



TECHNICAL GUIDELINES FOR
**WORKPLACE
ELECTRICAL SAFETY**

DISCLAIMER

The information produced by WorkCover Corporation of South Australia in 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 and injury management, the specific issues relevant to your workplace should always be considered. This publication is not intended as a substitute for the requirements of the Workers Rehabilitation and Compensation Act, 1986 or the Occupational Health Safety and Welfare Act 1986.

262.00 - 945/BO, Printed April 2004
Designed and produced by WorkCover Corporation
www.workcover.com
ISBN: 1 877016 22 5
Acknowledgements
Illustrations by: Fontaine Anderson.

CONTENTS

| | |
|--|----|
| 1. Introduction | 2 |
| 2. Definitions | 3 |
| 3. The hazards of electricity | 4 |
| 4. The legislative framework for electrical safety | 5 |
| 5. Management of electrical hazards | 7 |
| 6. Electrical installations | 11 |
| 7. Electrical plant | 13 |
| 8. Residual current devices (RCDs) - safety switches | 17 |
| 9. The competent person - who can examine and test? | 23 |
| 10. Work in proximity to electrical hazards | 25 |
| APPENDIX A - Examination and testing frequency chart | 26 |

1. INTRODUCTION

These guidelines have been produced to assist people at work to implement the provisions of the Occupational Health, Safety and Welfare Regulations, 1995 - Division 2.5 Electrical (OHSW Regulations). This version of the guidelines relates to the amended Division 2.5 - Electrical which comes into effect on 1 September 2002. The guidelines provide advice applicable to South Australian legislation regarding workplace electrical safety.

These guidelines are explanatory only and do not introduce any additional duties or responsibilities beyond the requirements of the OHSW Regulations. The guidelines therefore provide clarification and do not form part of a legally enforceable framework, provisions for which are stated in the Occupational Health, Safety and Welfare Act, 1986 (OHSW Act) and OHSW Regulations.

The aim is to clarify the requirements in the following areas:

- electrical installations in the workplace
- electrical plant used in the workplace
- the use of residual current devices (RCDs) or 'safety switches' in the workplace.

To achieve this, the following processes and links will be explored and examples provided, to assist in the interpretation of the regulations:

- identification, assessment and control of workplace electrical risks
- maintaining and testing of workplace electrical plant according to the required standards
- links to other relevant legislation and standards.

The advice in these guidelines should assist employers to design and develop workplace management systems, including training and supervision, in consultation with employees. Employers are responsible for ensuring that these systems are implemented to ensure their safety, the safety of their employees and the safety of any other person who may be affected by their work.

2. DEFINITIONS

Competent person

- Means a person who is suitably qualified (whether by experience, training or both) to carry out the work or function described in the relevant regulation.

Electrical installations

- Means any electrical wiring, accessory, consuming device, control or protective gear or other equipment associated with wiring situated in or on a workplace.

Electrical plant

- Means plant, which consumes, converts or generates electricity.

Flexible supply cord

- Means a length of flexible cable, for supply purposes, that has one end connected to a plug with pins designed to engage with a mains outlet socket, and the other end either:

- connected to terminals within the equipment (electrical plant) or
- fitted with an appliance connector designed to engage with an appliance inlet socket fitted to the equipment.

Hazard

- Means the potential to cause injury or illness.

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.

Residual current device (RCD)

- safety switch

- Means a mechanical switching device designed to make, carry and break currents under normal service conditions and to cause the opening of the contacts when residual current attains a given value under specific conditions. Also commonly referred to as a safety switch.

Risk assessment

- Means the process of evaluating the probability and consequences of injury or illness arising from exposure to an identified hazard or hazards.

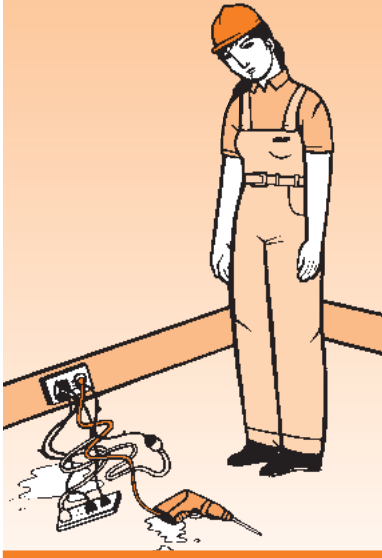
Risk control

- Means control measures to minimise or eliminate the risks associated with specific hazards.

Workplace

- Means any place (including aircraft, ship or vehicle) where an employee or self-employed person works and includes any place where such a person goes while at work.

3. THE HAZARDS OF ELECTRICITY



Electricity is invisible - this in itself makes it dangerous. It has great potential to seriously injure and kill. The average person can receive critical injuries as a result of even very short exposures to everyday 240-volt single-phase alternating current supply voltages.

Major electrical risks exist when insulation protection is not maintained in a safe condition or is placed in a hostile environment causing it to fail.

Circuit breakers and fuses provide some protection at times when sufficient current causes them to operate in the following situations:

- short circuits between live parts
- between live parts and exposed metal parts.

However, circuit breakers do not provide reliable personal protection when one or both protections fail. These failures could be due to a lack of regular maintenance, mechanical damage or being operated in hostile environments.

In order to be effective as personal protection, a circuit breaker or fuse must operate before the potential difference or voltage reaches a level high enough to cause an electric shock to personnel. This electric shock can result from any exposed conductors, exposed metal or other unrelated conductive paths (eg, water or dust).

The average-sized human will be exposed to approximately 0.2 amps when exposed to 240 volts ac. This can be potentially fatal within one to ten seconds. Therefore, reliance on 10 or 15 amp 'circuit breakers' as the only 'protective' measure for personal protection is often useless.

There is a high risk of serious injury to people, which is why normal circuit breakers should only be regarded as property, installation or electrical plant protectors, and not as personal protective devices.

Conducting regular maintenance and testing of electrical installations and electrical plant will reduce the chances of an electric shock or fire. Residual current devices (RCDs or 'safety switches') have been devised for personal protection. RCDs are efficient detectors of very low levels of electric current leakage from the active or neutral conductors to earth, and operate at speeds that provide total current shutdown before the current becomes a threat to the operator.

WARNING

It must also be remembered that there are other electrical hazards and risks with potentially fatal consequences where a residual current device or safety switch might be inoperative.

This can occur when the electrical plant has a fault and there is contact by the operator between the active (positive) and the neutral (negative) conductors forming a short circuit through the body with no leakage to earth, and therefore insufficient residual current for the RCD to operate.

It is therefore necessary to manage workplace electrical safety as an integral part of day-to-day operations in order to ensure the integrity of electrical installations and electrical plant.

4. THE LEGISLATIVE FRAMEWORK FOR ELECTRICAL SAFETY

The OHSW Act, 1986

The OHSW Act sets out the general requirements for protecting health and safety in the workplace. The Act makes it clear that everyone who may affect health and safety at work has responsibilities. This includes employers, employees and their representatives, designers and owners of buildings used as workplaces, manufacturers and suppliers of plant, electrical plant and substances used at work.

The Act aims to bring employers, employees and their representatives together to resolve health and safety issues at work. The Act also gives powers to government inspectors from Workplace Services to inspect workplaces and investigate health and safety issues.

Employers' duties under the Act are to 'ensure so far as reasonably practicable that the employee is, while at work, safe from injury and risks to health'. This is a wide-ranging responsibility that involves taking action to control risks associated with hazards in the workplace.

In determining what is reasonably practicable, employers must take into account the severity of the risk, knowledge about the hazard and ways to remove or reduce it, the availability and suitability of ways to reduce or remove the hazard, and the cost of taking action.

Employees must take reasonable care to protect their own health and safety, and the health and safety of others that may be affected by their actions or omissions at work. Employees' responsibility for health and safety only extends to the things they have control over. However, they must cooperate with their employer in ensuring health and safety in the workplace.

The OHSW Regulations, 1995

The OHSW Regulations are made under the OHSW Act and set out the general principles that provide practical steps for employers in preventing injuries and illness at work. These steps are:

- consultation with employees and their representatives
- hazard identification to identify potential causes of injury
- risk assessment to assess how likely it is that hazards will cause injury and how serious this might be
- risk control to ensure that injuries are prevented by minimising the risk
- provision of information, instruction, training and supervision to ensure employees are aware of risks and control measures
- reporting of hazardous situations, fatalities and injuries so action is taken to prevent them from happening again.

The Regulations also address specific health and safety issues, such as workplace electrical safety, to provide a framework for employers to follow.

The Electricity Act, 1996, and the Electricity (General) Regulations, 1996

This legislation makes it mandatory for electrical installations (electrical wiring, accessories, fittings, consuming devices, control and protective gear and other equipment associated with the wiring) to be installed according to the *Australian/New Zealand Standard Wiring Rules (AS/NZS 3000)*.

The legislation includes requirements for installation compliance testing. The Office of the Technical Regulator is the administrator of the Act and Regulations.

The provisions in the Regulations are to ensure that new or modified installations comply with *AS/NZS 3000* before the supply of electricity is connected.

The Plumbers, Gasfitters and Electricians Act, 1995, and Regulations

This Act establishes a system for the licensing of electrical contractors and registration of electrical workers, which is accompanied by a disciplinary process.

The Act requires that a registered electrical worker must carry out all installation, alteration, repair and maintenance work on electrical fixed-wiring up to the socket outlet, although there are some exemptions provided.

Electrical contractors and workers are responsible for ensuring that the work they do is carried out according to the relevant standards. The regulatory authority is the Office of Consumer and Business Affairs (Attorney General's Department).



5. MANAGEMENT OF ELECTRICAL HAZARDS

General principles

One of the general principles in implementing the Occupational Health Safety and Welfare Regulations, 1995, is 'hazard management'. Hazard management consists of three stages. Those stages are hazard identification, risk assessment and risk control.

SAfer approach

A very basic interpretation of hazard management can be described using the SAfer approach:

See it (hazard identification)

Assess it (risk assessment) Assess the likelihood that a person will be hurt, how badly they will be hurt, how they could be hurt, how much, how long and how often a person is exposed to the hazard.

Fix it (risk control) How are the hazards going to be controlled? If elimination of the hazard is not possible, other controls should be implemented to reduce potential risks. These controls may include the use of Residual Current Devices (RCDs). Other controls that should be considered are: safety switches, regular monitoring, record keeping, the testing of electrical equipment and fixed wiring, safe systems of work and personal protective equipment.

Evaluate once the most appropriate fix has been selected and implemented. It is important to evaluate whether the fix has been successful in controlling the hazard. Simply re-assessing the risk again will establish if the hazard has been eliminated or reduced.

Review after a period of time and if the work environment or work practices change. A review of this process is needed to continually control the hazard.



Further details on hazard management principles follow.

Hazard identification (See it)

A hazard is something that has the potential to harm the health, safety and welfare of people at work. Examples of electrical hazards that may be found in the workplace include frayed flexible supply cords, cracked electrical plant covers, flexible supply cords which have been run over by vehicles, electrical plant used in wet areas and electrical plant which is moved frequently such as vacuum cleaners. These are all considered electrical hazards.

To identify hazards to health, safety and welfare:

- Check records of injuries and incidents (including near misses) that have occurred in the workplace or in other similar workplaces.
- Read publications such as *OHSW and Electrical Regulations, Codes of Practice, Guidelines* (such as this one) and the *Australian/New Zealand Standards*.
- Conduct walk-through inspections of the workplace using a checklist to identify potential electrical

hazards. This checklist may include, but is not limited to, checking all flexible supply cords, electrical plant, the way the electrical plant is used and the areas that it is used in.

- Ask employees if they have ever experienced problems with electrical plant to identify electrical hazards.

Hazard identification should be an integral part of workplace culture. This involves regular workplace inspections in consultation with employee representatives and encouraging employees to report any hazardous situations that may occur in the workplace.



Risk assessment (Assess it)

When hazards have been identified, the risk associated with each hazard needs to be assessed to evaluate the probability and consequences of injury, illness or disease arising from exposure to an identified hazard or hazards. When performing a risk assessment consider the following:

- the nature of the hazard
- how it may affect health and safety (the type and severity of injury, illness or disease which may result from the hazard)
- the likelihood that the hazard will cause injury, illness or disease, (how much, how often and how long employees are exposed).

Put simply, the identification of a frayed and worn electrical cable on an appliance is the identification of a hazard. An appreciation of the associated risk, that is, a risk that is likely to cause serious injury or a fatality, is an example of risk assessment.

Clearly such a situation would require immediate action, which would include removing the faulty item from service until it can be replaced or repaired. This is a form of risk control, which will be covered in more detail in the following stage.

The risk assessment also takes into account the way that the work is organised, the layout and condition of the work environment, the training and knowledge needed by the person to perform the work safely and the type of control measures that are available.

The assessment of risk is a process of gathering information and making decisions. There is no single correct answer, as people will make certain decisions about the risk because they have different ideas about what is acceptable. For this reason it is important that those who will be affected by the decisions made (the employer, relevant employees and their representatives) should be involved in the assessment.

More complicated situations may arise in large workplaces where major items of electrical plant could create hazards and risks much greater in scope than an individual 240-volt single-phase appliance. In more complicated situations a more formal documented process might be necessary. Advice on more detailed or formal risk analysis techniques can be obtained from *AS/NZS 3931 Risk analysis of technological systems*, or more generally, *AS/NZS 4360 Risk management*.

Risk control (Fix it)

When hazards have been identified and the risks assessed, appropriate control measures should be developed and implemented. The aim is to eliminate or minimise the risk. There are many ways for employers to control risks to health and safety in the workplace. As far as possible a hazard should be controlled at its source rather than trying to make the employee 'work safely' with dangerous electrical plant or in a dangerous environment.

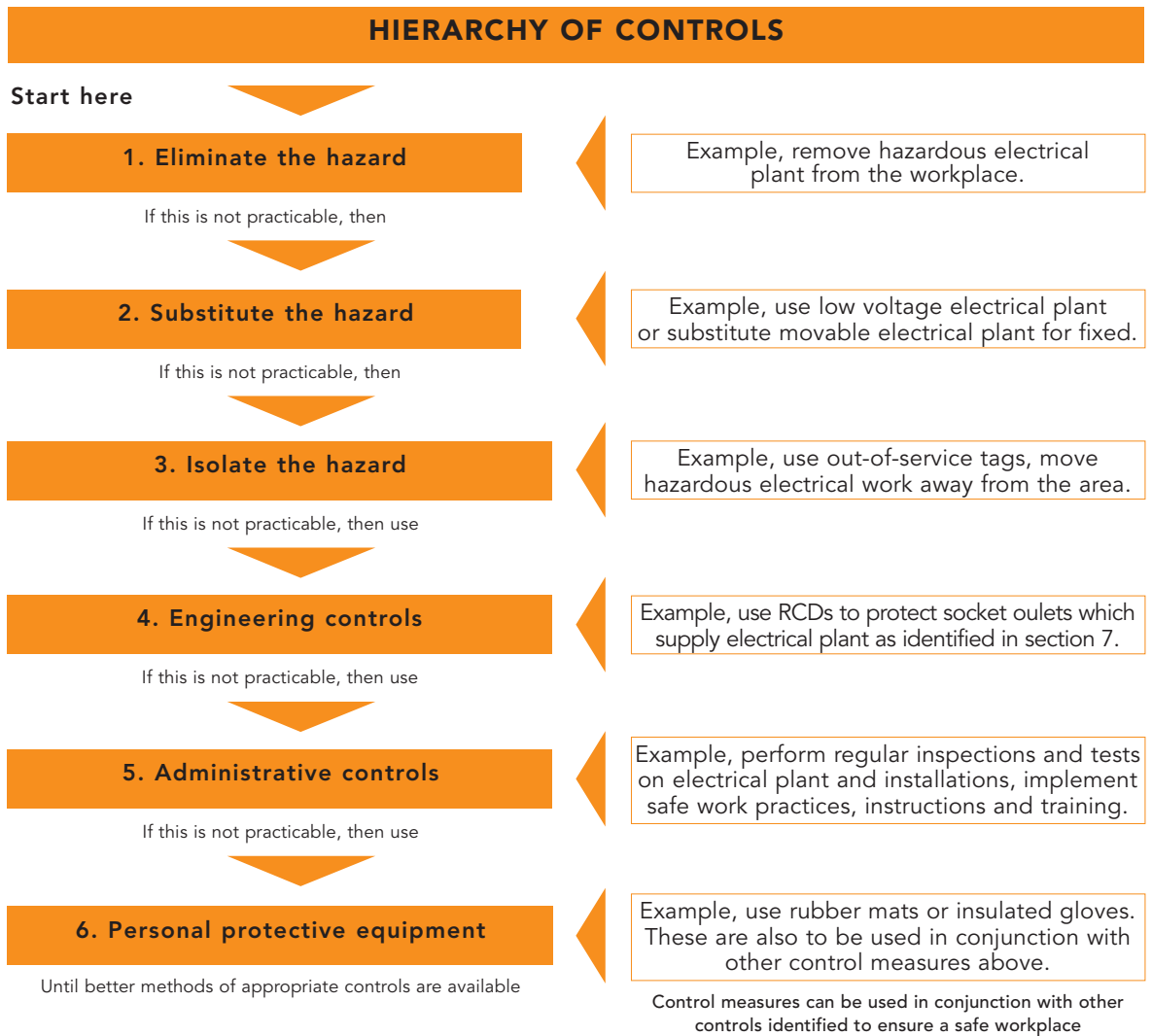
Controlling the hazard at the source is much more effective in the prevention of injury, illness or disease. To do this, action needs to be taken to control risks through a preferred sequence of risk control described on the following page.

Evaluate it

Once the control measures have been implemented it is important to evaluate how effective those measures have been. This is performed by simply re-assessing the risks associated with the hazard and establishing whether the controls have eliminated or minimised the risk of injury, illness or disease.

Review it

A review of the hazard management process should be performed at regular intervals. This can be part of a regular inspection or when work practices or the work environment changes, to ensure no new hazards have been introduced.



6. ELECTRICAL INSTALLATIONS

Fixed-wiring installations

New installations

New installation work requires the licensed electrical contractor and/or the registered electrical worker carrying out the work to complete the Electrical Certificate of Compliance. Guidance on this can be obtained from publications issued by the Office of the Technical Regulator.

Under OHSW Regulation 2.5.6, all new fixed-wiring installations (including the installation of a new sub-circuit to existing installations and modifications of existing sub-circuits) are required to be installed and tested according to *AS/NZS 3000 Wiring Rules*.

Before the connection of a new supply of electricity can be made, it is the employer's responsibility to ensure that a competent person in hazard management has been through the process prior to the supply of electricity to a new installation. A 'competent person' in this instance means someone who is suitably qualified in hazard management or in managing electrical hazards. New electrical installations are to be monitored and tested as required under *AS/NZS 3000*.

Existing electrical installations

Any work carried out on an existing electrical installation referred to in *AS/NZS 3000* or another standard called up by *AS/NZS 3000*, requires the licensed electrical contractor and/or the registered electrical worker carrying out the work to complete an Electrical Certificate of Compliance.

Testing of electrical fixed-wiring installations must be carried out in accordance with a hazard identification and risk assessment process that takes into account information provided by the designer or manufacturer.

A competent person can undertake the hazard management process by way of visual checks for mechanical or other damage that does not require work on the electrical installation.

The competent person then needs to request that a licensed electrical contractor or registered electrical worker carry out corrective action on the electrical installation.

There are many appliances which unregistered persons can use to monitor and diagnose faults on fixed-wiring installations. Some of these, while 'safe' to use, do not always give reliable diagnostic results and can indicate safe conditions that mask potentially serious faults such as neutral conductor and earth conductor transposition. Therefore, regardless of the results of any surveys with such instruments, a more detailed monitoring and testing of fixed-wiring installations may be necessary.

Based on the work environment and principles of hazard management, an employer, in consultation with employees, should determine the frequency necessary for ongoing in-service fixed-wiring installation checks. There should be little or no deterioration in fixed-wiring installation conditions in stable environments such as most buildings. However, in environments subject to vibration such as a mobile office, construction site, corrosion prone area such as a laboratory, wet area, or heat affected area, the installations should be monitored more frequently.

Records of these regular inspections using the hazard management principles should be kept to assist in determining their future frequency based on any observed deterioration in the condition of the installation.

It is also a requirement of the Regulations that employers have a competent person performing inspections and checks using the hazard management process on any existing electric fixed-wiring installation at a proposed workplace or location prior to occupation. An appropriately licensed person can then rectify problems detected with the installation by negotiation with the owner, prior to occupation.

More complicated installations, such as three-phase supply systems, also require ongoing monitoring to ensure their continuing compliance with AS/NZS 3000 and the OHSW Regulations.

What happens when Standards change?

Although it is recommended that electrical installations be upgraded when necessary, it is not intended that compliance with AS/NZS 3000 requires every existing installation to be upgraded each time there is a revised edition of AS/NZS 3000. This form of compliance with AS/NZS 3000 is intended to apply only to new installations and modifications to existing installations. Existing installations should be monitored and maintained at a minimum standard according to the specification of AS/NZS 3000 that was applicable at the time of the initial installation.

7. ELECTRICAL PLANT

Purchasing or constructing electrical plant

Before purchasing or constructing an electrical plant for use in a workplace, the task, the plant and the hazards involved need to be assessed. Only suitable electrical plant that has been through a hazard management evaluation should be purchased or constructed.

This can be achieved by consulting the designer or supplier of any electrical plant being manufactured or purchased, to ensure that the electrical plant has been manufactured and tested according to the relevant Australian Standard Approval and Test Specification.

Any electrical plant constructed for use in the workplace should be constructed and tested according to the relevant Australian Standard Approval and Test Specification before being used.

Classes of electrical plant (equipment)

Class I equipment – (protectively earthed) protection against shock does not rely on basic insulation only. An additional safety precaution is that all conductive (metal etc) parts are connected to the protective earthing conductor of the flexible supply cord and then connected to the earthing of the fixed wiring installation.



Class II equipment – (double insulated) protection against electric shock does not rely on basic insulation only. Additional safety precautions are used such as double insulation or reinforced insulation and there is no provision for protective earthing. This is identified by the symbol of a square inside a square. □

Both these classes are described in more detail in *AS/NZS 3760*.

What electrical plant needs to be examined and tested?

Due to day-to-day wear and tear and the exposure of electrical plant to environmental hazards, there is a need for the examination and testing of electrical plant to be carried out periodically.

Electrical plant which may not require regular examination and testing

Not all electrical plant requires regular examination and testing. In some situations certain electrical plant such as extension leads and desktop computers do not present a risk to their operators, due to the permanent/ fixed nature of their location.

Permanent or fixed electrical plant refers to permanently located electrical plant, which is not moved. Once again the hazard management principles along with the examination and test requirements of the designer and manufacturer need to be taken into account to determine whether permanent/fixed electrical plant should be tested and maintained.

If the hazard management evaluation shows there is a risk to employees then the examination and test frequencies to be used can be seen in Appendix A – Inspection and Test Frequency Chart on page 26.

Electrical plant requiring regular examination and testing

The following is a list (guide only) of generally identifiable electrical plant that **does require** regular examination and testing (where the supply of electricity to the electrical plant is through a socket outlet [power point]) with examples of the types of electrical plant.

How to examine and test electrical plant

What needs to be done for an examination?

The examination for electrical plant is simple and can be performed by a person who is familiar with the equipment. This could be the user of the equipment and can be done by visual inspection. The following checklist will provide the basis for an examination and has been adapted from AS/NZS 3760 and the frequency of examination can be seen in Appendix A – Examination and Testing Frequency Chart on page 26.

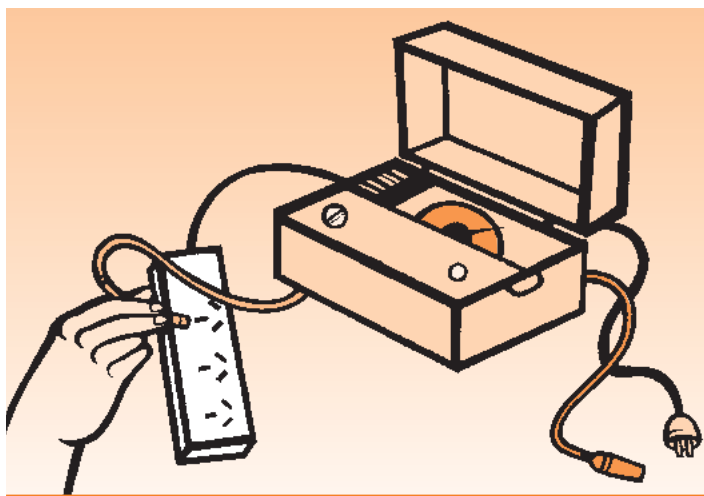
| Category of electrical plant | Types of electrical plant |
|--|---|
| Hand-held electrical plant | Hand-held power tools, hairdryers, kitchen accessories |
| Portable electrical plant moved while in operation | Floor polishers, vacuum cleaners, portable lighting |
| Electrical plant that is moved between operations in such a manner that damage to the flexible supply cord could occur | Hospital diagnostic equipment on trolleys, electronic whiteboards, overhead projectors, laptop computers, electrical plant used on building sites, welding machines, extension cords and power boards |
| Electrical equipment that is used in an environment where damage to the appliance or the electricity supply to that appliance could occur such as wet and dusty conditions | Electrical plant used in wet or dusty areas, electrical plant used outdoors, in kitchens, laboratories (chemical damage) and construction sites |

What needs to be done for a test?

AS/NZS 3760 In-service safety inspection and testing of electrical equipment can be used as a guide to establish the tests required. Frequencies for testing of electrical plant can be seen in *AS/NZS 3760* or Appendix A – Examination and Test Frequency Chart on page 26. Tests and testing methods for each class of electrical plant such as extension cords and extension power boards are described in *AS/NZS 3760 Sections 2.4.3 and Appendices A to D*.

Special note:

Examination and testing should be carried out before initial introduction to service and before re-introduction into the workplace after repair or maintenance which could affect the electrical operations of the electrical plant or frequencies as specified in Appendix A – Examination and Testing Frequency Chart.



The equipment required to perform electrical testing

The equipment needed for testing to the standard required by *AS/NZS 3760* is a Class 5 -insulation resistance meter with a measuring circuit isolated from earth and capable of measuring at 500 volts to an accuracy of five per cent.

A residual current tester that measures trip time is also needed. This equipment is readily available at wholesale electrical stores. To ensure the accuracy of test equipment, regular calibration should be maintained.

| Examine | Y/N | Examine | Y/N |
|---|-----|---|-----|
| Safety devices are working | | Warning signs are clearly visible | |
| Outer housing of the electrical plant is not damaged and any guards are secure | | Flexible supply cords are not damaged eg, by frayed cords, bent plugs, exposed wires, twists, deep cuts | |
| Vents for cooling are not obstructed | | Test tags are within test dates and secure | |
| The electrical plant while operating (ask the operator if they have any concerns) | | Controls are in good working order | |



Tagging and record keeping

Tagging of electrical plant

Tags should be attached to electrical plant or flexible supply cords to make it easier to identify examined and tested electrical plant, both for the operator and during regular workplace inspections. This tag should be durable and have information such as:

- the date of the last examination and test
- the date of the next examination and test
- who performed the examination and test.

Colour coded tags can be used to identify the examination and testing periods. Most construction and demolition sites will require these colour codes, as it is a requirement of the *AS/NZS 3012 Electrical installations – Construction and demolition sites*.

Records of examination and testing

Records of RCD tests (excluding the daily push button test for portable RCDs) are to be kept by the owner of the RCD for a period of five years.

Although it is not a mandatory requirement of the OHSW Regulations to keep records of examinations and tests for other electrical plant, it is good business practice as this will provide an inventory of all electrical plant.

It is most important that the 'scope' of this Standard is properly applied in its entirety. If only the first paragraph of the scope is applied, then this wide-ranging statement of generic types of equipment could lead to the testing of practically every item of electrical plant. However, the remaining paragraphs of the scope provide broad descriptions of hazards and risk environments in which these generic types of equipment are being used. This focuses the application of the Standard from the wide-ranging generic approach to a specific hazard management basis.

It should also be noted that if proper implementation of the hierarchy of controls is in place, then the application of engineering controls would reduce the purchasing of electrical plant that requires testing under the OHSW Regulations and *AS/NZS 3760*.

8. RESIDUAL CURRENT DEVICES (RCDs) - SAFETY SWITCHES

When RCD protection is required

The Occupational Health, Safety and Welfare Regulations, 1995, intend that where electrical risks are still present:

- after the proper monitoring, maintenance and testing of fixed-wiring installations, and electrical plant; and
- after the application of the hierarchy of controls

the risk must be controlled, so far as is reasonably practicable, by the installation of a Type I or Type II RCD. RCD installation is therefore a risk control measure, further to hazard identification and the risk assessment process.

The following is a list of generally identifiable risks that require RCD protection:

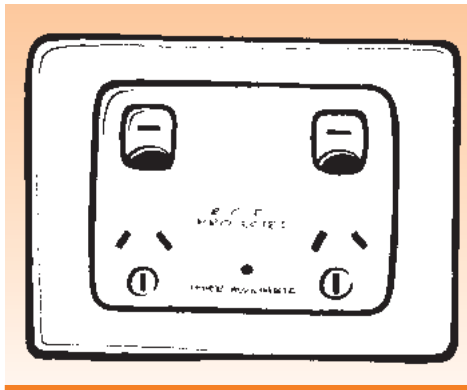
- all hand-held electrical plant
- portable electrical plant that is moved while in operation
- electrical plant that is moved between operations in such a manner that damage to the electrical plant or flexible supply cord could reasonably occur
- electrical plant where the electrical safety performance could be affected by the operating environment.

This does not necessarily include all electrical plant that might be generically classified as in the above criteria. Electrical plant that is not actually moved as part of its normal usage will probably not require RCD provision as there may be insufficient risk associated with its operation to justify RCD protection.

This would include items such as stationary fridges, freezers, facsimile machines, personal computers or other electrical plant permanently stationed in non-hazardous environments such as office workstations.

Labelling of RCD protected socket outlets

The labelling of all socket outlets that are protected by a non-portable RCD is not mandatory but is advisable. This will indicate to the person using the socket outlet that a non-portable RCD is fitted. An example would be 'RCD Protected' or something similar for easy recognition.



Portable or non-portable RCDs

RCDs and new electrical installations

Non-portable RCDs are required for new electrical installations where the supply of electricity in any situation in a workplace is through a socket outlet not exceeding 20 amps, to electrical plant identified above in 'When RCD protection is required'.

RCDs and modifications to existing electrical installations

Non-portable RCDs are required for a new or modified circuit on an existing electrical installation where the supply of electricity in any situation in a workplace is through a socket outlet not exceeding 20 amps, to electrical plant identified above in 'When RCD protection is required'.

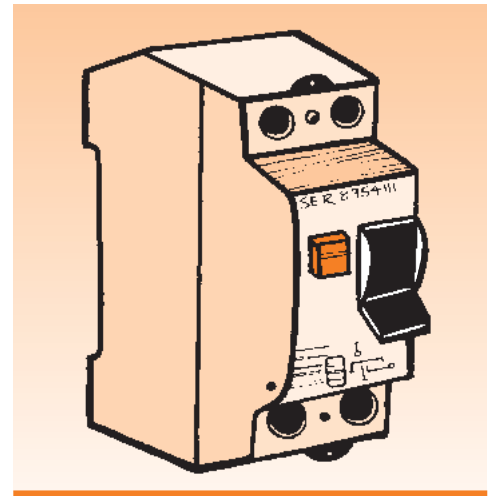
RCDs and existing electrical installations

Non-portable (preferred) or portable RCDs can be used for existing electrical installations where the supply of electricity in any situation in a workplace is through a socket outlet not exceeding 20 amps, to electrical plant identified above in 'When RCD protection is required'. Note, if portable RCDs are used they must be Type II and connected at the socket outlet supplying electricity to the electrical plant.

RCDs on construction and demolition sites

As construction and demolition sites represent a greater risk of electric shock the requirements for RCD protection are greater.

Construction and demolition sites that are within the scope of *Australian Standard AS 3012; Electrical Installations - Construction and Demolition Sites* must comply with the requirements regarding portable RCDs, as well as the requirements relating to the provision of RCDs set out in that standard, except in the circumstances where final sub-circuits to single socket outlets may be fitted with a common RCD.



Selecting the right RCD

Advantages and disadvantages of non-portable and portable RCDs

The four basic methods of RCD provision together with their advantages and disadvantages are as follows.

Non-portable RCD installed on main switchboard

Advantages

- Permanent within the installation, it protects fixed-wiring faults as well as electrical plant faults. It is usually inaccessible except to a key holder to the main switchboard. Testing to *AS/NZS 3760* is necessary only once every three years.
- This can be an effective and economic safety solution if the existing switchboard can accept installation without major modification and if RCDs are required on all the circuits supplied from the main switchboard.

This type of RCD can be used for new, modified or existing installations where the socket outlet is beside the electrical plant requiring RCD protection.

Disadvantages

- It protects all sockets downstream. There is the possibility of nuisance tripping, which could trip important electrical plant or fridges etc. Fault detection and isolation can be complicated. It can be expensive if the switchboard cannot easily accept their installation.

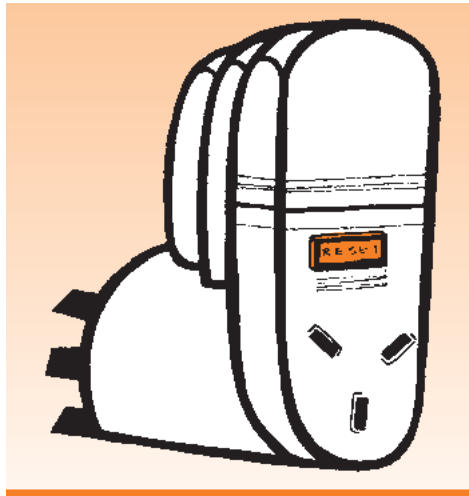
Non-portable RCD within-socket outlet

Advantages

- Permanent within the installation. No further RCD protection would be required as the RCD is always there. This type will ensure the RCD is used without the operator even knowing they are protected (apart from an indicator light and label) and therefore suitable for areas where the work environment is used in many different ways or uncontrolled areas such as public places.
- It is readily accessible for function test and re-set. Testing to AS/NZS 3760 is necessary only once every three years. This can be a safe and cost effective alternative if the switchboard option is a problem.
- Probably the most cost-effective RCD protection as it is permanent and protects everything plugged into it and is visible to the operator. This type of RCD can be used for new, modified or existing installations where the socket outlet is beside the electrical plant requiring RCD protection.

Disadvantages

- It provides only limited fixed-wiring protection. Fault detection and isolation might be complicated.



Portable plug type

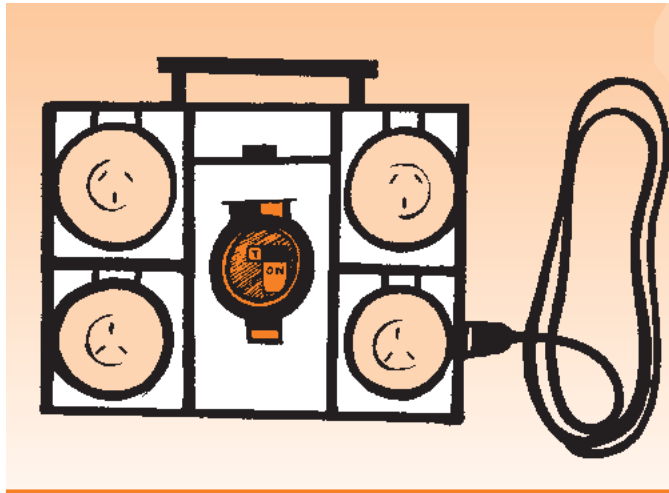
Advantages

- 'Permanent' but portable. Will protect the electrical plant connected and ensures the RCD is used at all times when the electrical plant is in operation.
- Very good RCD protection for electrical plant used in work environments where the operator is uncertain whether an RCD could be fitted to the fixed-wiring installation.

This type of RCD can be used for existing installations where the socket outlet is beside the electrical plant requiring RCD protection.

Disadvantages

- It provides no fixed-wiring protection. If these plug type RCDs are installed directly onto appliance connection cords it may be difficult to test the RCD.



Portable stand-alone unit

Advantages

- These are adaptable for use in specific situations when it is not known whether another RCD facility has been provided. It is useful to allocate them to operator personnel rather than to every electrical plant. Tradesmen extensively use these types as they provide a number of protected socket outlets from the one RCD unit.

This type of RCD can be used for existing installations where the socket outlet is beside the electrical plant requiring RCD protection.

Disadvantages

- They provide no fixed-wiring protection, may be subject to breakage and might not be used. They can regularly go missing or be left behind. Frequent testing is required. They can be less economical if many items of electrical plant require protection.

How RCDs operate

A residual current device (RCD) relies on the balance between the current in the active conductor and the current in the neutral conductor being the same. The sensitivity of the RCD is set at a predetermined level of current and duration of leakage that is sufficiently sensitive to provide personal protection.

If an imbalance is detected between the active and neutral conductor a switch will break open on the active conductor and shut down the circuit, rather than relying on the fuse or circuit breaker to isolate or switch off the electricity supply, which is often too late.

For a Class I appliance where the earthing conductor is sound, and a fault occurs between active and neutral, the earth will carry sufficient fault current to cause the circuit breaker or fuse to open the circuit and leave it safe. If the earth conductor has been damaged and is unsound or broken, the earth conductor may not carry sufficient current to operate the circuit breaker or fuse.

If there is an RCD in the circuit, the RCD will sense the leakage to earth at a much lower level of current and break the circuit, leaving it safe.

With double-insulated (Class II) equipment if the functional insulation fails then there is protective insulation to physically protect the live conductors.

For double-insulated equipment, repairs should be carried out as soon as the functional insulation of the appliance has failed to ensure the continued safety of the appliance. However, if severe damage to the appliance has occurred and live parts are exposed, then body contact could provide a path to earth.

In these situations an RCD should provide protection. However, if there is no leakage path to earth and live parts of different polarity are contacted, a highly dangerous short circuit through the body could result in sole reliance on the circuit breaker to close the circuit.

Types of RCDs

Selecting the right RCD is a critical decision as there are many types of RCDs, some of which are not designed to operate quickly enough to protect the operator. There are four sensitivities specified in *AS 3190 Approval and Test Specification for Current Operated (Core-Balance) Earth-Leakage Devices* for the different types of RCDs based on their intended operating situation.

Type I

These are RCDs with a residual current rating not exceeding 10 milliamps and a tripping time within 30 milliseconds. This is the most sensitive operating criteria for RCDs and is required for electrical plant that is directly connected to people, such as patient treatment areas of hospitals and dental practices.

Type II

These are RCDs with a residual current rating greater than 10 milliamps but not exceeding 30 milliamps and tripping time within 300 milliseconds.

This is the most suitable class of RCD for personal protection. Provision of either a Type I or Type II is required within the OHSW Electrical Regulations.

Type III

These are RCDs with a residual current rating greater than 30 milliamps but not exceeding 300 milliamps, tripping within 300 milliseconds. This type of RCD would normally be installed on a main switchboard.

It is intended for protection against indirect contact with live parts or where a high-standing leakage current exists, perhaps from the use of several appliances, which would cause a Type II RCD to nuisance trip. In these situations an individual portable Type II RCD on a particular appliance will provide better personal protection.

Type IV

These are RCDs with a residual current rating greater than 30 milliamps but not exceeding 300 milliamps with selective tripping between 50 and 150 milliseconds. These are intended for similar use as Type III RCDs, as back-up protection to Type II RCDs or for fire prevention and installation protection on circuits where no other type of RCD is installed. Type IV may not be suitable for personal protection.

Exemptions from RCD protection

There are certain circumstances where RCDs are not required due to the voltages used or in situations where the RCD will not operate. The following criteria for situations where RCD protection is not required applies where the supply of electricity to electrical plant is:

- to an extra low voltage system which is electrically separated from earth and from other systems in such a way that a single fault cannot give rise to the risk of electric shock
- direct current (DC)
- provided through an isolating transformer that complies with *AS/NZS 3108 Approval and Test Specification – Particular requirements for isolating transformers and safety isolating transformers*
- provided from a portable generator complying with *AS 2790 Electricity generating sets – transportable (up to 25kW)*.

WARNING

It is important that the risks associated with the hazards of these electrical installations listed above are identified, assessed and controlled prior to the connection of electricity and monitored on a regular basis.

Building owner or employer? The legal responsibility for providing RCDs in the workplace

It is likely that the person with day-to-day control of activities involving electrical supplies will be the employer. However Regulation 1.2.5 and Schedule 1 of the OHSW Regulations, 1995, involve building owners in providing safe buildings and fixtures or fittings.

By allowing the use of portable RCDs in existing installations, there are many scenarios where the safest and least expensive method of controlling risks may be the provision of non-portable RCDs.

However, owners and tenants may choose to cooperate in permanently modifying the existing electrical installation(s) with non-portable RCDs rather than individual tenants resorting to multiple portable RCDs.

9. THE COMPETENT PERSON - WHO CAN EXAMINE AND TEST?

The *OHSW Regulations* define a **competent person** as a person who is suitably qualified (whether by experience, training or both) to carry out the work or function described in the relevant regulation.

Examination and testing can be conducted by a person the employer considers competent having the necessary skill, training or experience to conduct the tests. The competency table below identifies the level of competency required to perform certain tasks.

A person who is familiar with the electrical plant can perform the visual examination for hazards, such as external damage or frayed insulation.

Tests requiring electrical measurements should be done by someone with the understanding and ability to assess the hazards involved with particular electrical plant. The person should be trained in the use of the test equipment and procedures and be assigned this task as part of their job description.

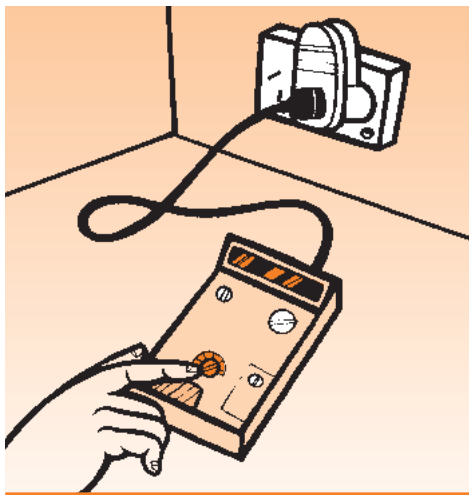
On the same basis it would be advisable that the person who carries out the visual inspections and testing of electrical plant also visually monitors the fixed-wiring installation condition.

It may be necessary in some circumstances, given the nature and complexity of the electrical plant in use and the complexity of hazards associated with them, to consider periodic testing by a registered electrical worker or professional appliance tester.

In large organisations with substantial fixed-wiring installations and electrical plant requirements (eg, a large workshop, factory or analytical laboratory) the workplace might be subdivided into several suitably sized designated areas.

Supervisory staff who have a day-to-day working knowledge of the installation and appliance requirements of the area should be trained to supervise the electrical safety of the designated area, including the visual monitoring of fixed-wiring installations and testing of electrical plant. It is advisable to keep a register of persons considered competent to perform these tasks.

Switchboard RCDs protecting fixed-wiring and fixed equipment may need to be performance-tested by a registered electrical worker. However, switchboard RCDs protecting socket outlets may be tested by a competent person using appropriate test equipment, although some switchboards may be accessible only to authorised persons due to exposed live conductors.



COMPETENT PERSON TABLE

| Task | Type of work | Competency level required |
|--|----------------------------|---|
| Routine examination of electrical equipment. <i>Checking for external damage, frayed or damaged cords etc</i> | <i>Non-electrical work</i> | Person who is familiar with the equipment. This could be the user of the equipment |
| Protective earth testing of equipment to AS/NZS 3760 | <i>Non-electrical work</i> | Person who is trained in the use of earth testing meters such as a continuity meter or ohmmeter |
| Insulation resistance testing of equipment or isolation transformers to AS/NZS 3760 | <i>Non-electrical work</i> | Person who has been trained in the use of insulation resistance testing meters, such as an insulation resistance meter or appliance tester |
| Push button test of portable RCDs | <i>Non-electrical work</i> | Person who is using the RCD and has been instructed how to use the built-in test button |
| Performance test of portable RCDs. <i>Measure the tripping time and tripping current to AS/NZS 3760</i> | <i>Non-electrical work</i> | Person who is trained in the use of an RCD tester. This training could be by in-house personnel, qualified electrician, TAFE or by the supplier of the RCD tester |
| Push button test on non-portable RCDs | <i>Non-electrical work</i> | Person who is using the RCD and has been instructed how to use the built-in test button |
| Performance test of non-portable RCDs. <i>Measure the tripping time and tripping current to AS/NZS 3760</i> | <i>Non-electrical work</i> | Person who is trained in the use of an RCD tester. This training could be by in-house personnel, qualified electrician, and trade school or by the supplier of the RCD tester. A licensed electrician may be required if it is necessary to access the supply distribution board |
| Repair, alteration, testing or modification of the internal components of electrical plant, or fixed-wiring installation. <i>Examples include installation of power points, wiring of extension leads, repairs to electrical plant etc. to AS/NZS 3000</i> | <i>Electrical work</i> | For electrical work a competent person should meet the criteria of a non-electrical work competent person and have a suitable electrical licence as is required under the <i>Plumbers, Gas Fitters & Electricians Act 1995</i> which is administered by the Office of Consumer & Business Affairs |

10. WORK IN PROXIMITY TO ELECTRICAL HAZARDS

There are some electrical hazards which need to be considered even if the work task is not on the electrical installation or electrical plant. Work in proximity to electrical hazards can range from tree trimming near power lines to drilling a hole in a wall to fit a picture frame.

Both these examples have the potential to injure or kill an employee if the hazards are not appropriately controlled. The following requirements are to ensure that electrical hazards are not forgotten.



Hazard management and electrical hazards

When working in proximity to electrical hazards the *OHSW Regulations* require that hazard identification and risk assessments are conducted and appropriate risk control measures implemented. This may include de-energising the installation or installing protective covers over the power lines whilst the work is being completed.

* Work on construction and demolition sites carries additional requirements specific to that industry. Please refer to the 'Industry Guideline Electrical practices for construction and demolition sites' also produced by WorkCover Corporation.

WorkCover Corporation

100 Waymouth Street, Adelaide
South Australia 5000

General enquiries: 13 18 55

Fax: (08) 8233 2211

info@workcover.com

www.workcover.com

TTY calls: (08) 8233 2574 for people who are deaf or have hearing/speech impairments.

Non-English speaking: (08) 8226 1990 for information in languages other than English, call the Interpreting and Translating Centre and ask them to call WorkCover. This service is available at no cost to you.

The information produced by WorkCover Corporation of South Australia in this publication is correct at the time of printing and is provided as general information only.

© WorkCover Corporation of South Australia, 2003

All rights reserved

ISBN: 1 877016 22 5



Supported by
**Government
of South Australia**