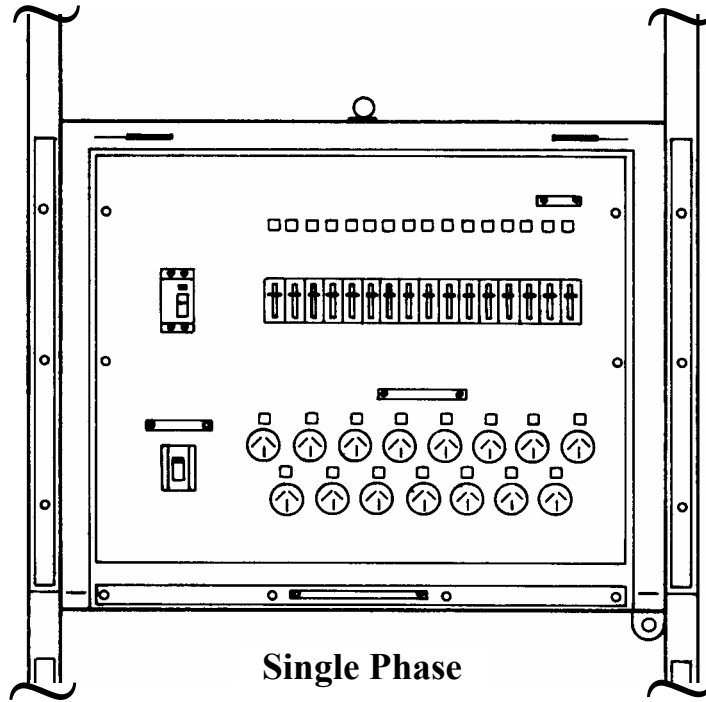











In addition, a DANGER sign as illustrated below, with an additional message of appropriate wording, should be conspicuously displayed on the enclosure of the ASSEMBLY to alert persons to the hazard.



The following drawings are generalised examples of single phase and three phase switchboards appropriate for a commercial construction site.





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. Sub-Circuits

Protect final sub-circuits with an overcurrent circuit breaker and RCD protection.

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 240 volt three pin socket outlet is:

- (a) Rated at 10 amperes minimum and protected by a dedicated clearly identified circuit breaker; and
- (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 plant 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 Outlet Devices

Multi-Socket portable outlet devices complying with AS/NZS 3105, Approval and Test Specification for Electrical Portable Outlet Devices, and incorporating overcurrent protection and supplementary RCD protection, may be connected to fixed wiring through a flexible cord and 3 pin plug. These units should be of robust construction and approved for outdoor use.

Double adapters and 3 pin plug adapters (piggy back) and similar type fittings shall not be used in building, construction or demolition site work activities.

15. Construction Wiring

- (a) Cables and fittings used in construction wiring shall comply with the requirements of AS/NZS 3000.
- (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 tired, bundled or grouped with permanent wiring.
- (c) 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 meters and stamped with the words 'construction wiring'.
- (d) Unarmoured cables shall not be installed on metallic roofs or similar structures unless suitably protected against mechanical damage.
- (e) 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 the 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 6m on either side of the overhead wiring and 0.6m below the lowest point of the overhead electrical cables or lower.

- (f) All aerial conductors installed on construction and demolition sites shall be insulated.
- (g) Cables supported by means of a catenary shall be stranded or flexible cables affording double insulation or the equivalent of double insulation.
- (h) Construction wiring (including switchboards) shall be visually inspected at intervals not exceeding 6 months.

16. Extension Cords and Fittings

- (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.
- (b) Fit three pin plugs to flexible extension cords in the manner described in the AS/NZS 3000 Wiring Rules. Cables that are normally used for fixed wiring should not be used as flexible extension cords.

- (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.
- (d) The sheath of a flexible cord should not contain the colour green.
- (e) Locate flexible extension cords above any work area or passageway to ensure that clear access is provided beneath.
- (f) 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.
- (g) 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); and
 - (iv) 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.

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 plant.

Where non-portable electrical plant 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 plant.

TABLE 1 - MAXIMUM LENGTHS OF FLEXIBLE CORD

Cord Extension set rating A	Conductor area mm²	Maximum length of flexible cord (m)
<i>10</i>	<i>1.0</i>	<i>25</i>
	<i>1.5</i>	<i>35</i>
	<i>2.5</i>	<i>60</i>
<i>15</i>	<i>1.5</i>	<i>25</i>
	<i>2.5</i>	<i>40</i>
<i>20</i>	<i>2.5</i>	<i>30</i>
	<i>4.0</i>	<i>50</i>

17. Electrical Plant in Service Testing

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

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

Electrical Plant found to be unsatisfactory shall not be returned to service until it has been repaired and retested.

- (b) The inspection and testing specified in this clause should be carried out by a competent person.
- (c) Movable electrical plant 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 3 months and in accordance with AS/NZS 3760.
- (d) All other electrical plant used for construction purposes shall be inspected and tested in accordance with AS/NZS 3760 at intervals not exceeding 6 months.
- (e) The results of the inspection of electrical plant should be recorded and kept on site or made available for audit. Information recorded shall include:
- the name of the person or company who performed the tests;
 - the test or retest date; and
 - identification of faulty equipment and action taken to repair or remove it from use.

- (f) Portable equipment and fixed equipment 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 tag should be colour coded to identify the period in which the test was performed.

The recommended colour coding for tags on tested plant is prescribed below and should indicate by its colour the period in which the test was performed.

January – March	<i>Red</i>
April – June	<i>Green</i>
July – September	<i>Blue</i>
October – December	<i>Yellow</i>

18. Electrical Plant Inspections

When inspecting electrical plant, ensure that:

- (a) The plant is free from external damage;
- (b) The outer sheath of electrical cords are not damaged to an extent that reveals the insulation of the inner conductor;
- (c) The sheath of all electrical cords is secured at the ends;
- (d) Rewirable plugs and extension sockets are satisfactorily connected and are serviceable; and
- (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

- (a) Access Lighting

- Install adequate artificial lighting to illuminate the work area if there is insufficient natural lighting. 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.

Note: A lampholder is not regarded as a luminaire.

- Install sufficient battery powered lighting in stairways and passageways 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 lighting has sufficient capacity to operate for one hour to allow persons to exit the building safely.

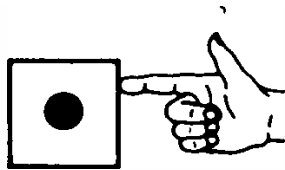
Temporary wiring supplying lighting circuits should be connected to the designated lighting circuits of the switchboard.

(b) Task Lighting

Portable luminaires shall be provided with the appropriate International Protection (IP) rating in accordance with AS 1939. For example in indoor dry locations a minimum rating of IP2X and in wet areas a minimum rating of IP24; and

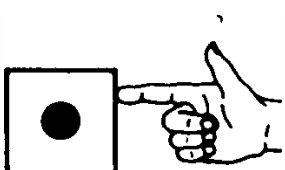
- A mechanical guard for the lamp; and
- Adequate stability

International Protection Rating IP2X (For Dry Areas)



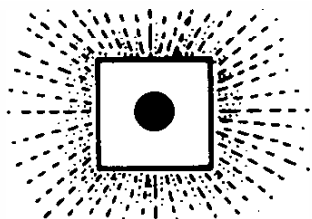
Protected against solid objects larger than 12mm (e.g. finger of the hand) from being inserted into the light fitting

International Protection Rating IP24 (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.

(c) Lift and Service Shaft Lighting

Lift and service shaft lighting may have either construction wiring or permanent wiring. Use fluorescent lighting. Locate the lights on the floor above or below the work area. Ensure that the emergency lighting has sufficient battery capacity to operate for a minimum of one hour if there is a loss of supply to the normal lighting in the area.

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 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 3001 – Movable Premises.

Ensure that electrical installations to transportable construction buildings comply with the following requirements and Clause 5 contained herein:

- (a) If supply is by means of a flexible cord, do not take it from one transportable building to another transportable building;
- (b) The flexible cord supplying a transportable building must not be more than 15 metres in length;
- (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 30mA;
- (d) Protect flexible cords from mechanical damage;
- (e) Power outlets in site sheds should be used to supply power to plant and lighting within the shed only; and
- (f) Socket-outlets installed on the outside of transportable building 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.

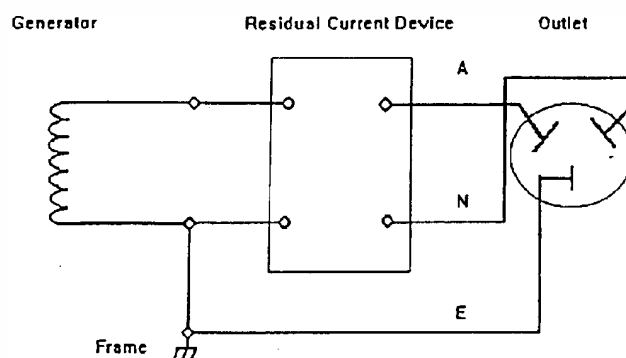
22. Portable Generators

All portable generators shall:

- (a) Comply with Australian Standard AS 2790, Electricity Generating Sets Transportable (up to 25 KW); or
- (b) Be fitted with core balance earth leakage protection having a rated tripping current not exceeding 30mA; and
- (c) Be appropriately wired to ensure the correct operation of the RCD.

To ensure that RCDs fitted to portable generators function correctly to protect against electric shock complete the following steps:-

- STEP 1 Test the RCD function on the generator using a portable RCD tester plugged into one of its outlets. Portable RCD testers such as Clipsal Cat 4860 or HPM Cat 5000T are suitable.
- STEP 2 Check that the neutral terminal of the generator upstream of the RCD is connected to the frame terminal.
- STEP 3 Check that the earth pin of all outlets is connected to the frame terminal.
- STEP 4 Physically check that the neutral wire downstream of the RCD is not connected to the frame.



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 demolitions 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.

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