WorkSafe VICTORIA

Industry standard

Electrical installations on construction sites

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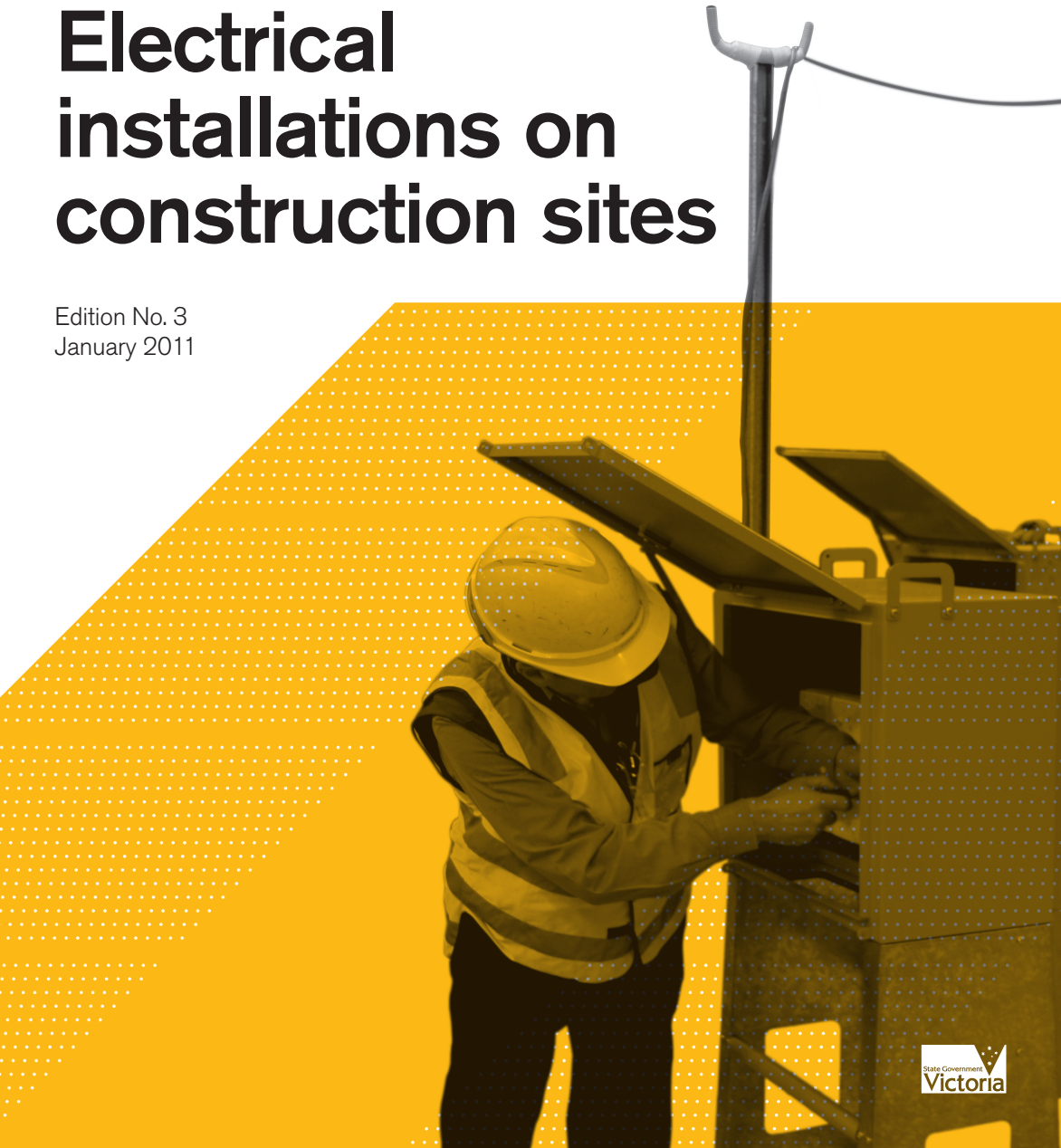

State Government Victoria

The information presented in the *Industry Standard – Electrical installations on construction sites* is intended for general use only. It should not be viewed as a definitive guide to the law, and should be read in conjunction with the *Occupational Health and Safety Act 2004*, Occupational Health and Safety Regulations 2007, *Electrical Safety Act 1998* and the Electricity Safety (Installations) Regulations 2009.

Whilst every effort has been made to ensure the accuracy of the *Industry Standard – Electrical installations on construction sites*, the advice contained herein may not apply in every circumstance. Accordingly, the Victorian WorkCover Authority cannot be held responsible, and extends no warranties as to the suitability of the information for your specific circumstances, or actions taken by third parties as a result of the information contained in this publication.

WorkSafe Victoria is a trading name of the Victorian WorkCover Authority.

Acknowledgements

This industry standard was first published in 2002 on behalf of Foundations for Safety Victoria to provide practical guidance on safeguarding construction workers and the general public from electrocution and electric shock on construction sites.

It was revised in 2010 by a Foundations for Safety Victoria working group to be consistent with AS/NZS 3012 *Electrical Installations – Construction and demolition sites* and following changes to occupational health and safety (OHS) and electricity safety legislation.

The working group consisted of representatives from:

- CEPU Electrical Trades Union
- CFMEU – Construction and General Division
- Energy Safe Victoria
- Housing Industry Association
- Master Builders Association
- National Electrical and Communications Association
- Victorian Construction Safety Alliance
- Victorian Volume Home Builders Safety Alliance
- WorkSafe Victoria.

This industry standard was published by WorkSafe Victoria and Energy Safe Victoria on behalf of Foundations for Safety Victoria.

Developing industry standards in partnership

Foundations for Safety Victoria is Victoria's primary forum for dealing with OHS issues in the construction industry. It brings together regulatory agencies, construction unions and employer associations representing principal contractors, designers and specialist trades sub-contractors.

Chaired by WorkSafe Victoria, Foundations for Safety Victoria meets every three months to progress OHS issues. One of its initiatives is establishing working parties to develop industry standards that provide practical guidance to the industry on particular issues.

Organisations represented on Foundations for Safety Victoria are:
Air Conditioning and Mechanical Contractors Association
Association of Wall and Ceiling Industries
Australian Industry Group
Australian Manufacturing Workers Union
Australian Workers Union
Building Commission Victoria
CEPU Electrical Trades Union
CEPU Plumbing Division
CFMEU Construction and General Division
Civil Contractors Federation
Energy Safe Victoria
Engineers Australia
Finishing Trades Association of Australia
Housing Industry Association
Master Builders Association of Victoria
Master Plumbers and Mechanical Services Association of Australia
National Electrical and Communications Association
National Federation of Bricklayers and Masonry Employers
Plumbing Industry Commission
Royal Australian Institute of Architects
Victorian Construction Safety Alliance
Victorian Crane Association
Victorian Employers Chamber of Commerce and Industry
Victorian Trades Hall Council
Victorian Volume Home Builders Safety Alliance
WorkSafe Victoria

Help improve health and safety in the construction industry by providing feedback on this industry standard or on other health and safety issues to any member organisation of Foundations for Safety Victoria.

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1. Introduction

1.1 Purpose

Electrical hazards are a major cause of death and serious injury on construction sites. This industry standard provides practical guidance to employers, designers, manufacturers, importers, suppliers (including hirers), electrical contractors and electricians on eliminating or reducing the risk of electrocution and electric shock to any person.

1.2 Scope

This industry standard applies to fixed wiring, construction wiring, fixed and/or portable electrical apparatus, tools, appliances and associated flexible cords used in construction work.

Construction work referred to in this industry standard means the construction, renovation and demolition of all types of buildings and structures including residential buildings (see Appendix E for details on classes of domestic housing) and any related excavation work.

1.3 Status of this industry standard

The guidance in this industry standard should be followed to achieve the minimum level of health and safety. An alternative method may be followed if it achieves an equivalent or better level of health and safety.

Where this industry standard reflects Acts or Regulations, the word 'must' is used. In such cases, the guidance must be followed.

In other cases 'should' is used to indicate recommended safe practices and procedures.

1.4 Legal duties and application of Australian Standards

Following the provisions of this industry standard will assist duty holders comply with two separate sets of laws covering the safety of electrical installations on Victorian construction sites:

- OHS duties are covered by the *Occupational Health and Safety Act 2004* (OHS Act) and Occupational Health and Safety Regulations 2007 (OHS Regulations) administered by WorkSafe Victoria
- electricity safety duties are covered by the *Electricity Safety Act 1998* (ES Act) and the Electricity Safety (Installations) Regulations 2009 (ES Regulations) administered by Energy Safe Victoria.

1. Introduction

OHS laws

The OHS Act requires employers to provide and maintain, so far as is reasonably practicable, a working environment for workers and independent contractors that is safe and without risks to health. This includes a duty to provide or maintain, so far as reasonably practicable, plant or systems of work that are safe and without risks to health.

Designers, manufacturers, importers and suppliers (including hirers) of plant (including electrical plant and equipment) also have duties under the OHS Act to ensure such plant and equipment is:

- safe and without risks to health when properly used
- appropriately inspected, tested and maintained
- accompanied by adequate information regarding its safe use.

Employers involved in construction work also have specific duties under the construction part of the OHS Regulations to control any risk associated with construction work so far as reasonably practicable.

Electricity safety laws

Registered electrical contractors and licensed electricians must also comply with duties under the ES Act and specific duties under the ES Regulations. The regulations incorporate the following Australian Standards:

- AS/NZS 3000 Wiring Rules
- AS/NZS 3012 *Electrical installations – Construction and demolition sites* (incorporated by reference in AS/NZ 3000).

This makes compliance with those Australian Standards mandatory and this industry standard should be read in conjunction with these documents.

Where conflict arises between a provision of this industry standard and a technical wiring provision of the referenced Australian Standard, the Australian Standard provision should be followed. However, where the guidance in this industry standard reflects a legal requirement in Victoria, this industry standard must be followed.

This industry standard refers to some other Australian Standards for specific requirements. These Australian Standards are listed in Appendix B along with other relevant standards for further information.

2. Switchboards

2.1 General

All construction switchboards installed for construction or demolition purposes must be designed and constructed to comply with AS/NZS 3012, and:

- include a tie bar or other device to prevent strain on termination of cables and flexible cords. The tie bar or other means to prevent strain must be insulated and prevent mechanical damage
- be securely attached to a pole, post or wall or other stable, free-standing structure designed to withstand external forces that may be exerted on the switchboard (eg from flexible cords)
- be protected from the environment by an enclosure meeting IP23 requirements (see Appendix A – Definitions of terms)
- be designed to ensure all main switches and isolating switches are accessible at all times, clearly marked and capable of being locked in an open (off) position
- have markings at least six mm high identifying all main/isolating switches
- incorporate insulated stands for supporting cables and flexible extension cords or have a stand fixed near the switchboard
- be fitted with a lockable door for isolation and security purposes that will not damage the cables when closed.

The door must have:

- a device to keep it open when working on the switchboard
- a sign on the door – 'KEEP CLOSED – RUN LEADS THROUGH BOTTOM'
- an opening at the bottom to allow flexible cords to pass through without damage.

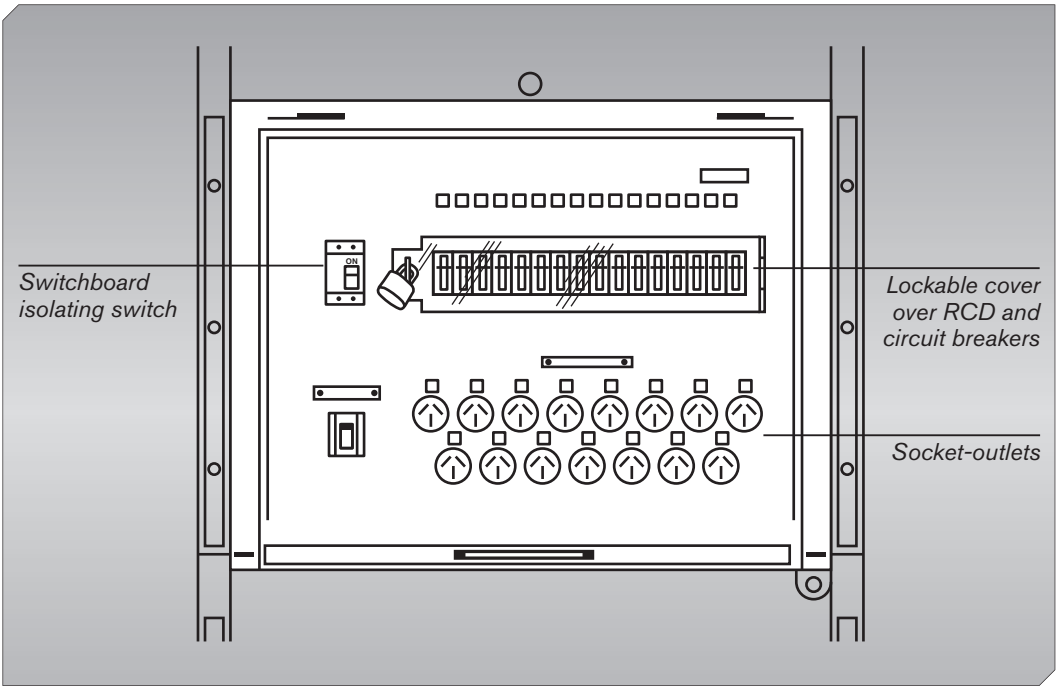
See Figures 1 and 2 for examples of construction switchboards.

In some situations additional measures should be taken:

- switchboards with more than one final sub-circuit should have a lockable cover, lock-dog or other security device to prevent unauthorised access to circuit breakers and residual current devices (RCD)
- where supply is needed for equipment such as welders and floor sanders, a switchboard should be fitted with at least one 15A single phase socket-outlet
- where more than one switchboard is installed on site, each switchboard should have a unique identification mark on the exterior of the switchboard enclosure.

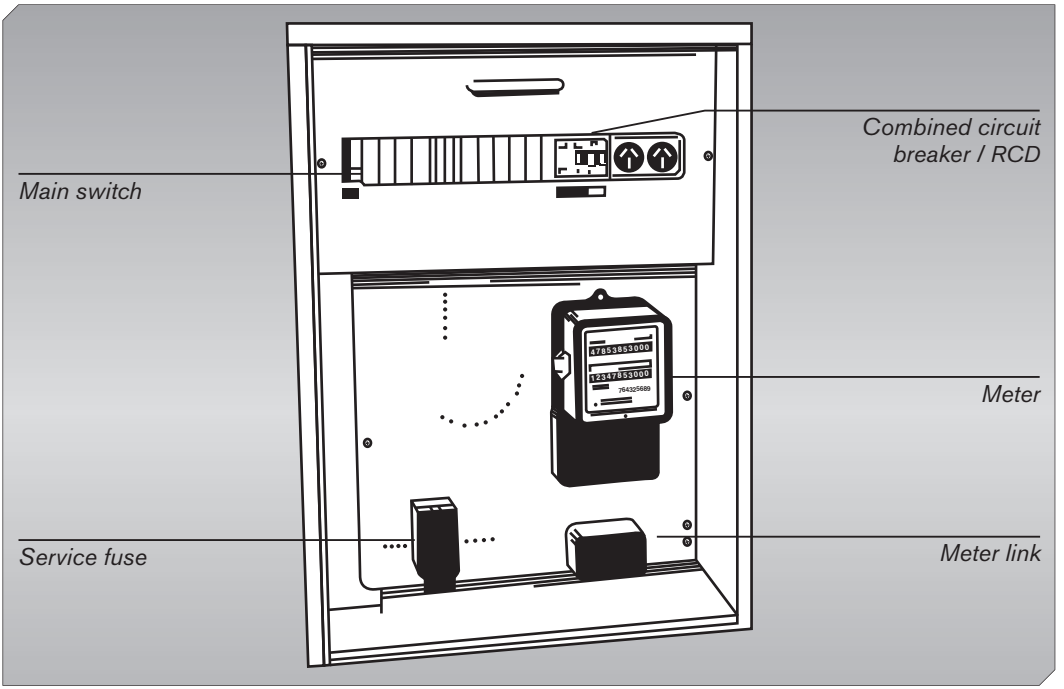
2. Switchboards

Figure 1



Example of a typical switchboard for a commercial construction site. The tie bar, insulated stand, door, signage, and means of passage for flexible cords have been omitted for clarity.

Figure 2



Example of a single final sub-circuit switchboard for a domestic construction site. General purpose outlets and/or a 15A outlet may also be required, depending on site works. The tie bar, door, signage, service fuse lock and means of passage for flexible cords have been omitted for clarity.

For details of the service fuse locking arrangement, refer to 2.6 on page 11 and Figure 4.

2.2 Installations with one final sub-circuit

Where the electrical installation has only one final sub-circuit, or has a combined circuit breaker/RCD as the main switch, the fitting of a lockable cover over circuit breaker/RCD is not necessary.

2.3 Location of switchboards

Switchboards should be:

- readily accessible and located where they cannot be damaged during demolition and construction activities
- located to suit the maximum flexible extension cord lengths as set out in Table 1 on page 14
- positioned so flexible extension cords or cables don't have to run between levels.

On general construction sites, where short duration work is to be undertaken on an additional work level, such as a roof or small mezzanine level, power may be taken from a switchboard on the adjacent level. The extension cord must be mechanically protected. If the total amount of work carried out in the area is likely to exceed one full day, a switchboard should be located on that level.

On multi-level housing construction, switchboards may be positioned to allow for the use of extension cords up or down one level from the switchboard. Flexible extension cords must be mechanically protected at the transition between levels and in places where damage is likely to occur. Use of flexible extension cords must also meet requirements of 3.6 on page 13.

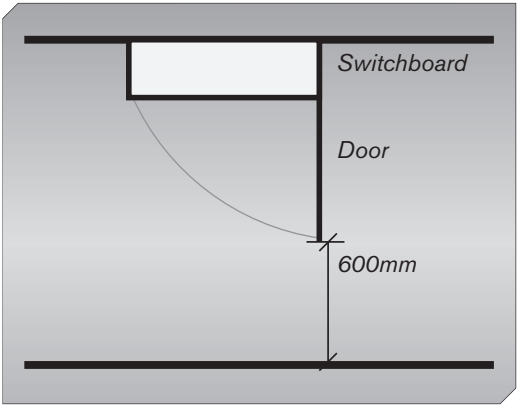
On sites with multi-level housing construction, a suitable hard wired socket-outlet may be installed to supply one floor above or below a switchboard, if:

- the type and location of the socket-outlet protects against exposure to weather
- the final sub-circuit is protected by an RCD and circuit breaker in the switchboard
- the socket-outlet is positioned to prevent the risk of mechanical damage
- the wiring is protected from mechanical damage (eg inside conduit or in a protected location)
- the wiring is clearly identified as construction wiring ie not permanent wiring (see 3.4 on page 12)
- there is a means to prevent strain on terminations of cables and flexible cords such as a tie bar, secured insulated lead stand or other means.

2.4 Clearance for switchboard doors

Minimum clearance of 600mm must be maintained to allow unimpeded opening of the switchboard door (see Figure 3).

Figure 3



Clearance around the switchboard door.

2.5 Resetting

Where the power supply has been lost, the builder or principal contractor who has overall control and management of the site should ensure a competent person is nominated and available to access and reset any circuit breaker or RCD that has tripped.

The competent person should:

- through a process of elimination identify any faulty tool or equipment that may have caused the tripping
- remove faulty equipment that may have caused or been damaged by the tripping
- check if water has affected any area and the tools and equipment in that area
- refer the matter to a licensed electrician if the:
  - cause of the tripping cannot be readily identified
  - tripping may have been caused by the switchboard or construction wiring (including a lighting sub-circuit)
  - circuit breaker or RCD cannot be reset.

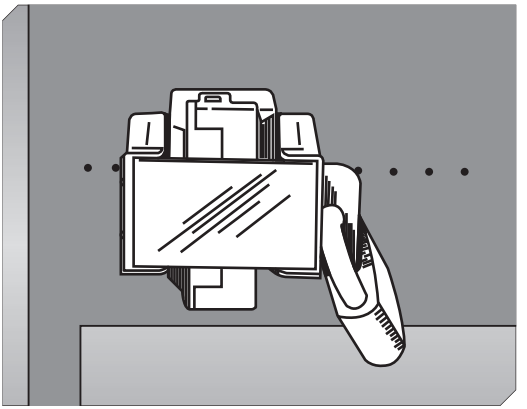
Before restoring power, the competent person should sight all persons affected by the tripping and advise them that power is about to be restored.

2.6 Use of permanent meter panels

Where the supply is from the permanent meter panel, either a circuit breaker or a service fuse assembly (see Figure 4) with a locking and/or securing device must be fitted.

The requirement does not apply to construction sites where there are permanently occupied domestic or business premises.

Figure 4



A typical securing device for the service fuse.

3. Electrical circuits

3.1 Circuit breakers

Circuit breakers provide protection against circuit overload and fire.

Every final sub-circuit must be protected by a circuit breaker except final sub-circuits exceeding 50A, which may be protected with high rupturing capacity (HRC) fuses.

3.2 RCD to final sub circuits

An RCD is a 'safety switch' fitted to an electrical circuit to reduce the risk of electric shock or electrocution.

Every final sub-circuit including lighting and socket-outlets must be protected by an RCD with a rated tripping current not greater than 30mA. This also applies to the final sub-circuits in transportable structures.

This requirement need not apply to final sub-circuits supplying equipment such as cranes or personnel lifts where interruption of supply is a risk to safety.

3.3 Security of power circuits

To prevent unauthorised access and the risk of electric shock or fire, the principal contractor or nominated persons should ensure all power circuits are secured at the end of the work shift, and/or when the site is unattended. This is not necessary for security lighting and essential equipment or for locked, transportable structures.

3.4 Identification of wiring

Construction wiring for consumer mains, sub-mains and final sub-circuits must be readily distinguishable from permanent wiring by using a different coloured cable or by attaching iridescent yellow tape labelled 'construction wiring'.

The tape should be spaced at five metre intervals.

Any wiring that has been previously energised must be treated as 'live' until verified otherwise. All live, permanent wiring near construction or demolition work must be clearly identified and labelled.

Construction wiring must not be tied to, bundled or grouped with permanent wiring.

3.5 Protection of wiring

Construction sites are dynamic workplaces where **permanent** wiring (see 3.11) or **construction** wiring may be at risk of mechanical damage from changes to the site.

Existing permanent wiring that is not protected by conduits or metal covers must be protected by an enclosure or barrier.

When a change occurs that may risk damage to construction wiring, a risk assessment should be undertaken. Where the assessment identifies a risk, the wiring must be protected by a suitable enclosure or barrier. If it is not reasonably practicable to protect wiring by the above means, another risk control needs to be determined.

Examples of construction wiring that may be at risk of mechanical damage are where wiring is slung under concrete ceiling slabs or in risers that may have to be accessed for various tasks.

Cables installed within 150mm of a corner of a ceiling and a wall or a beam and a ceiling are unlikely to be at risk of damage and may not require additional protection.

3.6 Flexible extension cords

Flexible extension cords must have heavy duty sheathing. The sheathing must not contain the colour green.

The maximum length of an extension cord depends on the amperage rating, minimum cross section and resulting conductor resistance.

Where extension cords are joined by portable socket-outlet assemblies (PSOA) or other means, the maximum length is the total length of all extension cords as well as the length of the supply cord of the final PSOA from which power is supplied.

If the supply cord on a tool is greater than two metres, this length must be included in calculating the maximum length.

Exceeding the maximum length may effect operation of RCD or circuit breakers during a fault and increase the risk of electric shock. It can also cause voltage drop that can damage equipment.

The allowable length of flexible extension cords is restricted on some equipment, such as motors operating trailing cables on suspended scaffolds, swing stages and false cars, to ensure the safety of operators is not affected by voltage drop.

Flexible extension cords must be raised off the floor using insulated hangers or stands to provide a safe route through the work area and clearance for personnel and vehicles. This is not necessary if the distance is four metres or less between the work area and the power supply

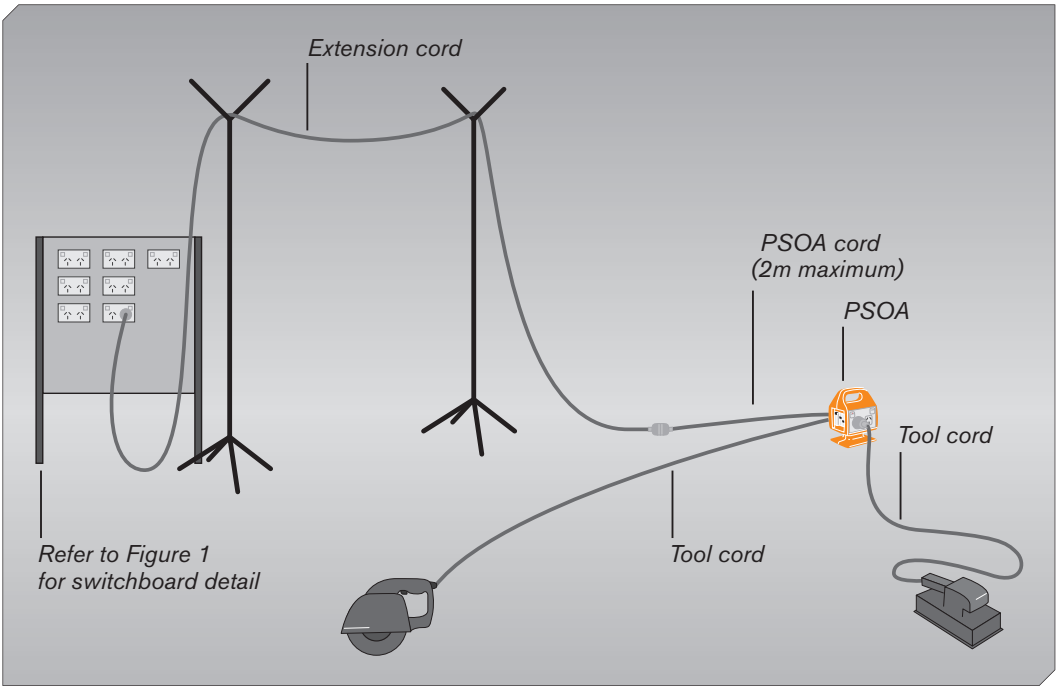
Where cords cannot be raised off the floor, another means of protection against mechanical damage, damage by liquids or high temperature must be provided.

Where flexible extension cords pass through scaffolding or other metal structures, they should be run on insulated hangers to eliminate the risk of mechanical damage.

Where flexible extension cords are used where water may be present, the extension socket and plug shall be protected against the ingress of water. This may be achieved through the use of proprietary manufactured water proof screw type coupling accessories designed for this purpose.

Orange circular, TPS type cables and other cables normally used as fixed wiring must not be used as flexible extension cords.

Figure 5



Maximum length of extension cord(s) + PSOA cord must not exceed length given in Table 1 below and outlined in 3.6.

Table 1 Maximum flexible extension cord lengths

Plug and socket rating (A)	Conductor area (mm²)	Maximum length of single phase flexible extension cords (m)	
		General use eg handheld power tools	Circuits where the safety of personnel utilising the equipment depends on the reliable starting of motors (eg trailing cables from suspended scaffold or swing stages).
10	1.5	35	20
15	1.5	25	15

Refer to AS/NZ 3012 for any variation from above figures.

3.7 Double pole switches

Double pole switches must be used on every socket-outlet installed on portable equipment designed to be supplied by a flexible extension cord.

All switches, including light switches, on transportable structures must be double poled.

Note: Double pole switches require all live conductors, including active and neutral conductors, to be switched.

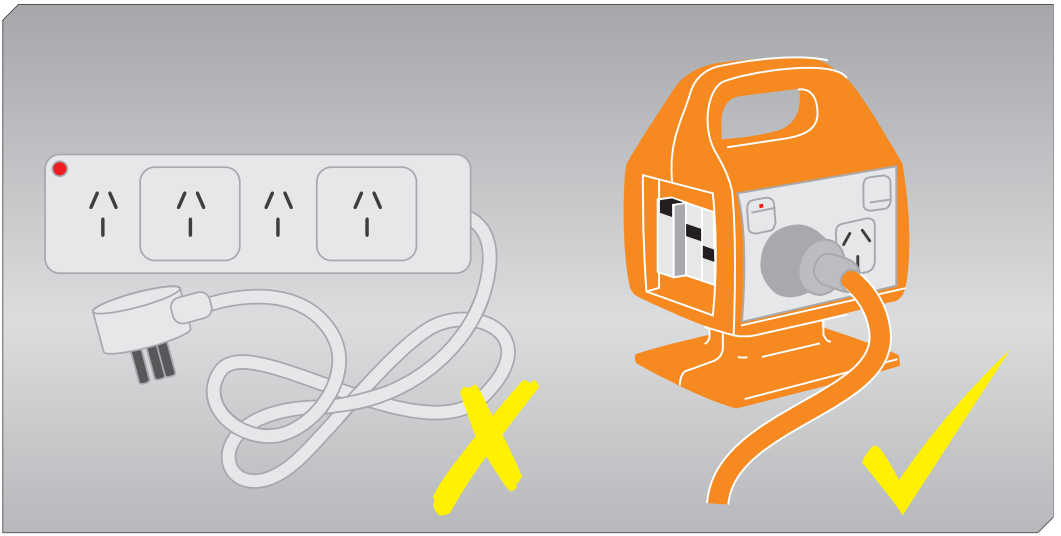
3.8 Portable socket-outlet assemblies (PSOA)

Multi-plug PSOA must:

- comply with AS/NZS 3012
- incorporate over-current and RCD protection
- be of robust construction
- have extended sides or covers over the outlets
- have a degree of protection appropriate for the environment (IP33 as a minimum)
- incorporate a heavy duty flexible cord no more than two metres long.

Domestic type powerboards, double adaptors, three pin plug (piggy back) adaptors and homemade powerboards must not be used on construction or demolition sites.

Figure 6



Examples of PSOA

3.9 Unused electrical wiring

Unused permanent and construction wiring must be appropriately terminated by a licensed electrician or removed.

3.10 Aerial conductors

Any aerial conductors on site must be insulated, clearly identified and marked, and have height clearances as set out in Table 3.8 of AS/NZS 3000.

Aerial conductors including conductors on catenary cables must not be used in hazardous bushfire risk areas (ie assigned by a fire control authority as 'high' fire hazard rating under the ES Act).

Advice on 'No Go Zone' requirements is available from WorkSafe Victoria or Energy Safe Victoria. Refer to Appendix B.

3.11 Use of permanent power

Permanent power should only be used for minor or short duration work. When the construction work is more significant in duration, scale or equipment, arrangements should be made to have construction wiring and equipment installed.

Permanent wiring for construction purposes must be protected by an RCD located in the switchboard at the origin of the final sub-circuit. If this is not reasonably practicable, the RCD may be incorporated into the socket-outlet supplying the electrical equipment, or a PSOA plugged directly into the socket-outlet.

4. Inspection and testing

4.1 Certificate of electrical safety

An Energy Safe Victoria certificate of electrical safety must be provided when work is handed over for use. This covers alterations, additions, modifications and repairs that have been carried out to the construction wiring or any fixed electrical installation.

Examples of the type of work requiring a certificate include:

- installation of fixed construction wiring and switchboards
- relocation of construction lighting
- relocation of a fixed construction supply switchboard
- disconnection and removal from the premises of permanent and/or construction wiring
- fitting or repairing a cable.

Certificates should be kept on site and be made available for audit.

4.2 Inspection and testing of construction wiring

All construction wiring, including switchboards and wiring within transportable structures, must be inspected, tested and certified by a licensed electrician (A class) before connection to the mains supply and whenever alteration, additions and/or repairs are carried out.

Testing must cover earth continuity, insulation resistance, polarity, correct circuit connections, earth fault loop impedance and operation of RCD.

Testing must follow the requirements of AS/NZS 3000. Guidance relating to testing may be found in AS/NZS 3017 *Electrical Installations – Verification guidelines*.

For a summary of testing requirements, see Table 2 on page 20.

Results of inspection and testing should include details of visual inspection, continuity of earthing system, insulation resistance value, polarity, correct circuit connections and RCD trip times.

4.3 Re-testing of construction wiring

Following initial testing, construction wiring must be inspected and re-tested every six months by a licensed electrician (A class) or electrical inspector.

As well as a visual inspection, wiring should be re-tested for earth continuity and insulation resistance of the installation.

Records of inspection and re-testing should be kept on site and be made available on request.

4.4 Inspection and testing of plant, appliances and flexible extension cords

Before every use, plant (including portable electrical tools and equipment, appliances and flexible extension cords) should be inspected for wear and mechanical damage.

Plant must be inspected before it is used for the first time and tested every three months for earth continuity, and insulation resistance in accordance with AS/NZS 3760 *In-service safety inspection and testing of electrical equipment.*

Inspection and testing to be undertaken by a:

a) licensed electrician, or

b) licensed electrical inspector, or

c) person who has successfully completed a structured training course and been deemed competent in the use of a pass-fail type portable appliance tester and the visual inspection of electrical equipment. (Refer to Appendix C).

Portable electrical equipment and flexible extension cords that pass testing must be tagged as tested and safe to use and test results recorded and kept on site or made available as required.

Electrical equipment found to be faulty must be withdrawn from service and tagged as faulty.

Where the results are not kept on the site, arrangements should be made so they can be provided to a WorkSafe Victoria inspector or the site's elected health and safety representative (HSR) within 24 hours of a request.

The details recorded must include:

a) date of inspection

b) number of the item inspected

c) details of person undertaking test

d) any repairs required as a result of the inspection.

4.5 Inspection and testing of RCD

Pushbutton test

All portable RCD, such as those located on portable generators and PSOA, must be tested by operating the test button after connection to a socket or before connecting equipment and at least daily when in use.

All fixed RCD, such as those located on permanent switchboards in transportable structures and on construction switchboards, must be tested every month by operating the test button. Details of the test and the date must be recorded.

Tripping current and time test

All portable RCD, such as those located on portable generators and PSOA, should be tested for tripping current and time each month.

All fixed RCD, such as those located on permanent switchboards in transportable structures and on construction switchboards, should be tested for tripping current and time each month except where the site can demonstrate:

- implementation of a system to ensure all electrical equipment being brought on the site is in a safe condition
- a risk assessment of the operating environment and usage of the RCD (eg exposure to the environment) justifies a longer duration between tests.

Under the above conditions the interval between tests may be up to three months.

Tripping current and time testing can only be undertaken by appropriately qualified persons, including:

a) a licensed electrician, or

b) a person who has successfully completed a structured training course and been deemed competent in the use of an RCD tester and interpretation of the results. (Refer to Appendix C).

Tested RCD must be tagged to identify them as tested and safe to use and all test results should be recorded and kept on site or made available as required.

When an RCD has been tripped, the cause must be determined before re-setting and re-use. Refer to 2.5 on page 11 for further advice.

4.6 Repair of electrical equipment

Any repairs to electrical equipment must be done by an authorised repair agent, service personnel or licensed electrician as appropriate, and re-tested before returning to use.

4.7 Testing hire equipment

Hire equipment should be tested and inspected before delivery. Re-testing and inspection may be required during the hire period.

Table 2 Frequency for testing

Equipment	Test	Frequency	Who
Construction wiring including switchboards and wiring within transportable structures	Initial test and certification	Before initial introduction to service	LE (A class)
	Re-test and inspect	Six month intervals	LE (A class)
Emergency evacuation lighting	Re-test	Six month intervals	LE, trained person
Plant including portable equipment and flexible cords	Initial test and inspect	Before first use	LE, CP
	Re-test and inspect	Every three months	LE, CP
Fixed RCD eg located on permanent switchboards in transportable structures and construction switchboards	Push button	Every month	LE, CP, SR
	Operating time	Every month, except where the site can demonstrate compliance with 4.5.	LE, CP
Portable RCD eg located on generators, PSOA	Push button	After connecting to socket/before connecting equipment (minimum daily)	Operator
	Operating time	Every month	LE, CP

LE – Licensed electrician
CP – Competent person (sections 4.4, 4.5)
SR – Site representative

5. Generators

5.1 Hard wired generators

When a generator supplies a fixed installation it must be:

- installed and certified by a licensed electrician and a certificate of electrical safety provided
- inspected by a licensed electrical inspector before it is used for the first time, and after any alteration to the location or installation of the generator.

Where generators are supplying fixed switchboards, the RCD may be mounted on the switchboard.

5.2 Free-standing generators

Manufacturers or suppliers of generators must provide information regarding relevant earth and bonding connections if the generator is used to supply portable tools and equipment. This information should be on a decal or label displayed prominently on the generator.

The information should indicate whether the unit is a bonded generator or an isolated winding generator.

Electrical socket-outlets on generators must be protected by RCD not exceeding 30 mA and should be connected in accordance with AS/NZS 3012.

PSOA must not be used in connection with isolated winding generators, as the RCD will not function. Only one item of class 1 electrical equipment must be used with an isolated winding generator.

6. Lift shafts

6.1 General

Where a permanent lift installation is connected to construction wiring, the following conditions must be met:

- the wiring must comply with AS/NZS 3013 *Electrical installations – Classification of the fire and mechanical performance of wiring system element*s
- the cables must be fire rated
- the electrical supply must not be subjected to other main switches
- all other safety requirements of AS/NZS 3000.

6.2 Separate final sub-circuit

Construction wiring in lift shafts must be from a separate final sub-circuit protected by a 30mA RCD. Its sole purpose should be to supply power for installing lift shaft equipment.

6.3 Circuit breakers and RCD

Circuit breakers and RCD should be locked and tagged to prevent accidental isolation of the supply to the lift shaft by other persons on the site.

6.4 Lift shaft lighting

Lift shaft lighting may be supplied from temporary or permanent fixed wiring and should conform with the following:

- fixtures are fluorescent lamps of a minimum 36 watt, or equivalent, and guarded against mechanical damage
- fixtures are connected to the wiring by a lighting plug and socket-outlet
- fixtures are installed at maximum intervals of six metres with the uppermost fixture within one metre of the top of the lift shaft
- the lighting is controlled by two-way switches located within easy reach of the lift well access points at the top and bottom floors
- where fixtures are intended to be part of the permanent lift installation, the lighting complies with section 11.3 of AS 1735.2 *Lifts, escalators and moving walks – Passenger and goods lifts – Electric.*

Where more than one lift is being installed in a lift shaft, lighting may be provided from a vertical riser in an adjacent shaft.

6.5 Emergency lighting

Emergency lighting must be provided to allow safe egress from the lift well when normal lighting fails. Emergency lighting must provide illumination of at least 20 lux throughout the lift well and be capable of operating for a minimum of one hour.

6.6 False-cars

Where false-cars are to be used for installing lift well equipment, the supply for construction wiring should be 230 volt as a minimum. It should have a 20A socket-outlet sourced from a separate final sub-circuit protected by a 30 mA RCD.

The sole purpose of this supply is to provide adequate power to the climbing hoist including task lighting and power for tools when working from the false-car.

The wiring to the false-car should be:

- heavy duty, double insulated flexible cord rated at a minimum of 20A with a minimum conductor size of 4mm^2
- compliant with the maximum length in AS/NZS 3012
- suspended from a device that does not damage the core wires, such as a built-in thimble.

The flexible cord should be:

- secured at the top of the shaft and at the point of attachment to the false-car by a means that prevents mechanical damage
- suspended in the lift well to allow running clearance between the false-car and the lift well and prevent fouling or damage to the cord
- long enough to allow for free travel of the false-car through the length of the lift well.

7. Lighting

7.1 General

Guidance on providing adequate lighting to work and access areas on sites where there is insufficient natural light can be found in AS/NZ 3012.

To prevent mechanical damage, lights must be fitted with devices such as wire cages or be manufactured from impact resistant material such as polycarbonate.

7.2 Emergency lighting

Emergency evacuation lighting, when required, must be sufficient to allow safe egress from the site.

As a minimum requirement, sufficient battery-powered lighting must be installed in stairways and passageways and near the switchboard to allow safe access to, and egress from, the area if there is insufficient natural lighting.

Battery-powered evacuation lighting, including exit signs, must operate for a minimum of one hour following loss of supply.

Evacuation lighting should be subject to a discharge test every six months and results recorded and kept on site, or made available for audit.

7.3 Exit lights

Exit lights must not be more than one metre directly above an exit or more than two metres directly in front of an exit.

Exit directional arrows are required in hallways that do not lead directly to an emergency exit.

7.4 Festoon lighting

Festoon lighting is restricted to underground shafts, wells, and tunnels and must meet the following requirements:

- lamp holders are the moulded, non-removable type
- supply voltage does not exceed 50 volt
- non-conductive and mechanically guarded.

8. Miscellaneous

8.1 Supply to and from transportable structures

Where electrical supply to a transportable structure is from a flexible extension cord, the supply must not be from a socket-outlet in another transportable structure, or to another inlet on the same structure.

Socket-outlets installed inside a transportable structure must only be used to supply appliances and lighting within that structure. Socket-outlets installed on the outside of transportable structures must only be used to supply electrical equipment and lighting close to the structure.

8.2 Evacuation system

Where an evacuation system, including sirens, is installed, battery back-up should be provided.

Evacuation systems should be regularly tested and maintained.

8.3 Construction wiring installed on fences

Construction wiring may be installed along fences, where permitted, provided the fence is permanent (not temporary wire or security fences), in good condition and secure. The wiring must be:

- mechanically protected even if unlikely to be damaged during construction work
- run along the top (or top rail), securely fixed and clearly identified
- disconnected and removed at completion of construction work.

If appropriate, consider placing signs on the back of the fence to warn of live wiring.

Note: Energy Safe Victoria prohibits permanent wiring being fixed to timber boundary fences.

8.4 Inverters

Inverters must comply with requirements of AS/NZS 4763 *Safety of portable inverters* and be isolated or protected by a 30mA RCD.

Appendix A

Definition of terms

Aerial conductor: Any stranded conductor (including aerial bundled conductors) supported by insulators or purpose-designed fittings above the ground and directly exposed to the weather.

Construction switchboard: An electrical switchboard used to supply power to construction wiring.

Construction wiring: Wiring installed to provide electrical supply for construction or demolition work and not intended to form part of the permanent electrical installation. (Refer to AS/NZS 3012 for full definition).

Fixed equipment: Electrical equipment fastened to a support, or otherwise secured, in a specific location, weighing more than 18kg and is not designed to be easily relocated.

Licensed electrical inspector: Holder of a current electrical inspector's licence issued by Energy Safe Victoria.

Licensed electrician: Holder of a current electrician's licence issued by, or recognised by, Energy Safe Victoria.

Lock-dog: Locking device designed to be fitted to an RCD, circuit breaker or switch to prevent these devices from being reset or switched.

Monthly: An interval of up to five weeks, in relation to testing that is required to be carried out 'monthly'.

Portable equipment: Includes portable generators, welders, portable power tools and appliances.

RCD: Residual current device. RCD is an internationally adopted term for an earth leakage circuit breaker or safety switch.

Transportable structure: Vehicles and structures with or without wheels that are capable of being moved from one site to another. Includes site sheds, portable sheds, transportable construction huts and transportable construction premises.

IP23: Protected against entry of objects larger than 12mm. Protected against liquids when up to 60˚ from vertical. Refer to AS/NZS 3000.

IP33: Protected against entry of objects larger than 2.5mm. Protected against liquids when up to 60˚ from vertical. Refer to AS/NZS 3000.

Appendix B

References

Acts and Regulations

Occupational Health and Safety Act 2004

Occupational Health and Safety Regulations 2007

Electricity Safety Act 1998

Electricity Safety (Installations) Regulations 2009

Australian Standards

A list of the main Australian Standards relating to electrical installations:

AS/NZS 1680.0	*Interior lighting – Safe movement*
AS 1735.2	*Lifts, escalators and moving walks – Passenger and goods lifts – Electric*
AS 1939	*Degrees of protection provided by enclosures for electrical equipment*
AS/NZS 2293.1	*Emergency escape lighting and exit signs for buildings – System design, installation and operation*
AS/NZS 3000	*Wiring rules*
AS 3010	*Electrical installations – Generating set*
AS/NZS 3012	*Electrical installations – Construction and demolition sites*
AS/NZS 3013	*Electrical installations – Classification of the fire and mechanical performance of wiring system elements*
AS/NZS 3017	*Electrical installations – Verification guidelines*
AS/NZS 3105	*Approval and test specification – Electrical portable outlet devices*
AS/NZS 3190	*Approval and test specification – Cord extension sets*
AS/NZS 3191	*Electric flexible cords*
AS/NZS 3760	*In-service safety inspection and testing of electrical equipment*
AS/NZS 4763	*Safety of portable inverters*

Available from standards.org.au

Appendix B References

Guidance

No Go Zone guidance:

esv.vic.gov.au

worksafe.vic.gov.au

WorkSafe Victoria publications:

Framework for undertaking work near overhead and underground assets

Appendix C

Competency required for testing

Testing of electrical equipment

A person who is not a licensed electrician and who carries out testing and tagging of electrical equipment must:

- demonstrate an understanding of the dangers associated with electricity
- demonstrate safe electrical work practices when testing and tagging
- be able to identify a range of defects and damage to electrical equipment during a visual examination
- be familiar with the operation of equipment guards and accessories that are required for the safe use of the equipment
- be able to identify a range of defects and damage to mechanical guards, protection and control devices during an inspection of electrical equipment
- be able to test a range of electrical equipment with a portable appliance tester
- be able to accurately record results of tests and understand the requirements of maintaining records
- demonstrate an understanding of the actions to be taken with equipment, based on the results of the inspection and testing
- understand the limitations of their training and not attempt to test electrical equipment or undertake work they have not been trained to do
- demonstrate an understanding of the relevant sections of AS/NZS 3760 and their responsibilities under relevant electricity safety and OHS legislation.

The knowledge and skills required to undertake testing and tagging should be obtained through formal training on in-service testing of electrical equipment specified in AS/NZS 3760. Training should include a competency assessment on testing and tagging portable equipment.

Appendix C

Testing of residual current devices

A person who is not a licensed electrician and who carries out testing of residual current devices (RCD) must:

- demonstrate an understanding of the dangers associated with working on electrical equipment that remains 'live' during testing
- demonstrate safe electrical work practices when testing RCD
- understand the effect that upstream RCD can have on the RCD being tested
- be able to test and correctly interpret test readings when using an RCD tester
- be able to accurately record results of tests and understand the requirements of maintaining the records
- understand the limitations of their training and not attempt to test RCD that are required to be tested by a licensed electrician.

The knowledge and skills required to undertake testing of RCD should be obtained through formal training based on in-service testing of electrical equipment to AS/NZS 3760. Training should include a competency assessment on testing RCD.

Additional requirements

A person testing any equipment to be used on a construction site must have:

- an understanding of the requirements of AS/NZS 3012 and this industry standard
- hold a WorkSafe Victoria Construction Induction Card or equivalent if testing is being undertaken on site.

Appendix D

Testing of RCD

Test current	Type (II)
100% rated tripping current	300*
500% rated tripping current	40*

* Maximum tripping time in ms

Type (II) – 10 mA ≤ 30 mA minimum requirement to protect final sub-circuits and hand held equipment on construction sites.

Appendix E

Building classification for domestic housing

Domestic housing construction for the purpose of this industry standard encompasses Classes 1, 2 and 10 as classified by the Building Code of Australia. See extract below:

Class 1

One or more buildings which in association constitute –

(i) Class 1a – a single dwelling being –

(A) a detached house; or

(B) one or more attached dwellings, each being a building separated by a fire resisting wall, including a row house, terrace house, town house or villa unit; or

(ii) Class 1b – a boarding house, guest house, hostel or the like with a total floor area not exceeding 300m^2 and which not more than 12 persons would ordinarily be resident; which is not located above or below another dwelling or another Class of building other than a private garage.

Class 2

A building containing two or more sole-occupancy units each being a separate dwelling.

Class 10

A non-habitable building or structure –

(i) Class 10a – a non-habitable building being a private garage, carport, shed or the like; or

(ii) Class 10b – a structure being a fence, mast, antenna, retaining or free-standing wall, swimming pool or the like.

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