

Electrical Safety Code of Practice 2010

Electrical Work

Electrical Safety Office Queensland

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Part 1 : Introduction

1.1 Application and scope of Code

- This *Electrical Safety Code of Practice 2010 - Electrical Work* (the Code) replaces the *Code of Practice - Electrical Work 2002*.
- This Code was made on 18 December 2009.
- This Code commenced on 1 January 2010.
- This Code expires 10 years after the above commencement date.

1.2 Legislative framework

The Queensland *Electrical Safety Act 2002* (the Act) is directed at eliminating the human cost to individuals, families and the community of death, injury and destruction that can be caused by electricity not only in workplaces, but throughout the community.

The Act sets out the obligations that entities, employers, employees, workers, designers, manufacturers, importers and persons in control of electrical equipment must meet in order to comply with the requirements of the law.

The fundamental principle of the legislation is to set legal requirements to ensure the electrical safety of licensed electrical workers, other workers, licensed electrical contractors, consumers and the general public.

The *Workplace Health and Safety Act 1995* (WHS Act) places obligations on certain persons to ensure health and safety in the workplace. Workplace health and safety is ensured when persons are free from death, injury or illness and the risk of death, injury or illness created by workplaces, relevant workplace areas, work activities or plant or substances for use at a workplace.

In terms of electrical safety, where the Act and the WHS Act both apply, the Act takes precedence.

The *Electrical Safety Regulation 2002* (the Regulation) prescribes, among other things, the requirements for working around live electrical parts.

While this Code gives practical advice on ways to manage obligations of the Act, it does not provide advice about all electrical safety obligations. Four other codes of practice made under the Act are:

- *Electrical Safety Code of Practice 2010 - Working Near Exposed Live Parts*
The *Electrical Safety Code of Practice 2010 - Working Near Exposed Live Parts* gives practical advice on ways to manage electrical risk when working **near** exposed live electrical parts. The code applies to people such as plant operators, painters, people erecting or working on scaffolds, sign makers and people working with irrigation pipes near exposed live electrical parts. The practical guidance provided in the code may be relevant to electrical workers when they are performing electrical work near another exposed live part.
- *Electrical Safety Code of Practice 2010 – Electrical Equipment Rural Industry*
The *Electrical Safety Code of Practice 2010 – Electrical Equipment Rural Industry* gives practical advice on a way of discharging a person’s electrical safety obligation. Included in the code are ways to identify and manage exposure to risks of injury and property damage caused directly or indirectly by electricity.
- *Electrical Safety Code of Practice 2010 - Works*
The *Electrical Safety Code of Practice 2010 - Works* provides practical advice for an electricity entity to manage electrical safety risks associated with earthing systems, underground cable systems and supporting structures of overhead lines forming part of the works of an electricity entity.
- *Electrical Safety Code of Practice 2010 – Risk Management*
The *Electrical Safety Code of Practice 2010 – Risk Management* gives practical ways of managing electrical safety risks. The code clearly defines and explains the five step risk management process that obligation holders under the Act should perform to make sure all electrical risks are minimised.

References to legislation, Australian Standards and other documents in this Code are current at the time of printing. From time to time, amendments are made to legislation. The user should therefore check to ensure applicable legislation is current at the time of reading.

1.3 What is a code of practice?

A code of practice is a document made under section 44 of the Act. It gives practical advice on ways to discharge electrical safety obligations. Included in a code are ways to identify and manage exposure to risks of injury and property damage caused, directly or indirectly, by electricity.

Under section 45 of the Act, the code of practice does not state all that a person must do, or must not do, to discharge their electrical safety obligation.

However, the person fails to discharge the electrical safety obligation if they:

- contravene, or otherwise act inconsistently with, the code of practice; and
- do not follow a way that is as effective as, or more effective than, the code of practice for discharging the electrical safety obligation.

1.4 What is this Code about?

This Code provides practical advice and gives benchmarks for performing electrical work in ways that are electrically safe. It provides guidance on managing electrical risk only; no guidance on other risks is provided. This Code has been designed to reflect the two ways to perform electrical work: working de-energised and working live.

Appendix A contains the meaning of terms used in this Code.

1.5 This Code includes

This Code applies to:

- electrical workers;
- employers of electrical workers and self-employed electrical workers;
- electrical contractors; and
- persons not required to hold an electrical work licence under section 55 of the Act.

This Code focuses only on the electrical aspects of work performed by the following classes of licence:

- restricted electrical work licence holders;
- electrical work training permit holders;
- licensed electrical linespersons;
- licensed electrical jointers;
- licensed electrical fitters; and
- licensed electrical mechanics.

1.6 This Code does not include

- Approved work performed under a high voltage live line management plan, as prescribed in section 13 of the Regulation, is not covered by this Code. However, high voltage live line workers are subject to this Code for electrical work activities while not performing high voltage live line work. Information on high voltage isolation and access is contained in Appendix B.4.
- Functional operations such as switching performed regularly to operate electrical equipment are not covered by this Code. However, switching to provide electrical access is part of this Code.
- Practical guidance provided in the *Electrical Safety Code of Practice 2010 – Working Near Exposed Live Parts* may be relevant to electrical workers when they are performing work on either live or de-energised parts.
- Apart from correct connections (including polarity) this Code does not address the inspection and test procedures detailed in section 8 of AS/NZS 3000¹.
- This Code does not cover general health and safety matters, such as preventing falls from heights. These requirements can be supplied by the Department of Justice and Attorney-General's Workplace Health and Safety Queensland. This information may be obtained online at www.worksafe.qld.gov.au.
- Information may also be found from sources including:
 - Safe Work Australia;
 - Electricity Networks Association;
 - Australian Radiation Protection and Nuclear Safety Agency; and
 - Standards Australia.

¹ Further information on inspection and testing can be obtained from codes and standards produced by other sources including: Manufactures and suppliers, Electricity Networks Association of Australia, Standards Australia; and other relevant industry associations.

1.7 How is this Code set out?

- Parts 1 and 2 outline general information about the Code, the legislation and risk management.
- Parts 3 and 4 provide guidance on working de-energised and working live.
- The appendices contain definitions and further guidelines on how to perform work that is electrically safe along with relevant parts of the Act and the Regulation.

1.8 What is ‘electrical work’?

The definition of electrical work from section 18 of the Act is contained in Appendix A: Meaning of terms used in this Code.

1.9 Obligations under the *Electrical Safety Act 2002*

Sections 29 to 40 of the Act impose obligations on persons who may affect the electrical safety of others by their acts or omissions.

For example, an employer has an obligation to ensure their business or undertaking is conducted in a way that is electrically safe. This includes identifying electrical risks, assessing the risk of injury or property damage that may be attributed to risks and taking necessary actions to minimise exposure to the risk.

The full list of obligation holders is included in part 2, division 2, of the Act.

1.10 How can I meet my obligations?

Under sections 41 to 45 of the Act, there are three methods outlined to assist you in meeting your electrical safety obligations: through either regulations, ministerial notices, or codes of practice.

Where applicable, you must comply in the following manner to meet your obligations.

- If a regulation is identified as prescribing a way of discharging your electrical safety obligation, you will fail to meet your obligation if you contravene the regulation.

- If a ministerial notice prescribes a way of meeting an electrical safety obligation in relation to an electrical risk, you will fail to meet that obligation if you contravene the ministerial notice.
- If a code of practice states a way of meeting your electrical safety obligation, you will fail to meet that obligation if you:
 - contravene the code or act in a way inconsistent with the code; and
 - do not follow a way that is equally effective to, or more effective than, the code of practice for discharging your electrical safety obligation.

If this Code is inconsistent with the Regulation, then the Regulation prevails to the extent of the inconsistency.

If this Code and the Regulation are inconsistent with a ministerial notice, the ministerial notice prevails to the extent of the inconsistency.

You should also refer to Part 2 of this Code on risk management for meeting your obligations generally.

1.11 Defences for failing to meet your electrical safety obligation

Under sections 46 and 47 of the Act, if charged with a breach of obligation, you can provide a valid defence by establishing that the offence was due to causes beyond your control. In this instance, you cannot claim as a defence those sections of the Criminal Code relating to an accidental act or omission, or a mistaken belief.

Where there was no regulation, ministerial notice or code of practice that told you how to meet your electrical safety obligation under the circumstances, you can seek to establish that you chose an appropriate way, took reasonable precautions and exercised proper diligence to discharge the safety obligation.

1.12 Penalty for failure to meet your electrical safety obligation

Under section 27 of the Act, a person on whom an electrical safety obligation is imposed must discharge the obligation.

Maximum penalty:

- if the breach causes multiple deaths: 2000 penalty units or three years imprisonment;
- if the breach causes death or grievous bodily harm: 1000 penalty units or two years imprisonment;
- if the breach causes bodily harm: 750 penalty units or one year's imprisonment; or
- otherwise: 500 penalty units or six months imprisonment.

This Code should be read in conjunction with the Act, the Regulation, and other relevant codes of practice. Hard copies of these documents are available from the Queensland Government Bookshop by phoning (07) 3883 8700 or 1800 801 123 (outside Brisbane), or by visiting www.bookshop.qld.gov.au.

Further information on electrical safety is available from the Department of Justice and Attorney-General website at www.electricalsafety.qld.gov.au or by phoning the Infoline on 1300 650 662.

Part 2 : Risk Management

'Risk management' is defined by the Australian / New Zealand Standard *AS/NZS ISO 31000:2009 Risk Management* as 'the coordinating of activities to direct and control an organisation with regard to risk'.

The term 'hazard' is often used as an identifier of potential sources of risk. However in the practical application of risk management principles, it is the risk itself that must be addressed. The *AS/NZS ISO 31000:2009 Risk Management Standard* (the Standard) refers to the identification of risk, while the term hazard is used in Workplace Health and Safety and Electrical Safety legislation in the same context. Similarly, 'risk control' is referred to in the Standard as 'risk treatment'. These distinctions are definitional only and the terms 'risk' and 'treatment' are used in this code for the purposes of clarity and consistency with the Standard.

The risk management process required by the WHS Act is systematically divided into five steps:

1. identify hazards (risks under the Standard), based on experience, recorded data and other information;
2. assess risks that may result because of the hazards (risks) by making an evaluation of the level of risks to the health and safety of workers, based on the consequences and likelihood of harm;
3. decide on control measures (risk treatment measures under the Standard) from the hierarchy of control (risk treatment hierarchy) i.e. eliminate, substitute, isolate or engineer out the risks, or reduce them through administrative measures or personal protective equipment to prevent or minimise the level of the risks. This should be achieved by selecting the highest order control (treatment) method possible and then proceeding down the list in order;
4. implement the selected control (treatment) measure(s) in the workplace; and
5. monitor and review the effectiveness of the control (treatment) measures to ensure that they are working correctly to control the risks and that no other risks have been introduced.

NOTE: Compliance with the risk management process does not excuse a person from ensuring workplace health and safety or from complying with an obligation under the Act.

Effective risk management involves identifying all of the risks in the workplace, and then carrying out a risk assessment for each, to assess its severity, before deciding its priority for treatment. When carrying out a risk assessment, determine the risks that have the greatest potential to cause harm and a greater likelihood of occurring. These risks are controlled (treated) first, followed by the less serious risks.

Attention should be given to risks that may be easy to fix but may have low risk priority scores (e.g. power leads across the floor). These risks should be fixed promptly. Particular attention should be given to risks that may have very low likelihood of causing harm but may result in major consequences.

The Act requires that electrical work and associated equipment be electrically safe (sections 29 to 40); that is, free from electrical risk. Electrical risk can be managed through the risk management process as described below. Specific applications of the risk management process are covered in relevant following parts.

In many circumstances, the risks associated with undertaking electrical work near exposed live parts can be equivalent to those associated with live electrical work. Evaluation of the risks and development of risk treatment measures as described in Part 5 of the *Electrical Safety Code of Practice 2010 - Risk Management* will provide assistance in developing safe work practices.

2.1 Risk

Risk is the likelihood and consequence of injury or harm occurring.

For example, if the risk is electricity, there the likelihood that a worker might be electrocuted because of the exposure to electrical live parts.

The degree of risk will depend on the amount of exposure to the risk. With regard to electricity, this would relate to aspects of the electricity i.e. voltage, frequency of exposure, and degree of risk treatment measures in place.

2.2 The risk management process

Effective risk management involves identifying all of the risks in the workplace and then carrying out a risk assessment for each, to assess the severity of a risk, before deciding its priority.

When carrying out a risk assessment, determine the risks that have the greatest potential to cause harm and a greater likelihood of occurring. These risks are treated first, followed by the less serious risks.

As set down in the *Electrical Safety Code of Practice 2010 – Risk Management*, there are five basic steps in the risk management process:

Step 1 - Identify all risks by:

- observing, inspecting, investigating, communicating and consulting; and
- making a record of the risks identified.

Step 2 - Assess the risks by:

- assessing and prioritising the risks;
- dealing with the highest priority risks first; and
- dealing with less risks or least significant risks last.

Step 3 - Decide on measures to treat the risks by:

- eliminating the risk;
- if elimination of the risk is not possible, select these risk treatment measures in the following order of preference:
 - substitution e.g. using machines with better guarding or using an instrument with a higher installation category;
 - isolation (not administrative) e.g. remove or separate people from the risk;
 - minimisation by engineering e.g. modify a switchboard to reduce the amount of exposed live parts;
 - application of administrative measures e.g. using signs, training or policies to treat risk; and
 - use of personal protective equipment (PPE), equipment or clothing designed to protect the worker.

Step 4 - Implement appropriate risk treatment measures that will:

- adequately treat the risks;
- not create other risks; and
- allow workers to do their work without undue discomfort or distress.

Step 5 - Monitor the risk treatment measures and review the process:

A: Monitor

- Have the treatment measures been implemented as intended?
- Are the treatment measures adequate?
- Did the implementation of treatment measures create other risks?

B: Review

- Has anything changed over time since the risk process was implemented?
- Is the treatment of risks still adequate?
- Was the risk management process conducted effectively?

For further information on risk management and guidelines on how to complete a risk assessment, please refer to the *Electrical Safety Code of Practice 2010 - Risk Management*.

The five step risk management process is illustrated in Figure 1.

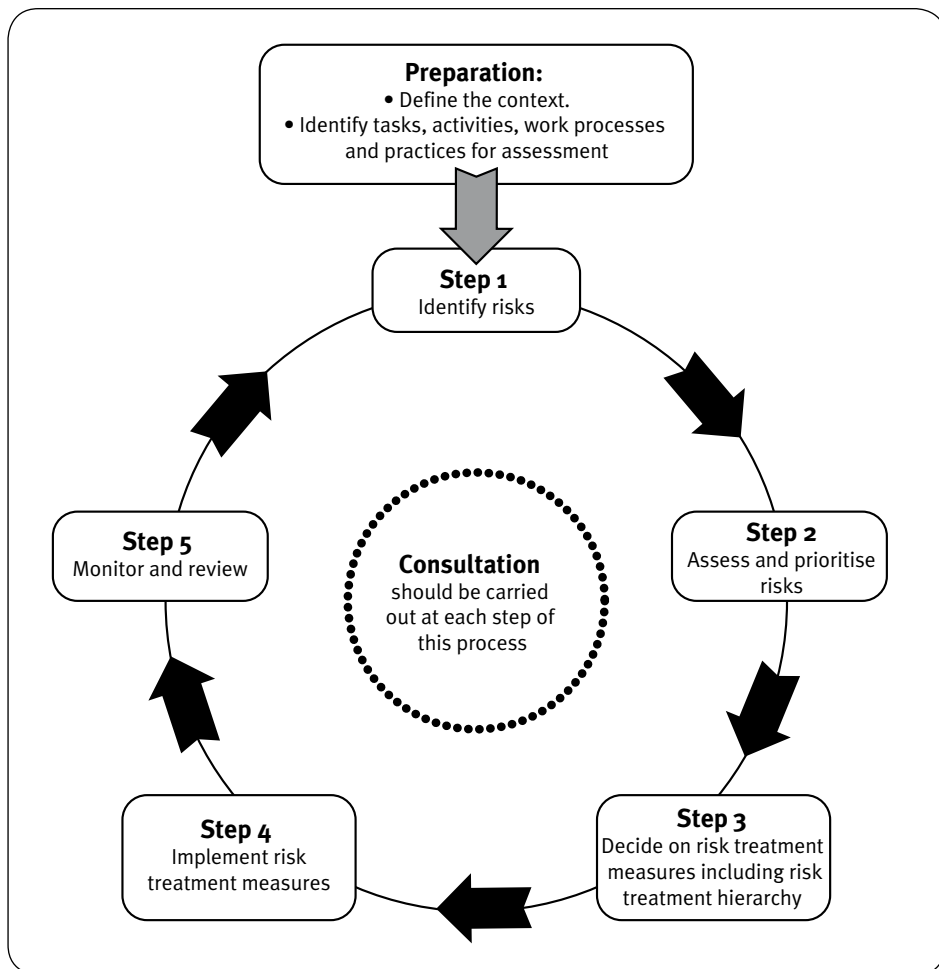


Figure 1: The five step risk management process

2.3 Common electrical risks

2.3.1 Electrical risks and causes of injury

The common electrical risks and causes of injury can be broken into three broad categories. These categories are:

- **Electric shock** causing injury or death. The electric shock may be received by direct contact, tracking through or across a medium, or by arcing.
- **Arcing, explosion or fire** causing burns. The injuries are often suffered because arcing or explosion or both occur when high fault currents are present.
- **Toxic gasses** causing illness or death. Burning and arcing associated with electrical equipment causes a range of gases and contaminants to be present. Compounds ranging from ozone to cyanide and sulphuric acids can be present as well as the risks such as low oxygen content in the air.

The three common electrical risks may be present individually or combined.

For example, if a fault occurred in the main switch-room of a large shopping centre all three of the electrical risks could be present. The presence of step and touch potentials should be addressed as well as the potential for an explosion. Further, burning materials such as PVC and epoxy resins can cause the atmosphere to become hazardous.

Under section 11(2)(a) of the Regulation, parts that are normally energised or that may become energised under fault conditions **must** be treated as live until the parts are proven de-energised. The categories of common electrical risks, listed above, are relatively clear. However, as electricity is not usually detected by sight, smell or sound, the identification (or recognition of the potential) of the risks can be more difficult. Refer to Part 2.3 of this Code for guidance regarding the identification of risks and Appendix B for further information on electrical risks.

Areas, outside the scope of this Code, that should also be addressed include:

- The flammable atmosphere in battery rooms or hazardous locations.
- Working in confined spaces.
- Electric field strength and magnetic field strengths. These fields, especially if the source of the field is a direct current, can cause interference with cardiac pacemakers and other medically implanted electronic devices. Precautions should also be taken to prevent other risks such as flying metal objects.
- Preventing falls, e.g. when working at height.

- Use of explosive powered tools.
- Working on roadways.
- The use of hazardous substances such as poisons, chemicals, solvents, synthetic resins, forms of asbestos and polychlorinated biphenyls (PCB).
- The use of flammable gases such as liquid petroleum, oxygen, acetylene etc.
- The use of explosives.

2.4 Instruction, training and supervision

Under the *Workplace Health and Safety Act 1995*, sections 28 and 29, a person who conducts a business or undertaking must provide instruction, training and supervision to persons to whom they owe an obligation. Section 30 of the *Electrical Safety Act 2002*, which sets down the obligation of an employer to ensure their business or undertaking is conducted in a way that is electrically safe, includes an implied requirement to provide training to ensure that they meet their obligation.

Workers who are likely to be exposed to electrical risks and anyone supervising these workers should be trained and provided with information and instruction.

Training should be appropriate to the type of work to be performed. In some cases, formal training may be required. In others, on-the-job training may be more appropriate. The special needs of workers should be taken into account in deciding on the structure, content and delivery of training. This assessment should include literacy levels, work experience and specific skills required for a job.

Adequate and appropriate training is a way of managing the risks associated with electrical risks. This can be done by:

- determining who needs to be trained;
- determining what training is required;
- determining how training will be delivered;
- ensuring that the training is provided;
- evaluating the training; and
- keeping training records.

The amount of training will be determined by:

- the nature of the workplace risks;
- the degree of associated risk;
- the complexity of work, such as operating procedures and equipment;
- other risk treatment measures being implemented; and
- the qualifications and experience of the worker.

2.4.1 Types of training

There are different types of electrical safety training that have different purposes, including:

- **Induction training:** for workers when commencing employment or when new to the job. This training is general and may involve a workplace tour, and information about conditions of employment, administration, organisational structure, emergency procedures and workplace amenities.
- **Supervisor and management training:** provided to help ensure that the supervision and management of the electrical safety issues are appropriately carried out in the workplace.
- **Specific job training or familiarisation training:** providing information about the electrical and other risks associated with the job.
- **Specific electrical risk training:** providing information about the risks associated with working near exposed live parts.
- **Ongoing training or refresher training:** provided periodically to ensure that work continues to be performed safely.
- **Emergency procedures training:** provided to ensure workers know what to do in the event of an emergency, including identifying persons with specific emergency roles and responsibilities.
- **First aid training:** provided to ensure appropriate procedures are followed for administering first aid.
- **Job specific training required under a Regulation e.g. safety observer and high voltage live line work training.**

Part 3: Working De-energised

3.1 Scope

This part provides guidelines for creating an electrically safe work environment by removing sources of electrical risk by:

- de-energising low voltage; and
- de-energising and earthing high voltage parts.

These guidelines apply to both alternating and direct current systems.

3.2 Regulatory requirement

For regulatory information, refer to Appendix E for a list of relevant sections of the Regulation.

3.3 General

An employer or self-employed person should ensure that an effective process of isolation and access is used to protect electrical workers and others. A safe system of work should be developed with people who:

- are representative of the electrical workers; and
- have skills and knowledge in the area of work.

A person in control of electrical equipment should make sure that, where isolation and access is complex, there are sufficient instructions to ensure the process is performed safely.

Instructions for isolation and access should be documented where:

- complex isolation and access is to be performed;
- isolation and access is to be performed on a complex electrical system; or
- both of the above apply.

3.4 Low voltage isolation and access

3.4.1 Switching, de-energising and re-energising

As set down in section 12 of the Regulation, switching, de-energising and re-energising **must** be performed under a safe system of work including the preparation of a documented risk assessment.

Switching includes, but is not limited to, switching for isolation or return to service and synchronising. The electrical safety of workers and others should be addressed when switching.

Other electrical safety considerations that should apply to de-energising, the process of de-energising and re-energising connecting parts from all sources, include:

- the capacity of switching devices to make and break load currents, including in-rush currents;
- the capacity of switching devices to make and break fault currents;
- connecting sources that may not be synchronised or have the same phase relationship; and
- creating circulating currents within ring feeds of networks.

Contingency actions to be taken, should a fault occur. Examples include what form of action should be taken if:

- the main switch is a circuit breaker and the breaker trips the instant it is closed;
- if a thermal over load trips a motor; and
- a safety switch (residual current device) trips.

3.4.2 Isolating and disconnecting

Isolating

Subject to sections 11 and 12 of the Regulation, any parts worked on **must** be isolated and proved de-energised unless a safe system of work exists and permission has been granted to work live.

Before you carry out work that is de-energised, you must ensure that supply is effectively isolated. Under section 11(2) of the Regulation, each exposed part is treated as if it is energised until it is isolated and proved not to be energised.

Matters that should be addressed in the isolation process include:

- de-energising the parts from all sources of electrical potential; to effectively de-energise parts, a number of isolation points may be required;
- removing risks from other sources of energy e.g. spring tension or hydraulic pressure within mechanisms; and
- finally, conclusively proving that the parts are de-energised so that electric shock is not possible.

Both electrical and non-electrical workers should clearly understand the method or systems used to isolate and maintain isolation. Isolation points for the job should be explained and, where practical, shown to each of the workers.

A warning or safety sign should be attached in a prominent position on each isolation point or device.

Isolation can be achieved by methods or systems using locks or rendering the mechanism inoperable or a combination of these. In situations where isolation points are able to be accessed by other people, it is important that the isolation method or system is not able to be inadvertently or easily compromised.

Without proper authority, people should not alter, remove or change the status of a tag, lock, or the method used to render the mechanism inoperable.

Disconnecting

Under section 90(3) of the Regulation, out of service tags must be used to identify equipment or machinery that is faulty or not suitable for use and has been taken out of service. The electrical equipment or machinery must be isolated and tagged out of service.

Out of service parts should be left in a safe manner. Since out of service tags apply to electrical as well as non-electrical persons, the safety of all should be addressed.

Where isolation and access is required, the safe system of work should state whether tagging out of service is to occur in addition to isolation and access. Refer to Appendix B.2.5 for further information.

For example, tagging on the job of replacing a 45kW motor on a feedwater pump while maintenance is being performed on the intake 'foot valve' would include:

- circuits for the pump supply, starter control and control and telemetry circuits would be isolated and proved de-energised;
- out of service tags would be placed in key locations e.g. on the starter; and
- personal tags, locks, methods of rendering the mechanism inoperable, or a combination of these would then be installed.

3.4.3 Proving de-energised

Under section 11(2)(a) of the Regulation, exposed parts **must** be proved de-energised before work begins. Within the electricity industry, an extensive range of devices can be used to prove parts de-energised. In general, when proving de-energised, a worker should at least know:

- How to determine whether the device is fit for purpose.
- How to determine whether the device is within test, inspection or calibration dates, as applicable.
- How to correctly operate the device, including self test functions, as applicable.
- The technical limitations of the device, tester or equipment used:
 - the threshold value of pick-up for the device e.g. for series test lamps indication of voltages, can depend on the operator and light conditions;
 - whether the device will detect the presence of DC on AC circuits and vice versa;
 - whether the device indicates induction on a circuit;
 - whether a clean connection is required for accurate readings; and
 - if the device is to be used outdoors, whether the device is water resistant or waterproof.
- The actions required to complete the process of confirming the tester is operating correctly, prove de-energised and re-confirm the tester. These actions should include being able to determine:
 - Is the use of self-test mode preferred to testing the device on a known live source?
 - How can the device be proven if there is no self-test mode and no known source of supply?
 - The sequence of actions required to prove the part de-energised.

- What is deemed a conclusive test i.e. there is conclusive proof that the part is de-energised.
- What is deemed an inconclusive test or incorrect test and what action should be taken to resolve the situation.

The method used to prove de-energised must be effective. For example, a panel voltmeter should not be used as the only indication that a part is de-energised.

Proving cables de-energised before work

Where work is to be performed on a cable, the cable should be de-energised. If the cable's connections are exposed, the connections and attached live parts should be proved to be de-energised and identified before work starts.

Cutting cables

Particular attention is drawn to cutting cables. Both ends of the cable should be checked for isolation prior to cutting.

Ensuring that an insulated or covered cable is de-energised can present difficulties. Additional precautions should be taken regardless of whether the cable is low voltage, high voltage or a control cable.

For example, the action of cutting a multi-core control cable is likely to create a risk if secondary current from a current transformer is present. This risk may not be initially apparent i.e. the cable cutters may not be damaged when the cable is cut. A high voltage may develop across the open circuited secondary winding causing an electric shock, arcing or a fault at a later stage.

Depending on the situation, alternative precautions may include:

- using a cable spiking or stabbing device that is fit for purpose; or
- a combination of proving de-energised and physically tracing the cable.

3.4.4 Altering isolation for testing, fault finding and energising

At times electrical workers need to alter isolation to be able to test or fault find, or both, on energised parts. Typical examples are the testing performed before returning equipment to service and commissioning new equipment.

Testing, faultfinding or both, and the alteration of isolation points should be performed in line with a safe system of work. The safe system should address and control exposure to electric shock and electrical explosion.

Matters that should be addressed when isolation points are altered include:

- ensuring the isolation system or method is effective and not compromised;
- eliminating access to the equipment for all persons not directly involved in the work; and
- contingency plans if the test fails or a hazardous situation is discovered.

Refer also to Part 4.5 of this Code for details of risks associated with testing and fault finding.

Part 4 : Working Live

4.1 Scope

This part provides guidelines for safe electrical work practices when carrying out low voltage live work, within the restrictions set down by the Regulation. The part covers:

- important issues when working live;
- the selection and use of tools, instruments and equipment for live work; and
- testing and faultfinding (this part includes the importance of testing to confirm correct connections – including polarity test – to ensure electrical safety).

4.2 Regulatory requirement

For regulatory information, refer to Appendix E for a list of relevant sections of the Regulation.

4.3 Important issues when working live

4.3.1 Documentation

If it is not possible to work de-energised the decision to work live must be documented. The occasions that live work is permitted is restricted by section 12 of the Regulation. Section 12 of the Regulation also has a number of requirements e.g. a safe system of work must exist before working live. The development of a safe system of work includes the preparation of a documented risk management strategy. A safe system of live work should be developed with people who:

- are representative of the electrical workers; and
- have skills and knowledge in the area of work.

Risk treatment measures chosen for live work should not rely solely on items such as flame retardant or flame resistant clothing and PPE. Appropriate treatment measures can include:

- isolating as many of the sources of electric potential as possible; this may involve working live, though surrounding parts need not be live;

- reducing the fault level e.g. performing the work out of hours when the supply can be fed from only one transformer or a generator;
- using a safety switch (residual current device) e.g. testing an appliance; and
- in situations where uninterruptible power supplies, backup generators, auto re-closing, or auto change over systems are installed, these facilities should be disabled.

4.3.2 Conductive materials

Workers can be exposed to the risks of electric shock, arcing and explosion without making direct contact with exposed live parts. Other materials can provide current paths for the electric shock, fault current, or both.

All materials should be regarded as conductive, unless proved otherwise. Gases and liquids should be regarded as conductive materials.

Particular care should be taken when exposed live parts are near earthed situations. The electric shock path to earth can be via conductive materials, such as concrete, timber with a high moisture content or water.

Metallic personal items, such as watches and watchbands, should not be worn when working near exposed live parts. Objects of this kind can result in electric shocks. In addition, burns sustained near these items can be worse because the objects retain heat and provide contact points for current to flow.

Examples of other metal objects that should not be worn when performing electrical work include:

- neck chains;
- rings;
- bracelets;
- earrings;
- body piercings; and
- metal spectacle frames.

4.3.3 Work position

To prevent electric shock, you should work from a position where any contact with electricity would require a deliberate movement to touch energised parts or create a current path. Adequate working clearance to allow safe access and egress from the work position, in the case of an emergency, should be maintained.

Examples:

- Choice of body position should be such that if you made an involuntary action such as sneezing, you would not touch exposed live parts e.g. fault finding on a Programmable Logic Controller (PLC) whose inputs are next to live exposed parts.
- When working in an awkward position – such as testing components towards the rear of a washing machine via the front panel e.g. in a laundromat – the work system, including body position, should be such that no electric shock path can be created.
- Performing phase sequencing or rotation testing on overhead mains or at an underground pillar, the work system, including body position, should be such that no electric shock path can be created.

If a circuit breaker has the facility to be remotely operated, the preferred work position should be communicated to workers. For example, is operating a circuit breaker by standing at the unit acceptable, or, is it preferred to use remote control facilities?

4.3.4 Safety observer (electrical)

Under section 12(1)(j) of the Regulation, a safety observer (electrical) who observes the performance of the live work must be used when performing live electrical work, unless the work involves testing electrical equipment and a documented risk assessment shows the work is not high risk.

Where live work is performed, the following should apply:

- The role of the safety observer (electrical) should be clearly communicated and understood. Their role is to warn the worker or workers of danger as well as to perform rescue and resuscitation, as required.
- A safety observer (electrical) should have the authority to stop the work before the risks become too high.
- The safety observer (electrical) should not carry out any other work or function that compromises their role as a safety observer.
- The safety observer (electrical) should be able to communicate effectively with the worker or workers. Specialist equipment may be necessary in situations where there is a barrier to communication.
- The safety observer (electrical) should not have to observe more than one task at a time.

- A safety observer (electrical) should not be situated in the work basket of the elevating work platform.
- To meet an electrical safety obligation, a safety observer (electrical) should not be regarded as the sole risk treatment measure to ensure electrical safety.
- The safety observer (electrical) must be competent to help with the electrical work.
- The safety observer (electrical) must be competent in isolation techniques where appropriate.

When working near exposed live parts, a safety observer (electrical) may be used as one form of risk treatment measure.

Examples of work near exposed live parts include:

- fault finding at a switchboard that has a high prospective fault current level;
- installing and replacing components at a switchboard;
- where the worker is in the 'safety observer zone' i.e. near the exclusion zone for exposed live parts; and
- performing complex fault finding.

For further information on the functions of a safety observer (electrical) when working near exposed live parts, please refer to the *Electrical Safety Code of Practice 2010 – Working Near Exposed Live Parts*.

4.3.5 Emergency planning

If a person sustains an injury due to electrical risks, prompt and timely action can significantly reduce the injury's severity. Quick action may even save a life.

After an electrical incident, there is still a risk of injury because of the three common electrical risks (refer to Part 2.3). It is crucial the response be appropriate to electrical risk. For example, in a live low voltage situation, rescue may be acceptable. However, should a rescue require either the victim, the rescuer, or both to intrude into exclusion zones for exposed live high voltage, isolation and proving de-energised should be performed.

In an effective safe system of work, workers should be competent at reacting to electrical incidents to prevent injury or further injury. Emergency actions should be taken that suit the work being done.

In line with *AS/NZS 4836 Safe working on low-voltage electrical installations*, section 9.1, the safe system of work required before live work commences should stipulate that any person receiving an electric shock or involved in an electrical incident should receive medical attention. A trained medical practitioner is qualified to check for other possible effects of electric shock.

Processes and procedures that should be considered include:

- Response to high voltage incidents and injuries. This should include:
 - forms of isolation and access;
 - rescue and escape from an EWP;
 - cardiopulmonary resuscitation; and
 - first aid including treatment of burns.
- Response to low voltage incidents and injuries. These should include rescue procedures such as:
 - low voltage pole rescue;
 - low voltage switchboard rescue;
 - confined space rescue e.g. rescue from low voltage cable pits;
 - rescue and escape from an EWP;
 - cardiopulmonary resuscitation; and
 - first aid including treatment of burns.

4.3.6 Safety barriers and signs

Physical safety barriers and signs can be used to treat electrical risks such as those mentioned in Appendix B.1.

Barriers and signs may be designed, erected or installed to:

- protect the electrical worker from making contact with live parts;
- ensure that access to and egress from the work location of live work allows for clear, unobstructed passage; and
- warn others and direct people away from live parts.

A physical safety barrier should consist of a non-conductive material such as wood or plastic or alternatively, correctly earthed steel and be strong enough to withstand the impact from falling objects or loose material. Before any barriers are erected, a risk assessment must be carried out by an appropriately qualified

person to ensure the appropriate design and that correct materials are used. The barrier must be erected safely. This may entail isolating the electricity supply while the barrier is installed. A barrier may be temporary or permanent and should clearly designate the safe work area by defining the approach path to a piece of equipment.

4.3.7 Personal Protective Equipment (PPE)

Refer to Part 2 for the risk treatment hierarchy. The hierarchy lists PPE as the last – or least preferred – option.

PPE should be fit for purpose and its correct application, use, maintenance and testing should be explained to users.

Examples of PPE applications include:

- Reducing risks rather than compounding risks e.g. if an explosion occurs at thigh height that causes the energy to vent upwards. In this situation, a dust coat or an incorrectly fitted face shield could trap the explosion rather than protect someone from it.
- Prevention or reduction of the effects of electric shock and burns may be controlled by:
 - using clothing that covers the arms, legs and body; the clothing should have flame resistant or retardant properties e.g. cotton or wool, and contain no metallic threads or exposed conductive material e.g. zip or rivets in jeans;
 - using non-conductive footwear, such as steel toe capped boots or shoes manufactured to a suitable standard; and
 - using insulating gloves.

4.4 What to use to work safely – tools, instruments and equipment used for electrical work

4.4.1 General

In general industry, tools, instruments and equipment that are poorly maintained, inappropriately used or not fit for purpose can cause injuries. With electrical work, there is the added risk of electric shock or large releases of energy from arcing and explosion.

The tools, instruments and equipment used by electrical workers often have special design characteristics. For example, many are insulated as a risk treatment measure. However, regular maintenance and inspection are required. Otherwise, certain dangers can arise e.g. the insulating medium might conceal a mechanical defect that could cause an open circuit in the lead of a testing device.

Tools, instruments and equipment, include the following devices:

- insulated hand tools where the insulation is relied upon as a risk treatment measure;
- rescue and escape kits;
- portable short circuits and earth devices;
- operating rods, including measuring sticks;
- mechanical equipment such as serial hoists for line work;
- cable spiking or stabbing equipment;
- ladders and pole platforms;
- insulating mats and covers;
- harnesses, lanyards and fall restraint devices; and
- instruments and testing devices used for proving de-energised, testing and faultfinding.

Workers should be competent in the safe use of the device including:

- being able to use the device safely and in the manner for which it was intended;
- being able to determine, by inspection, that the device is safe for use e.g. the device is not damaged and is fit for purpose;
- understanding the limitations of the equipment e.g. when testing to prove an AC circuit is de-energised, whether the device indicates the presence of hazardous levels of DC;
- being aware of the electrical safety implications for others when the device is being used e.g. whether the device causes the electric potential of the earthing system to rise to a hazardous level; and
- knowing what to do to ensure electrical safety when an inconclusive or incorrect result is obtained.

Refer also to Appendix B.2.8 for information about the general use of tools for electrical work.

4.4.2 Selection, testing, maintenance of tools, instruments and equipment

When selecting or maintaining tools, instruments and equipment, you should address a number of factors to ensure electrical safety. As a minimum, the following issues are to be addressed:

- The device must be fit for purpose.
- Equipment and test instruments that can be visually confirmed as functioning correctly should have visual confirmation of correct function each time before use.
- Equipment and test instruments that are not able to be visually confirmed as functioning correctly **must** be tested at least every six months to ensure proper working order.
- Repairs and maintenance should meet appropriate standards and manufacturer's instructions.

Appropriate guidance and standards for testing, inspecting, calibrating and maintaining these devices can be obtained from sources that include:

- manufactures and suppliers;
- industry groups;
- national and international codes and standards such as those produced by:
 - Standards Australia e.g. AS and AS/NZS publications; and
 - International Electrotechnical Commission e.g. IEC publications.

When selecting devices the following should be avoided:

- flame producing devices, since flame conducts electricity; and
- fire extinguishers that contain conductive mediums such as water.

When working near exposed live parts or working live, the tools and equipment used should be non-conductive or insulated. Examples include:

- torches;
- telescopic devices e.g. antennas, dentists mirrors;
- rulers and tape measures;
- insulated tools e.g. screwdrivers, pliers, cable cutters, spanners, crimpers; and
- electrical or hydraulic powered tools.

4.4.3 Use of instruments and test devices

When using instruments and test devices, the work practice should include:

- Immediately before and after use, the device should be inspected and functional checks performed to confirm that the device is operating correctly, as appropriate.
- The work practices employed during use should not only be safe but in line with documented procedures. These documented procedures should address manufacturer's instructions.

4.4.4 Instruments and test devices

When selecting instruments and test devices, the following should be addressed:

- The device's function, range and class of accuracy should be appropriate to both work and conditions.
- To ensure electrical safety, the combination of leads and instrument used should be capable of withstanding the impulse voltages and fault current levels that could be experienced at the location.

The relevant protective category – or Installation Category – of instrument, device and leads should be chosen as a risk treatment measure for impulse voltages and prospective fault currents. The Installation Category is an inherent safety design criterion. Note: Installation Category is a safety focus and is not associated with instrument accuracy.

The rating for test instruments and test probes used on 415/240V mains voltage equipment connected on the supply side of a main switchboard should be Installation Category III (3) or IV (4).

Type A probes (leads) should be used for measuring supply voltages (415/240 V AC).

Therefore, workers who perform live testing or fault finding in switchboards should use at least Category III (3) devices with Type A probes.

If the combination of the probe type and installation category of the instrument is inadequate, alternative measures should be taken. These measures include:

- obtaining a more suitable instrument, device and lead combination; or
- using other appropriate means to ensure electrical safety; fused leads or probes may be a suitable risk treatment measure, but they should be fit for purpose.

When selecting a voltage indicating device, consideration should be given to whether a single or double probe device is more suitable e.g. a proximity tester or a multimeter style.

For example, a proximity tester that has a self test facility and a fail-safe design may be appropriate to test to prove de-energised in some low voltage situations. However, when measuring the voltage at a neutral link, a double probe voltmeter with a trailing earth lead is more appropriate.

4.4.5 Ladders, portable pole platforms and scaffolds

Refer to Appendix B.2.2.

4.5 Testing and fault finding – providing the work is safe

4.5.1 General

When fault finding, testing, applying a potentially fatal test current, or a combination of these, the common electrical risks are likely to be present (refer to Part 2.3). Consult Appendix B.1 for information on the sources of these risks. To treat risks of this kind, a safe system of live work as outlined in Part 4.3 of this Code **must** be in place.

Where a recognised test cannot or does not satisfactorily determine that parts are electrically safe – including proving that all connections are correct (including polarity) – or where any doubt exists, the following should apply:

- Ensure the electrical work or affected part of the electrical work is isolated, disconnected, and made safe.
- Make sure the electrical work remains safely isolated until the matter is resolved. Resolution may take the form of further advice and assistance being received and acted on.

To ensure electrical safety, procedures for fault finding and testing should also address the following:

- Considering the characteristics of the test instrument to be used and any resultant effects, including technical limitations. For example, when choosing a voltage indicating device to test at a low voltage switchboard, an appropriate class of device with an appropriate internal impedance will ensure accurate and valid tests while maintaining electrical safety by not introducing hazardous currents and potentials into the earthing system.

- Proving the correct operation of the test instrument, both before and after each test. If a test procedure is interrupted, the sequence of testing and confirmation should be restarted.
- Giving clear instruction on what is seen as a conclusive test e.g. what constitutes correct connections (including polarity).
- Providing clear instruction on what is regarded as an inconclusive test.

If the procedure includes a requirement for inspections, the criteria for the inspections should be clearly identified.

Where more than one electrical worker is involved in the process of installing, testing, energising, disconnecting and rectifying, an employer or self-employed person should ensure that an electrical worker is assigned to ensuring electrical safety is maintained at all times.

An employer or self employed person should make sure a person is clearly responsible for the overall integrity of the electrical work and testing.

Electrical workers should be regularly trained and assessed in the underpinning knowledge and practical aspects of testing across the range of variables the worker will encounter.

Clear guidelines should be provided on which test instruments, or combination of test instruments and equipment, to use including accessories such as trailing earth leads.

4.5.2 Ensuring correct connections (including polarity)

Importance of testing for correct connections (including polarity)

Failure to ensure correct connections (including polarity) can cause serious incidents and may result in severe and even fatal injuries. Examples of hazardous situations resulting from incorrect connections (including polarity) include:

- Transposing an active and neutral, or an open circuit neutral connection, resulting in exposed conductive parts of an installation becoming energised. In this situation, dangerous potentials are created between metal work, such as taps and sinks, and earth.

- On the low voltage distribution network, bonding a phase to earth instead of bonding the neutral to earth, thus causing dangerous step and touch potentials at the base of a pole.

When an active and neutral are transposed in a Multiple Earthed Neutral (MEN) system, the earthed metal work – such as taps – become live i.e. there is a significant potential to earth. An error of this kind will usually mean the supply cannot be isolated to an installation via the main switch. In this instance, the problem arises because the main switch is in the neutral and at least one active is not switched.

Connections must be tested to confirm that they are correct. The tests must be performed when any new work is energised. The same applies to any alterations or additions, or both. Testing to prove correct connections (including polarity) greatly reduces the risk of death or severe injury associated with incorrect connections (including polarity).

Where consumer's mains are connected to an overhead service line and a metallic pin, eye bolt or other similar fixture is required to be effectively earthed in accordance with section 144 of the Regulation, a polarity testing procedure must ensure that the earthing of the metallic part does not invalidate the polarity test.

Using the correct test procedures will ensure the electrical work is safe and will protect the worker, other workers and the public during and after testing.

Situations when testing correct connections (including polarity) are required

Examples of when tests of correct connections (including polarity) are required include when:

- electrical installation or repair work is connected to supply;
- items of electrical equipment, such as stoves and hot water systems, are connected to supply;
- consumers' mains or sub mains have been repaired or replaced;
- new consumers' mains or sub mains are installed;
- low voltage bridges are connected or reconnected on low voltage mains;
- connections to transformers or generators are made or remade;
- service connections to street light standards are made, remade or altered;
- a new low voltage service is installed;

- an existing service is disconnected or reconnected; or
- a distribution system is initially energised or when any addition or alteration to the system could affect electrical safety.

Procedure for ensuring correct connections (including polarity)

Test procedures should be properly documented and effectively communicated to the appropriate persons.

The minimum steps should include proving the correct electrical relationship exists between the:

- active/s;
- neutral;
- earthing, bonding conductors or both; and
- independent earth used for testing.

Both the source of supply and the electrical work may require testing. For example, if a three-phase generator is to supply an installation, the source – in this instance, the generator – and the installation require testing because incorrect connection/s may exist at either or both locations.

The electrical worker responsible for ensuring correct connections (including polarity) **must** be competent in confirming connections are correct. Section 12(1)(e) of the Regulation requires that the person performing the live work has the appropriate training.

Precautions when testing for correct connections (including polarity)

It is not acceptable to rely on equipment function as a means of testing connections. Examples of unacceptable test methods include:

- relying on motor or meter rotation or both as a reliable test; or
- assuming that, because a protective device has not operated, the connections are correct.

Within the test procedure, an indication should be given as to what the test is proving. The electrical worker following the procedure should be able to clearly identify exactly what he or she is testing for. For example, is the test purely a polarity test, or does it include other measures such as proving that there is no alternative source of supply?

Installations should not be connected to de-energised low voltage sources.

The installation earthing system should not be used for tests to earth unless the insulation between the neutral and earthing system has been proven acceptable. An independent earth may be used. The installation earthing should not be used because, as the test is performed, the potential of the earthing system may rise to a level that causes an electrical risk. In this situation, the impedance of the testing device directly affects the level of potential rise.

Appendix A: Meaning of terms used in this Code

Electrical Safety Act 2002 = the Act

Electrical Safety Regulation 2002 = the Regulation

Electrical Safety Code of Practice 2010 – Electrical Work = the Code

Workplace Health and Safety Act 1995 = the WHS Act

Access permit or authority means a document that forms part of a safe system to work, to provide electrically safe access to high voltage parts. At least one set of earths and short circuits must be applied before an access permit or authority is issued. Under an access permit or authority, earths and short circuits should not be removed.

An **appliance** (see section 13 of the Act) is a device that consumes electricity at a voltage greater than extra low voltage and in which the electricity is converted into heat, motion or another form of energy or is substantially changed in its electrical character.

Although a light fitting, including its bulb or tube, is an appliance, the bulb or tube, taken alone, is not an appliance.

Associated equipment, (see section 17 of the Act) for an electric line, means something ordinarily found in association with the electric line, especially for the purpose of protecting, insulating or supporting, or supporting the operation of, the electric line.

Examples of associated equipment:

- a bracket, casing, coating, covering, duct, frame, insulator, pillar, pipe, pole, tower or tube enclosing, surrounding or supporting a wire or conductor; or
- an air break, circuit breaker, switch, transformer or other apparatus connected to a wire or conductor.

Authorised person, for an electrical part, (see section 59 of the Regulation) means a person who:

- (a) has enough technical knowledge and experience to do work that involves contact with, or being near to, the electrical part; and
- (b) has been approved by the person in control of the electrical part to do work that involves contact with, or being near to, the electrical part, or is authorised to act for the person in control of the electrical part.

Cathodic protection system means a system by which a structure in contact with ground or water is protected from electrolytic corrosion by a direct electric current flowing between the structure and an electrical conductor through the ground or water.

Chief Executive is the Director-General of the Queensland Department of Justice and Attorney-General.

Competent person (see schedule 9 of the Regulation) means a person who has acquired through training, qualifications or experience, the knowledge and skills to do the task, for example to inspect and test electrical equipment in a safe way, including knowledge of:

- (i) relevant Australian Standards;
- (ii) relevant codes of practice; and
- (iii) other relevant legislation.

Construction work (see schedule 9 of the Regulation):

Work is **construction work** if it is:

- (a) work to erect, construct, extend, alter, convert, fit-out, commission, renovate, repair, refurbish, disassemble or decommission a structure, or part of a structure; or
- (b) work connected with site preparation, excavation and landscaping for work mentioned in paragraph (a); or
- (c) the assembly or installation of prefabricated components to form a structure, or part of a structure, for work mentioned in paragraph (a); or
- (d) the disassembly of prefabricated components for work mentioned in paragraph (a) that, immediately before the disassembly, formed a structure or part of a structure; or
- (e) an activity that is a prescribed activity.

Work is **not construction work** to the extent it is carried out at a workplace, as part of a business or undertaking, if the work is to erect or construct a structure that, when erected or constructed, is intended to be transported to another place e.g. construction of a manufactured home or prefabricated building.

Construction work is taken to stop:

- (a) when the construction work at the workplace where the construction work is being performed ends and possession of the workplace is returned to the client; or
- (b) if the client remains in possession of the workplace where the construction work is being performed while the work is performed, when the construction work at the workplace ends.

Construction workplace means:

- (i) a workplace where construction work is performed, if the construction work:
 - is a prescribed activity; or
 - is not a prescribed activity and the estimated final price for the construction work is more than \$80,000; or
- (ii) a place intended to become a construction workplace under paragraph (a) when work starts at the place.

Crane means a machine for raising or lowering (luffing) a load and moving it horizontally (slewing). It includes any type of crane, including an elevating work platform, whether independent or an integral part of another piece of equipment. This definition includes an agricultural tractor, or any other apparatus used or capable of being used for raising, lowering, handling or transporting materials or equipment in a similar manner. The definition also includes any supporting structure and any other equipment ancillary to the use of the crane or apparatus, but excludes any grab crane or floating crane.

A **mobile crane** means a machine that:

- (a) is used primarily for raising or lowering a freely suspended load;
- (b) is capable of travelling over a supporting surface without the need for fixed runways (including railway tracks); and
- (c) relies only on gravity for stability, with no vertical restraining connection between itself and the supporting surface, and no horizontal restraining connection (other than frictional forces at supporting-surface level) that may act as an aid to stability.

A **tower crane** means a crane with a boom that is mounted on a tower structure and includes self-erecting tower cranes.

A **dangerous electrical event** (see section 12 of the Act) is any of the following:

- The coming into existence of circumstances in which a person is not electrically safe, if:
 - the circumstances involve high voltage electrical equipment; and
 - despite the coming into existence of the circumstances, the person does not receive a shock or injury.
- The coming into existence of both the following circumstances:
 - if a person had been at a particular place at a particular time, the person would not have been electrically safe; and
 - the person would not have been electrically safe because of circumstances involving high voltage electrical equipment.
- An event that involves electrical equipment and in which significant property damage is caused directly by electricity or originates from electricity.
- The performance of electrical work by a person not authorised under an electrical work licence to perform the work.
- The performance of electrical work by a person if, as a result of the performance of the work, a person or property is not electrically safe.

Examples for the above paragraph:

- the connection of electrical equipment to a source of supply involving incorrect polarity or other incorrect connection;
- the performance of electrical work as a result of which an exposed wire is left in circumstances in which it can be energised by the operation of a switch or circuit breaker or the insertion of a fuse;
- the discovery by a licensed electrical worker of electrical equipment that has not been marked as required under this Act.

De-energise means the process of disconnecting lines or apparatus from all sources of electrical energy usually by the process of switching. De-energised does not mean isolated or discharged, or both.

Direct contact (see section 60 of the Regulation):

- (1) A person is in **direct contact** with an electrical part if:
- (a) the person is touching the electrical part with the person's bare hands or another part of the person's body; or
 - (b) the person is touching a conductive object with the person's bare hands or another part of the person's body, and the conductive object is touching the electrical part; or

- (c) an article of clothing worn by the person is touching the electrical part; or
 - (d) an article of clothing worn by the person is touching a conductive object, and the conductive object is touching the electrical part.
- (2) Operating plant is in **direct contact** with an electrical part if:
- (a) any part of the operating plant is touching the electrical part; or
 - (b) anything the operating plant is handling is touching the electrical part.
- (3) A vehicle is in **direct contact** with an electrical part if:
- (a) any part of the vehicle is touching the electrical part; or
 - (b) anything being carried or otherwise handled by the vehicle is touching the electrical part..

Discharged means connected to the general mass of the earth in such a manner as to remove any residual electrical energy e.g. applying earths and short circuits to high voltage parts before gaining access.

Discharged also means stored energy has been released e.g. a closing spring in a circuit breaker, hydraulic pressure in a system, or energy stored in a battery.

Disconnected means that the parts are not connected to an electrical source. Disconnection may be achieved by de-energising, isolating, separating or breaking connections, or through all of these methods. A part that is disconnected may still require discharging to remove all electric and other energy.

Earthed (see schedule 9 of the Regulation) means connected to the general mass of earth.

Earth moving machine means any item of plant used for excavating, transporting, unloading compacting or spreading earth, overburden, rubble, spoil, paving material, aggregate or similar material. The term includes backhoes and bulldozers.

Earths, portable earthing devices (PED), refer to earths and short circuits.

Earths and short circuits means portable earthing devices, earths, earth switches etc. The use of earths and short circuits should be part of a safe system of work on high voltage parts. Who, when and why the earths and short circuits are applied determines whether they are designated as operator or working earths and short circuits.

Earthing and short-circuiting form one part of a system to create an electrically safe environment. The purpose of earthing and short-circuiting is:

- to safely discharge induced or residual voltage;
- in the event that the circuit becomes energized, to cause the operation of protection equipment to trip the supply; and
- to limit the rise in potential difference at the work area.

Electrical equipment (see section 14 of the Act) is any apparatus, appliance, cable, conductor, fitting, insulator, material, meter or wire:

- used for controlling, generating, supplying, transforming or transmitting electricity at a voltage greater than extra low voltage; or
- operated by electricity at a voltage greater than extra low voltage; or
- operated by electricity of an extra low voltage, if the equipment forms part of an electrical installation located in a hazardous area; or
- that is, or that forms part of, a cathodic protection system.

However, 'electrical equipment' does not include any apparatus, appliance, cable, conductor, fitting, insulator, material, meter or wire forming part of a vehicle if:

- it forms part of a unit of the vehicle that provides propulsion for the vehicle; or
- its source of electricity is a unit of the vehicle that provides propulsion for the vehicle.

Examples of things that are not electrical equipment:

- the headlights of a vehicle;
- ignition spark plugs of a motor vehicle;
- the interior lighting system of a vehicle, if powered from a battery charged by the engine that drives the vehicle or by the vehicle's movement.

Examples of things that are not prevented from being electrical equipment:

- interior lighting or a socket outlet in a caravan, if the lighting or outlet is operated by a low voltage generating set or connected to low voltage supply; or
- a refrigeration unit in a food delivery vehicle operating at low voltage from a source separate from the propulsion unit for the vehicle.

Refer also to section 69 of the Regulation for further information on electric motors forming part of vehicles.

Electrical equipment work (see section 19(3) of the Act) is electrical work other than electrical installation work or electric line work.

Examples of electrical equipment work:

- repairing substation electrical equipment;
- repairing an electric range, whether or not it is part of an electrical installation; or
- installing, jointing or terminating covered cables.

Electrical installation (see section 15 of the Act):

- (1) **An electrical installation** is a group of items of electrical equipment.
- (2) However, a group of items of electrical equipment is an electrical installation only if:
 - (a) all the items are permanently electrically connected together;
 - (b) the items do not include items that are works of an electricity entity; and
 - (c) electricity can be supplied to the group from the works of an electricity entity or from a generating source.
- (3) An item of electrical equipment can be part of more than one electrical installation.
- (4) For subsection 2(a):
 - an item of electrical equipment connected to electricity by a plug and socket outlet is not permanently electrically connected; and
 - connection achieved through using works of an entity must not be taken into consideration for deciding whether items of electrical equipment are electrically connected.

Examples of an electrical installation:

- The switchboard, wiring, lighting, socket outlets and other electrical equipment permanently connected for a shop in a shopping centre.
- The switchboard, wiring, lighting, socket outlets and other electrical equipment permanently connected for a house or residential unit.
- The switchboard, wiring, lighting, socket outlets and other electrical equipment permanently connected for a shopping centre. The electrical installation for the shopping centre generally includes the electrical installations for the individual shops.
- The switchboard, wiring, lighting, socket outlets and other electrical equipment permanently connected for a residential unit complex. The electrical installation for the residential unit complex generally includes the electrical installations for the individual residential units.
- The switchboard, wiring, lighting, socket outlets and other electrical equipment permanently connected within a caravan.

An **electric line** (see section 16 of the Act) is a wire or conductor or associated equipment used for transmitting, transforming, or supplying electricity at a voltage greater than extra low voltage.

However, an 'electric line' does not include:

- a wire or conductor directly used in converting electricity into another form of energy; or
- a wire or conductor within the internal structure of a building.

Examples of things that are not electric lines:

- a cord for connecting an air conditioning unit, computer, lamp, television or toaster to a supply of electricity; or
- a power or lighting circuit within a building.

Electric line work (see section 19(2) of the Act) is electrical work associated with an electric line.

Examples of electric line work:

- erecting an aerial conductor that is part of the works of an electricity entity or of an electrical installation;
- installing or maintaining street lighting circuits; or
- testing an overhead electrical line to ensure it is correctly connected.

Electrical part (see section 59 of the Regulation) means:

- an exposed part; or
- an overhead insulated electric line.

Electrical place means a location where an electrical installation, electrical equipment, works of an electricity entity or a cathodic protection system is located, including a premises, place, land or water.

Electrical risk (see section 10(1) of the Act) means:

- in relation to a person, the risk to the person of death, shock or injury caused directly by electricity or originating from electricity; or
- in relation to property, the risk to the property of:
 - damage caused by a cathodic protection system; or
 - loss or damage caused directly by electricity or originating from electricity.

Electrically safe (see section 10(2) of the Act) means:

- for a person or property, that the person or property is free from electrical risk; and
- for electrical equipment or an electrical installation, that all persons and property are free from electrical risk from the equipment or installation;
- for the way electrical equipment, an electrical installation or the works of an electricity entity are operated or used, that all persons and property are free from electrical risk from the operation or use of the equipment, installation or works;
- for the way electrical work is performed, that all persons are free from electrical risk from the performance of the work;
- for the way a business or undertaking is conducted, that all persons are free from electrical risk from the conduct of the business or undertaking; and
- for the way electrical equipment or an electrical installation is installed or repaired, that all persons are free from electrical risk from the installing or repairing of the equipment or installation.

Electrical safety (see section 10(3) of the Act), for a person or property, means the person or property is electrically safe.

Electrical safety notification (see section 206 of the Act). The chief executive may issue a notification (*electrical safety notification*) that:

- is directed at designers, manufacturers, importers or suppliers generally, or at stated designers, manufacturers, importers or suppliers; and
- states requirements about the use or supply of stated electrical equipment, or a stated type of electrical equipment including, if appropriate, requirements about preventing the use or supply of the electrical equipment or type of electrical equipment.

Electrical work (see section 18 of the Act) is the manufacturing, constructing, installing, testing, maintaining, repairing, altering, removing, or replacing of electrical equipment.

Examples of electrical work:

- installing low voltage electrical wiring in a building;
- installing electrical equipment into an installation coupler or interconnector;
- replacing a low voltage electrical component of a washing machine; and
- maintaining an electricity entity's overhead distribution system.

However, the following are not 'electrical work':

- (a) Installing or removing electrical equipment by connecting it to electricity, or disconnecting it from electricity, by a plug and socket outlet.
- (b) Repairing or replacing non-electrical components of electrical equipment.

Examples for paragraph (b):

- repairing hydraulic components attached to an electric motor; and
 - replacing a drive belt on a washing machine.
- (c) Replacing a component forming part of electrical equipment if the electrical equipment has been designed so that the component is readily and safely able to be replaced by a person without electrical knowledge or skill.

Examples for paragraph (c):

- replacing a fuse; and
- replacing the bulb in a light fitting.

- (d) Assembling, making, modifying or repairing electrical equipment in a workplace registered under the WHS Act, that is prescribed under a regulation for this paragraph, if that is the principal manufacturing process at the workplace, and arrangements are in place, and are detailed in written form, for ensuring that:
 - (i) the work is done safely and competently; and
 - (ii) the equipment is tested to ensure compliance with relevant standards.
- (e) Building, under the supervision of an electricity entity, an overhead electric line on structures that do not already carry an energised overhead electric line.
- (f) Building or repairing ducts, conduits or troughs (channels) where electrical wiring will be or is installed, if:
 - (i) the channels are not intended to be earthed;
 - (ii) wiring installed in the channels is not energised; and
 - (iii) the work is done under the supervision of a person licensed to perform electrical installation work.
- (g) Laying, cutting or sealing underground cables that are part of the works of an electricity entity before the initial connection of the cables to an electricity source.
- (h) Recovering underground cables that are part of the works of an electricity entity after disconnection from an electricity source.
- (i) Altering, repairing, maintaining or recovering an overhead electric line that is part of the works of an electricity entity, if the work is performed under the entity's supervision and:
 - (i) if the line is not on supports supporting another electric line-the line has been isolated from an electricity source so that the closure of a switch cannot energise the section of the line where work is being done; or
 - (ii) if the line is on supports supporting another electric line-both lines have been isolated from an electricity source so that the closure of a switch cannot energise the section of the line where the work is being done or an adjacent section of the other line.
- (j) Erecting structures for the support of electrical equipment.

Example of structures:

- electric poles and towers.
- (k) Locating, mounting or fixing in place electrical equipment, other than:
 - (i) making or terminating electrical connections to the equipment; or
 - (ii) installing supply conductors that will connect the equipment to a supply of electricity.
- (l) Assisting a licensed electrical worker to perform work on electrical equipment under the direct supervision of the electrical worker, if performing the work does not involve the person directly contacting live electrical equipment.
- (m) Maintaining the structural parts of the electrical traction system on a railway, other than overhead electric lines, that forms part of the works of an electrical entity, if the work is structural work performed under a safe system of work.
- (n) Work performed by a person on electrical equipment if:
 - (i) the electrical equipment is not energised;
 - (ii) the work is prescribed under a regulation for this paragraph; and
 - (iii) it is necessary for the person to perform the work to meet the eligibility requirements for an electrical work licence.

Elevating work platform means a telescoping device, scissor device, or articulating device or any combination of those devices used to move and position personnel, equipment and materials to and from, or at work locations above or below the support surface.

Energise (see schedule 2 of the Act) means energise by electricity.

Exclusion zone (see section 61 of the Regulation):

- (1) The exclusion zone, for a person for an electrical part, or for operating plant or a vehicle for an electrical part, means the distance from the part stated for the person, plant or vehicle in Appendix C.
- (2) For applying Appendix C to a person, the person includes any article of clothing worn by the person, and any conductive object the person is handling.
- (3) For applying Appendix C to operating plant, the operating plant includes anything the operating plant is handling other than:
 - (a) a person; or
 - (b) a hand held object the person is handling.

- (4) For applying Appendix C to a vehicle, the vehicle includes anything the vehicle is carrying or otherwise handling.
- (4A) Despite subsections (2) to (4), the person, operating plant or vehicle does not include an object, for example, a tool, that alone or with another object or objects is an extension from the person, operating plant or vehicle if the object:
- (a) is an insulated device; and
 - (b) the device has been tested and found to be safe for use on and near the electrical part.
- (5) For applying Appendix C to operating plant operated by an authorised person or instructed person who does not have a safety observer or another safe system as required under the schedule, the authorised person or instructed person must be taken to be an untrained person.
- (6) However, the exclusion zone, for an electrical part, for operating plant operated by an authorised person or instructed person for the electrical part, is taken to be the same as the exclusion zone for an authorised person or instructed person for the electrical part if:
- (a) the operating plant is fitted with a device capable of stopping the operation of the operating plant immediately the operating plant is at the exclusion zone for an authorised person or instructed person for the electrical part;
 - (b) there is in place a safe system of work for the use of the operating plant;
 - (c) the safe system of work has been developed in consultation with persons who are broadly representative of industrial organisations of employees whose members commonly operate operating plant of the operating plant's type; and
 - (d) without limiting paragraph (b), the safe system of work ensures the device mentioned in paragraph (a):
 - (i) is operating properly; and
 - (ii) is set for at least the correct exclusion zone distance.
- (7) A reference in Appendix C to a vehicle does not include a reference to:
- (a) an aircraft; or
 - (b) a vehicle that is operating plant.

Examples for paragraph (b):

- Tip truck tipping a load would not be a vehicle for Appendix C.
 - However a tip truck travelling between sites would be a vehicle in Appendix C.
 - A vehicle that includes an elevated work platform being used for clearing vegetation would not be a vehicle for Appendix C. However, when the platform is not being used for clearing vegetation, the vehicle would be a vehicle for Appendix C.
- (8) For applying Appendix C to operating plant, a reference to ‘another safe system’ is a reference to a system of work that:
- (a) has been developed in consultation with persons who are broadly representative of industrial organisations of employees whose members commonly operate operating plant of the operating plant’s type; and
 - (b) provides, for persons and property, the same level of electrical safety as, or a greater level of electrical safety than, the level of electrical safety provided with a safety observer.

Extra low voltage (see schedule 2 of the Act) means voltage of 50V or less AC RMS, or 120V or less ripple-free DC.

Ferro-resonance can be described as a voltage multiplication circuit on a power system. The phenomenon causes higher than normal system voltages on the high and low voltage systems, e.g. 700 volts phase to phase on the low voltage system. Ferro-resonance occurs when a modest sized capacitance is either in series or in parallel, with non-linear inductance, such as an iron cored transformer.

In power systems, ferro-resonance is most commonly found in the following conditions:

- a three-phase distribution transformer is energised via an underground cable of moderate length;
- there is either no load, or very light load on the transformer; and
- a combination of the capacitance and inductance exists, and single-phase switching occurs e.g. operation of a high voltage fuse or asynchronous operation of single-phase high voltage switching devices, such as a drop out fuse unit or some ring main units.

Free from electrical risk (see section 10(4) of the Act), for a person or property, means that the electrical risk to the person or property is as low as reasonably achievable, having regard to:

- likelihood of harm; and
- likely severity of harm.

Hand excavation means using tools such as shovels, picks, mattocks, crowbars. Hand excavation does not include the use of equipment such as jackhammers. Even when hand excavating caution must be exercised when working close to live cables.

Handling (see section 59 of the Regulation) includes any of the following:

- (a) carrying;
- (b) connected to, whether or not temporarily;
- (c) controlling;
- (d) holding; or
- (e) lifting.

High voltage (see schedule 2 of the Act) means voltage greater than low voltage.

Include: Where the word 'include' is used in this Code, it should be interpreted as meaning 'includes, but is not limited to'.

Installation Category (instruments) means the fault level and voltage impulse level that the instrument is designed to withstand. (Refer to international standards IEC 61010-1 and IEC 61010-2-031 for further information.) The applicable Installation Categories are outlined below:

- **Installation Category I** relates to signal level, special equipment or parts of equipment, telecommunications, electronic and similar equipment. Impulse withstand voltage: 1500V.
- **Installation Category II** relates to the local level, appliances, equipment sub circuits, portable equipment etc. Impulse withstand voltage: 2500V.
- **Installation Category III** relates to the distribution level, main switchboards etc. Impulse withstand voltage: 4000V.
- **Installation Category IV** relates to the primary supply level, overhead lines, cable systems etc fixed installation.

Instructed person (see section 59 of the Regulation) for an electrical part means a person who is acting under the supervision of an authorised person for the electrical part.

Isolated means disconnected from all possible sources of supply and rendered incapable of being made live without premeditated and deliberate operation. Under section 20(2) of the Regulation, a suitable warning safety sign must be attached.

Examples of how isolation can be achieved is by opening isolators, racking out circuit breakers, removing fuses or links, inhibiting the operation of a mechanism by locking, or a combination of these measures. Isolation involves the use of suitable warning or safety signs and involves locks, rendering mechanisms inoperative or a combination of these.

Isolation and access means the process of fully or partly, switching, de-energising, isolating, proving de-energised, applying earths and short circuits, discharging, installing other precautions, the issuing of permits or authorities and the reversal of this process. Isolation and access should be part of safe system of work.

The term applies to:

- the operation of high voltage, low voltage and associated circuits e.g. secondary circuits; and
- alternating current, direct current or both. .

Isolation point means the point, or one of many points, used to isolate electrical parts.

Live (Alive, Energised) means connected to a source of electrical supply or subject to hazardous induced or capacitive voltages. Generally, 'live' refers to a conductor or conductive part intended to be energised in normal use, including a neutral conductor and conductive parts connected to a neutral conductor.

Under the MEN system live does not apply to the following:

- Earthing conductors.
- The neutral conductor of a low voltage distribution network that is earthed in accordance with section 129 of the Regulation.
- The MEN connection and the neutral bar or link which the MEN connection is made.
- The sheath of a Mineral Insulated Metal Sheathed (MIMS) cable and associated conductive fittings used as a combined neutral and protective earthing conductor fittings used as a combined neutral and protective earthing conductor in an Earth Sheath Return (ESR) system.
- Conductive supports and enclosures associated with unprotected consumers mains that are earthed in accordance with AS/NZS 3000.

Live work (see schedule 9 of the Regulation) means electrical work performed in circumstances in which the part of the electrical equipment the subject of the electrical work is energised.

Low voltage (see schedule 2 of the Act) means voltage greater than extra low voltage, but not more than 1000V AC RMS or 1500V ripple-free DC.

Must Where the word ‘must’ is used in this Code, it reflects the fact that a mandatory requirement exists in the Act or Regulation.

Neutral means the conductor of a three-wire or multi-wire system, which is maintained at an intermediate and approximately uniform potential in respect of the active or outer conductors, or the conductor of a two-wire system that is earthed at its origin. A neutral should be considered (and treated) as a live conductor.

Operating plant (see section 59 of the Regulation) means plant being operated for its intended purpose unless the operation of the plant can not materially affect the distance between the plant and any electrical part in relation to which there is an exclusion zone under this part.

Examples of operating plant:

- a tip truck tipping a load;
- a fixed crane operating at a building site;
- a vehicle that includes an elevated work platform being used for clearing vegetation from around overhead electric lines;
- a concrete pumping truck pumping concrete; and
- a harvester with height changeable attachments being used to transfer grain to a truck.

Example of plant that is not operating plant:

- a furniture removal van under an electric line raising or lowering the electrically or hydraulically operated platform located at the rear of the van, if neither the platform nor anything on the platform rises above the roof of the van.

Penalty units: please refer to section 5 of the *Penalties and Sentences Act 1992*.

Permit or authority means an access or a test permit or authority.

Plant includes any machinery, equipment and appliance, and any article designed for use as a component in, or as an accessory to, any machinery, equipment or appliance and includes earth moving machines and hoists.

Potentially fatal test current means current used as part of a test where the current is greater than or equal to 10 mA AC or 300 mA DC, or both. These values are based on the maximum value of current at which a person can let go or 'threshold of let go', described in AS 60479 *Effects of current on human beings and livestock*.

The threshold of let go should be considered the maximum value of current to flow through the human body before a significant risk of ventricular fibrillation exists. Therefore, if tests use currents above the potentially lethal test current, consideration should be given to the implementation of effective risk treatment measures.

Principal contractor for construction work is the person appointed by the client as the principal contractor for the construction. If there is no client for the construction work, the person who commissions the construction work is taken to be the principal contractor for the construction work (WHS Act, section 13).

A **qualified technical person** (see sections 7(2) to 7(4) of the Regulation), for an individual, partnership or corporation, is an individual who satisfies the chief executive that he or she:

- (a) is a fit and proper person; and
- (b) either:
 - (i) if the electrical work to be performed by the licensed electrical contractor may be performed only by the holder of an electrical work licence -- has held for at least a year, or a shorter period considered acceptable by the chief executive, and still holds, an electrical work licence; or
 - (ii) has held for at least a year, or a shorter period considered acceptable by the chief executive, and still holds, an external contracting authority; and
- (c) is competent to perform electrical work as, or for, a licensed electrical contractor; and
- (d) has satisfactorily finished a course of instruction, or an examination required by the chief executive, on technical aspects of performing electrical work.

Despite subsections (1) and (2), for a person who is an individual to be a qualified business person or qualified technical person:

- (a) for an individual who holds, or has applied for, an electrical contractor licence, the person must also be, or be an employee of, the individual; or
- (b) for a partnership that holds, or has applied for, an electrical contractor licence, the person must also be a member or an employee of the partnership; or
- (c) for a corporation that holds, or has applied for, an electrical contractor licence, the person must also be an executive officer, a member or an employee of the corporation.

In deciding whether a person who is an individual is a fit and proper person, the chief executive may only consider:

- (a) the standard of honesty and integrity demonstrated by the person in commercial and other activities in which the person has been involved; and
- (b) any failure by the person to perform commercial or statutory obligations and the reasons for the failure.

Rope test (rope pull test) means a test performed on wood and steel poles. By placing a mechanical load as close to the head of the pole as practical, via a rope, the test should indicate whether the pole is inherently sound.

Safe system of work, for live work on a low voltage electrical installation, includes, but is not limited to, a system of work that complies with the provisions of AS/NZS 4836 Safe working on low voltage electrical installations about ensuring the safety of persons while performing live work.

Safety observer means a person who:

- observes the performance of the work;
- is competent to help a person performing the electrical work; and
- has been assessed in the last six months to be competent to rescue a person performing electrical work and provide resuscitation.

A **serious electrical incident** (see section 11 of the Act) is an incident involving electrical equipment if, in the incident:

- a person is killed by electricity; or
- a person receives a shock or injury from electricity, and is treated for the shock or injury by or under the supervision of a doctor; or
- a person receives a shock or injury from electricity at high voltage, whether or not the person is treated for the shock or injury by or under the supervision of a doctor.

Should: Where the word 'should' is used in this Code, it should be interpreted as meaning a requirement which needs to be equalled or exceeded so that an obligation to be discharged. If this Code states that something should be done, the requirement is to do what the Code says or do it in a manner which is equal or better (electrically safer) than the Code.

Step and touch potential means step voltage or touch voltage, or both. Refer to Figure 2.

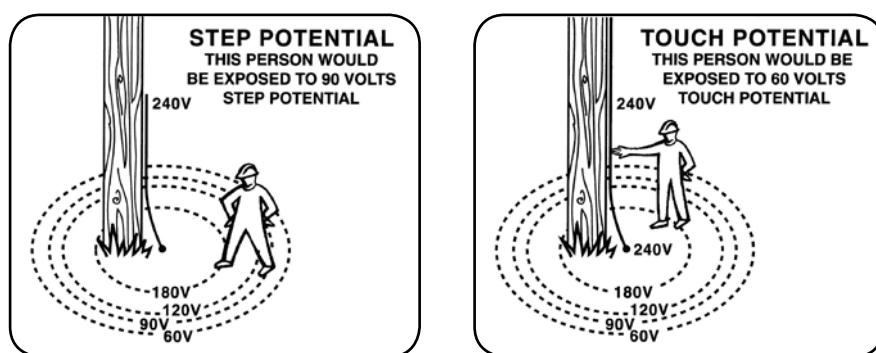


Figure 2: Examples of step potential and touch potential

Step voltage means the prospective or open circuit voltage that may appear between any two points (one metre apart) on the surface of the ground.

Supervision means the overseeing of workers, including trainees and apprentices, to ensure risks to people and property are eliminated or at least minimised. While a supervisor may perform audits, auditing should not be seen as interchangeable with supervision.

Supervision of electrical work includes:

- health and safety matters;
- statutory compliance e.g. monitoring the work an apprentice or restricted electrical worker is permitted to perform;
- technical aspects e.g. compliance with AS/NZS 3000; and
- implementation of a safe system of work.

Generally, the two distinct styles of supervision are described as:

- **Direct supervision** means supervision occurs at all times on a direct and constant basis.

- **General supervision** means supervision where the worker does not require the constant attendance of the supervisor.

Switching sheet means a document that is part of a safe system of work. Each switching sheet should have a unique reference and should list a process of isolation and access step by step.

The **Act** means the *Electrical Safety Act 2002*.

The **Code** means the *Electrical Safety Code of Practice 2010 - Electrical Work*.

The **Regulation** means the *Electrical Safety Regulation 2002*.

The **WHS Act** means the *Workplace Health and Safety Act 1995*.

Tiger tails (Torapoli pipes) are plastic pipe type cable covers, used as a warning to visually indicate the position of overhead power lines or stay wires. Tiger tails do not insulate wires.

Touch voltage means the prospective or open circuit voltage that may appear between any point of contact with conductive parts (that are located within 2.4 metres of the ground) and any point on the surface of the ground with a horizontal distance of one metre from the vertical projection of the point of contact with the conductive part.

Transferred earth potential: Although a line may be 'earthed', there may be a dangerous voltage or potential between the line and the earth point, including a concrete pole or a steel tower, at the work site.

For example, where a line is under access at a remote substation, a fault not directly associated with the line under access can cause a dangerous voltage rise on the substation earth grid. That voltage rise is transferred through the line to the work site, where it can create a risk to workers on the site.

Type A probe means probes suitable for application to low voltage and high voltage non attenuating non voltage dividing probe assemblies that are rated for direct connection to voltages exceeding 33V RMS (root mean square) but not exceeding 63 kV. These probe assemblies may contain passive components such as fuses. (Refer to international standards IEC 61010-1 and IEC 61010-2-031 for further information.)

Untrained person (see section 59 of the Regulation), for an electrical part, means a person who is not an authorised person or an instructed person for the electrical part. However, it should be noted from the above definition of exclusion zone,

that for applying Appendix C to operating plant operated by an authorised person or instructed person who does not have a safety observer or another safe system as required under the schedule, the authorised person or instructed person must be taken to be an untrained person.

Please note: under section 61(5) of the Regulation, for applying schedule 2 of the Regulation to operating plant operated by an authorised person or instructed person who does not have a safety observer or another safe system as required under the schedule, the authorised person or instructed person must be taken to be an untrained person.

Wilfully (see schedule 2 of the Act) means:

- intentionally; or
- recklessly; or
- with gross negligence.

Work (see section 59 of the Regulation) means work of any type, whether or not electrical work, other than live work or electrical welding performed in accordance with a safe system of work.

Works (see section 25 of the Act), of an electricity entity, means the electrical equipment, and electric line associated equipment, controlled or operated by the entity to generate, transform, transmit or supply electricity.

Example of works of an electricity entity:

- an overhead distribution system of a distribution entity, including transformers and switches.

Example of what is not works of an electricity entity:

- appliances or fixed wiring in an electricity entity's workshop or offices.

Appendix B: Further information

B.1 Common sources of electrical risks

B.1.1 Identifying sources of electric shock

Contact with electric potentials is one of the common risks identified in Part 2.3 for the electrical industry. The associated risks are significant. In managing risks associated electrical work, preventing electric shocks is a major part of discharging electrical safety obligations. Potential sources of electric shock include:

- Voltages between phases and between phases and neutral.
- Voltages between phases, neutral and earth where there is metalwork, damp situations, persons and other conductive surfaces nearby. These conductive surfaces are a source of potential that can cause an electric shock.

Identifying other sources of electric shock can be more difficult, but the following list will help. Sources include:

- Voltages across open switch contacts e.g. voltage across a light switch on an incandescent lighting circuit or the voltage across a bus tie where one side is de-energised.
- Voltages across undischarged capacitors.
- Voltages on disconnected conductors, particularly neutrals.
- Voltages caused by static electricity, leakage or discharge, or lightning.
- The potential (voltage) between parts of the earth in Multiple Earthed Neutral (MEN) systems can change, sometimes causing electric shocks. The changing earth potential can be due to a number of causes including: a high impedance return path to the low voltage distribution neutral, faults on other parts of the power system or lightning strikes.
- Induced voltages from sources other than the circuit being worked on e.g. nearby circuits or radio frequency transmitters.
- Voltages across the secondary terminals of transformers, including current transformers.
- Voltages between parts, or open circuited parts of one earth system, or voltages between different earthing systems.
- Incorrect wiring connections e.g. transposing active and neutral, commonly referred to as incorrect polarity.

- Faulty equipment e.g. the frame of faulty equipment may become energized.
- Voltages from sources near the work being performed. Examples include:
 - working on a remote area power supply where both AC and DC voltages may be present;
 - repairing lights on a shop fascia when overhead power lines are nearby;
 - working on transducer circuits when other AC and DC circuits are present; and
 - working on a power system with multiple circuits that may be of multiple potentials.
- Voltages on the circuit being worked on from other sources including:
 - illegal connections or reconnections;
 - Uninterruptible Power Supplies (UPS) and backup supplies;
 - motor generators or alternators;
 - DC on AC circuits;
 - AC on DC circuits;
 - harmonics e.g. 3rd harmonic 150 Hz in neutrals and earths where there is a large fluorescent light load and switch mode power supplies; and
 - back Electro Magnetic Forces (EMF) from collapsing magnetic fields or rotating machinery.
- Step and touch potentials and transferred earth potentials. Transferred earth potentials often result from system faults.

B.1.2 Tripping of supply on powerlines

If contact is made with powerlines, supply will not be disconnected immediately. In fact, if the fault current is low, the supply may not trip at all.

Depending on the voltage and type of protection, there is an inbuilt delay as long as a number of seconds before disconnection occurs. Even if an overhead feeder does trip, it may re-close and energise the fault again.

B.1.3 Working near sources of arcing, explosion or fires

Arcs, explosions and electrical faults can cause burns. Workers should be protected from the effects of burns. Examples of triggers for arc, explosions and faults which cause burns include:

- Materials providing a conductive path between sources of potential e.g. uninsulated tools falling across bus bars.
- Abnormal conditions on circuits such as:
 - lightning striking mains;
 - circuits of different voltages touching each other e.g. HV contacting LV circuits; and
 - high voltage in the secondary circuit of a current transformer if an open circuit occurs when current is flowing in the primary circuit.
- Abnormally high voltages when synchronising different supplies. For example, if the waveforms are 180° out of phase, twice the peak-to-peak voltage may be imposed.
- Voltage multiplication effects such as:
 - ferro-resonance where the capacitive and inductive components of underground cables and transformers can significantly increase voltages when single-phasing occurs; and
 - re-strike can occur if capacitors are energised, de-energised and re-energised in rapid succession.
- Leakage or electrical discharge causing insulation to be compromised e.g. a combination of a build up of contaminants on insulators and wet weather or tracking through air voids in pitch filled insulating chambers.
- Failure of insulating mediums².

The consequences of arcs, explosions and electrical faults are compounded by high fault currents. The potential for injury is extreme because of the rapid release of electrical energy.

The level of electrical energy released can equal 20 times the rated supply current. When high fault currents are present, magnetic forces between the conductors can be high enough to cause the conductor supports to mechanically fail. This causes additional damage.

Protection systems should ensure that these high fault currents only flow briefly. However, when high fault currents are present, circuit protection may not operate to protect a person from electric shock, arcing or explosions.

² There are numerous insulating mediums in use that should be considered. Some of the mediums include polyvinylchloride (PVC), cross linked polyethylene (XLPE), vulcanised insulating rubber (VIR), air, epoxy compounds and resins, zellamite, transformer oil, cable oil, vacuum, sulphur hexafluoride, pitch compounds.

During the time that it takes to clear the high fault current, the arcs produced have enough energy to cause an explosion, melt metallic switchboard cubicles, cause severe burns and flash burns to the face and eyes, as well as injury from flying debris or dislodged components.

B.1.4 Working in unsafe atmospheres

After faults and fires, often in emergencies, electrical workers may be exposed to unsafe atmospheres. Toxic gases and lack of oxygen can cause illness and death. General workplace health and safety risk treatment measures should be used in these situations.

The method of extinguishing fires should be addressed. Typically, carbon dioxide or powder type devices are used against electrical fires. Extinguishers such as water, foam, and wet chemical should not be used as they significantly increase the risk of electric shock. Further information can be obtained from the Queensland Fire and Rescue Service online at www.fire.qld.gov.au.

B.1.5 Isolation and access

Risks identified in Part 2.3 should be addressed in the context of isolation and access. Risk sources involving isolation and access include:

- Correctly isolating supply but not discharging residual energy e.g. a capacitive charge may be present in power supplies, single-phase motors, or high power factor fluorescent fittings.
- Insulation and equipment failing or partially breaking down.
- Earth connection failing to stop an electric shock in earthed conductive parts when step and touch potentials exist.
- Carrying out the task causes a person, something a person may be handling or something a person is in contact with, to intrude into minimum safe approach distances.
- A power system conducting fault current or being subject to high inrush currents.
- Instructions or markings on the parts being inadequate, incorrect or both.
- Using equipment not designed for or capable of an operation e.g. opening a 'no load – bus tie' under load conditions or relying on an open circuit breaker as an isolation point.
- Another person energising circuits while a worker is working on them, or a vehicle hitting a pole.

- Natural elements such as lightning or wind causing static charges, overhead mains to clash or a high voltage circuit to fall onto a low voltage circuit.
- The inter-core capacitive effects of long multi-phase cables.
- Changes to wiring not being reflected in drawings i.e. the drawings are not 'as built'. An example: a live control or supervision circuit being present though the drawing indicates otherwise.
- If there has been an error in wiring, opening the isolator may not de-energise the switchboard e.g. if incorrect connection (incorrect polarity) occurred in the service to an installation, opening the main switch will open circuit the neutral rather than the active.
- Intentionally disabling an interlock to perform a task e.g. opening the shutter of a 'rackable' circuit breaker test to prove de-energised in the orifice.
- Inadvertently disabling an interlock while performing a task e.g. in a switchboard with an integrated circuit breaker, isolator and earth switch, the operator accidentally moving the isolator into the earthed position.
- A combination of poor direction and insufficient knowledge e.g. a worker is instructed to apply a set of earths and short circuits at a Ring Main Unit (RMU). The worker correctly observes that the isolator is open. However, the worker assumes that the earth switch can be closed because the isolator is open. Most RMUs are configured in such a way that the earth switch earths the cable, not the busbar. In this situation, it is possible that the worker would be earthing and short circuiting a live circuit.
- When applying a set of portable earths and short circuits, accidental or inadvertent contact is made with live parts. If this occurs, the worker is using a device that is conducting fault current.
- The threshold value (lowest level of indication or reading) of a test device causing a misleading interpretation of a test to prove de-energised. Depending on the device used, an indication that parts are not energised, in a high voltage situation, does not mean that low voltage and direct current voltages are absent.
- Application of earthing and short circuiting devices that depend on a conductive path through a fuse or a circuit breaker that is not fit for purpose.

- Ineffective connection to the general mass of the earth e.g. the electrode, grid or temporary electrode that the earth from the earths and short circuits relies upon in a situation where a single phase becomes energised.
- Application of the short circuit portion of portable earthing devices prior to the earth tail being connected to the earth.
- Arcing and splattering associated with the application of earths and short circuits causing a risk. The arcing or splattering may result from using the device in situations that range from energised conductors to residual energy such as capacitance. If the parts are energised, the worker can draw the arc from one phase to the other, causing a phase to phase fault.
- A potential electric shock path existing once the earth tail is connected to earth. A worker may touch another live part and the earthed connector at the same time. For example, in a Common Multiple Earthed Neutral (CMEN) area, even when working on high voltage, contact between the earthed connector and a low voltage phase can cause an electric shock.

B.2 Other electrical risks to be addressed

B.2.1 Working in and around trenches, pits and underground ducts

Sources of electrical risks when working in and around trenches, pits and underground ducts include:

- Earthed situations in which an electric shock path is created when exposed live parts and conductive materials are present at the same time. Examples of conductive materials include metal pipes and liquids such as storm water or sewerage.
- Damage of live cable with excavation or hole boring equipment.
- Spark generations in an explosive atmosphere e.g. presence of LP gas.
- Exposed live parts. For example, an electrical worker may be required to inspect and repair a damaged underground cable.

An effective risk management and safe system of work should address risks of this kind. Examples of suitable methods include:

- Performing electrical and associated work only on de-energised parts.
- Using work methods that remove the risk of an earthed situation e.g. using mats and eliminating or avoiding liquids.
- If exposed parts of cables are present, maintaining relevant exclusion zone until you can determine whether the cable is high voltage or low voltage. If it is difficult to identify, you should treat the cable as live high voltage.

Construction of high voltage cables varies. Some high voltage cables are oil filled, some are filled with gas, and others rely on insulation only. A cable that is leaking oil or gas should be treated as a high voltage cable.

B.2.2 Working with ladders, scaffolds, portable pole platforms

Work within the electrical industry requires extensive use of ladders, scaffolds and similar equipment. When using these items, you will encounter the three common electrical risks from a number of sources including:

- A conductive device such as an aluminium ladder creating an electric shock path e.g. an electric shock path may be created when an electrical worker investigates a faulty light circuit if the metal frame of a suspended ceiling is energised and a conductive ladder is used.

- Moving a portable scaffold and damaging insulation when the scaffold strikes conductors or leads.
- If live work is being performed from a ladder i.e. the ladder slipping and causing the worker to touch exposed live parts e.g. grabbing a mains box.
- An incident happens while work is being performed de-energised near exposed live parts e.g. wind blowing an extension ladder into nearby live mains such as overhead power lines.
- In cases where lines are carrying large currents, conductive scaffolds becoming subject to induction.
- In switchrooms and switchyards, conductive devices such as aluminium ladders and scaffolds creating electric shock paths and current paths to earth e.g. a metal wire reinforced ladder causing a fault to ground if the ladder touches a live 33 kV busbar.
- When using ladders, scaffolds and similar equipment, workers are more likely to touch open wiring such as overhead lines.

To control situations of this kind, a risk assessment could be carried out and a safe system of work should be used. Effective risk treatment measures within this system of work should include:

- Using equipment that is fit for purpose, e.g. non-conductive ladders. However, such equipment should not be the only risk treatment measure used for live work under a safe system of work (see AS/NZS 4836).
- Using portable pole platforms that are fit for purpose. When selecting a portable pole platform, consideration should be given to using devices that can be safely attached to the structure e.g. wood or concrete or both. Design and use of the portable platform should ensure that an operator does not receive an electric shock when operating the device correctly.
- Identifying if there are nearby exposed live parts. Nearby exposed live parts, risk treatment measures such as de-energising, fitting covers, using a safety observer (electrical) or a combination of these should be addressed.
- Employing work practices such as:
 - two or more people carrying long devices in switchyards and switchrooms in a position below shoulder height;
 - two people handling extension ladders in windy conditions; and
 - restraining ladders using head ropes or footropes, or both.

- If conductive scaffolding is used within high voltage enclosures or in situations where there is induction, bonding the structure to the earthing system. Depending on the construction of the scaffold, you may have to bond a number of sections to ensure an equipotential state.

B.2.3 Working with elevating work platforms (EWP)

B.2.3.1 Scope

This part provides electrical safety information for electrical workers when using Elevating Work Platforms (EWP), including scissor lift and boom type machines. It outlines risks associated with the use of an EWP only in an electrical context and does not cover general safe operation.

B.2.3.2 Risks associated with EWP usage

Elevating work platforms are used throughout the electrical industry. Their configurations and applications vary widely, but there are common risks.

As the worker in the platform's basket moves in the travelling end of the machine, the risk of coming into contact with exposed live electrical parts is relatively higher than for other forms of plant.

Sources of risks associated with EWPs used for electrical and associated work include:

- Contacting exposed live parts and receiving an electric shock even in an insulated machine. This may be exacerbated by the close proximity to the exposed live part, any mechanical failure of the EWP or loss of stability resulting in contact with exposed live parts.
- Working near exposed live parts and poor judgement of distance.
- Mechanical failure or loss of stability possibly resulting in contact with exposed live parts.
- Step and touch potentials between vehicle and ground. This may result in an unsafe electrical environment where another person may accidentally touch the live vehicle while standing on the ground.
- Live exposed power lines on the ground as a result of pole failure or broken wires. An accident involving mechanical failure of the structure being worked on e.g. pole failure or live conductors falling to the ground.
- Creating an unsafe electrical environment at ground level e.g. if the body of the vehicle is live, passers by can receive electric shocks.

B.2.3.3 Working with an insulated EWP

If an insulated elevating work platform is used for electrical work, a risk assessment should consider whether the EWP's insulation is capable of protecting a person from a current path through the machine.

The insulation does not protect a person from electric shock if it is possible for him/her to simultaneously touch any two parts with different electric potentials.

In other words, if you are performing live work in the basket of an insulated EWP, it is still possible to receive an electric shock (refer to Figure 3).

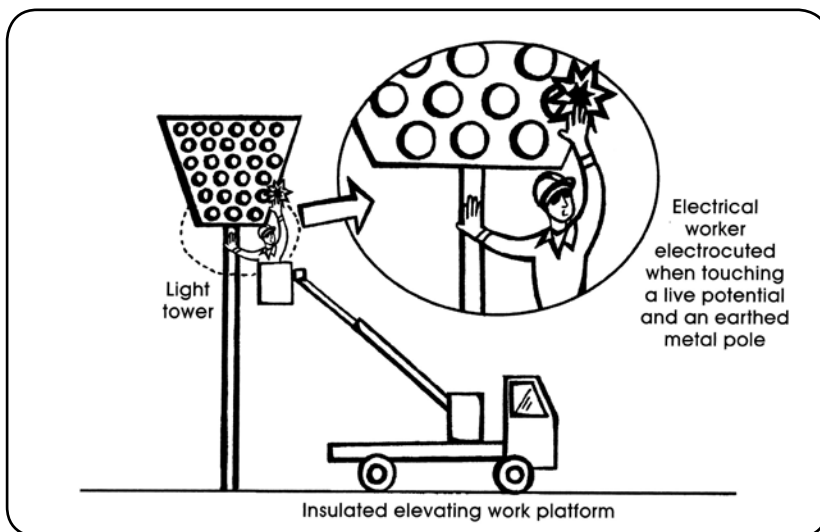


Figure 3: Example of an electrocution in an insulated EWP

Another example involves the application of earths and short circuits, such as portable earthing devices. In the case of portable earthing devices, you should address the likely effects of introducing potentials in or near the basket, as well as the mechanical effects of the conductors whipping about, should the device be applied to live parts.

Appropriate work practices should prevent different electrical potentials from existing in a basket. Situations like this can occur if people work on parts with different potentials, by an earth potential being introduced via a test lead, or through a portable earthing device, flexible extension lead or part of a structure.

B.2.3.4 Need for planning before electrical work using an EWP

Operations of EWPs with a boom length of more than 11m are deemed a Prescribed Occupation under schedule 5 of the *Workplace Health and Safety Regulation 2008*, as amended. Part 3 of the *Workplace Health and Safety Regulation 2008* requires certain minimum levels of training and assessment before the operator can gain the necessary certificate to engage in the occupation. The training, assessment and authorisation of EWP operators who are to work in an electrical context should be equivalent to, or better than, the workplace health and safety requirements.

Before electrical workers perform any electrical work from an elevating work platform, a risk assessment should be carried out and safety issues addressed. These issues vary depending on such conditions as the job, location, or weather. Though not exhaustive, the following list may be of assistance to determine suitability to perform work:

- Does the worker hold the appropriate electrical qualification?
- Is the electrical worker familiar with the procedure and method associated with the electrical work using the EWP?
- Is the electrical worker sufficiently familiar with tools and equipment, such as chain saws or augers, to use them safely while exposed to the additional risks associated with an EWP near exposed live parts?
- Will there be a suitably qualified EWP operator operating the machine?
- Is the EWP operator familiar with the particular machine?
- Where special testing of the EWP and equipment is required e.g. strength and insulation, are all the tests up to date?
- Are appropriate persons on site able to safely perform a rescue in case an accident occurs?

The EWP operator should ensure that all checks, inspections, set-up, stowage and maintenance requirements of the prime mover – as well as the EWP portion of the plant – are complied with. The checks, inspections, set-up, stowage and maintenance for each machine should be clearly documented. Though many of these requirements are similar to general EWP requirements, in electrical situations there are often additional requirements such as cleaning the insulating parts.

People should remain in the basket with their harness attached at all times when the basket is moved from the cradle. The only exception is when a documented

safe system of work is in place to provide a safe alternative. If the safe system permits access or egress, or both, from an EWP basket in a raised position, this procedure must be followed to treat the risks associated with this action. These risks include falls from heights and electric shock.

A safe system of work associated with electrical work from an EWP will invariably include training, assessment, authorisation and auditing components. Such components are general to machines as well as specific. Additionally, the safe system should consider at least the following contingency plans that instruct operators on how to deal with situations that include:

- Mechanical failure or electrical or mechanical accidents, or all three. Using the following may provide solutions:
 - ground controls;
 - bleed valves;
 - battery operated systems;
 - control descent devices; and
 - escape doors and hatches.
- Fire in the hydraulic system, possibly at basket level, including an incident in which the operator slumps over the controls, activating the 'deadman' as well as one of the controls. By-pass valves at ground level may cater for such situations.
- The roles of all persons on site with electrical safety responsibilities should be clearly documented e.g. the role of the basket operator and the interrelationship with ground operators and any safety observers. Communication needs should be defined, as should any actions required if direct contact is made with exposed live parts.
- A safe system of work should also include suitable controls for safely operating the EWP. The operator should be able to use the controls easily while wearing the PPE required. Additionally, design of the operator interlock device (deadman) should ensure it cannot be easily bypassed by the operator in the basket.
- A safe system of work should detail the requirements for checks, inspections, set-up, stowage and maintenance. The operational check should include safety components such as deadman switches and control descent devices. In addition, the correct operation of multiple park brakes, power take-offs and hydraulic accumulators should be detailed.

- The procedure for testing the machine electrically and mechanically should comply with relevant standards.
- If the safe system of work includes live work, risk treatment measures should not create dangerous step and touch potentials. At a strategic level, you should determine whether to adopt or reject the practice of earthing the machine frame. Regardless of the method chosen, appropriate technical consideration is required, since each method has significant advantages and disadvantages. A thorough analysis should include:
 - the piece of plant being used;
 - the tasks being performed;
 - configuration of the electrical network; and
 - the effect of electrical safety on workers and public.
- Where the EWP work is to be performed on distribution and/or transmission assets, private or otherwise, the following points should be addressed:
 - Ensuring that safe approach distances are maintained.
 - Making sure that step and touch potentials on and around the structure do not cause risks e.g. from faults or leakage.
 - Before work starts, ensuring that the mechanical integrity of the structure, conductors and equipment attachments has not or will not be compromised e.g. considering whether the structure is safe for work without further risk treatment measures.
 - If conductors are permitted to come into contact with the boom or basket of the EWP, a safe system of work should clearly state the electrical and mechanical requirements for this practice.
 - Detailing the authorisations, licences, restrictions and requirements in work practices to be used if booms and baskets are to work between, near and over energised and de-energised aerial works and installations. This list should include electrical and mechanical specifications including fail-safe systems.

B.2.3.5 Special provisions for working in the safety observer danger zone

What is the safety observer danger zone?

An elevating work platform is considered to be operating in the safety observer danger zone when there is a possibility that any of the following is capable of entering the exclusion zone of exposed live power lines.

- any part of the EWP not designed and capable of working safely within the area;
- any hand tools or other equipment held by any person involved with the operation and not designed or capable of working safely within the area;
- the load being moved; or
- the person working on an elevating work platform.

An elevating work platform is not operating in a safety observer danger zone when:

- the powerlines have been de-energised;
- limiting switches have been installed to warn the operator or prevent any part of the EWP or load from entering the no-go exclusion zone; or
- any parts of the EWP being moved are being prevented from entering the exclusion zone by physical barriers.

The safety observer danger zones for power lines on poles and on towers are illustrated in Figure 4: Safety observer zone for overhead power lines on pole and towers.

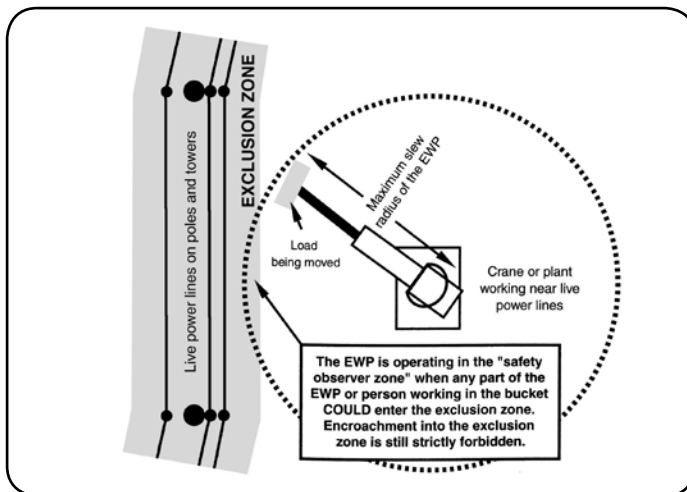


Figure 4: Safety observer zone for overhead power lines on poles or towers

Boom configuration

Boom configuration should also be addressed. Elevating work platforms used in the electricity industry include telescopic, 'knuckle' and scissor booms, fly jibs and hybrid versions. The appropriate boom configuration can assist or hinder electrical safety and needs to be addressed in risk management.

An example of a possible risk can be seen in Figure 5.

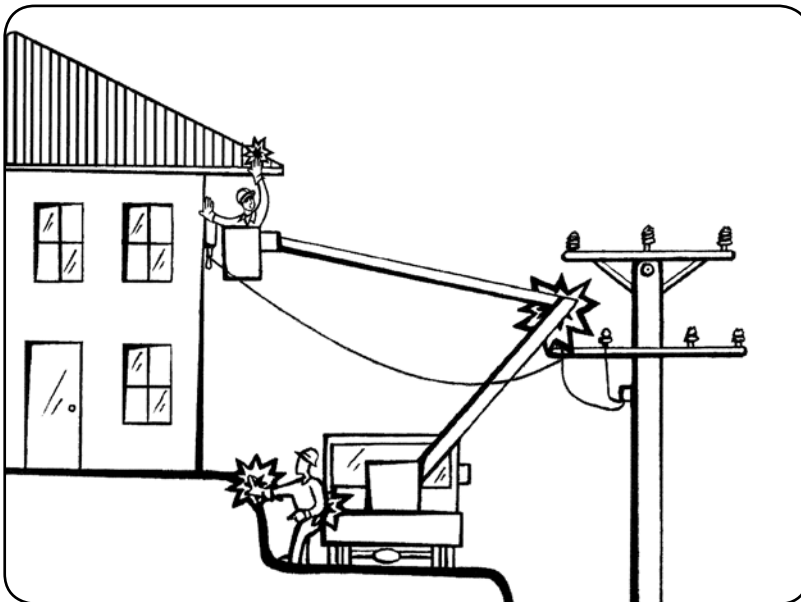


Figure 5: Example of a risk due to the position of the vehicle and boom configuration (worker performing de-energised work in an uninsulated EWP)

Safety observer

A safety observer is required when an elevating work platform is operated within the safety observer danger zone. The employer of the EWP operator or a self-employed operator is responsible for appointing a safety observer to observe the approach of the EWP or load to power lines.

People in contact with the EWP

When the elevating work platform operates in the safety observer danger zone, only the following persons may be instructed to touch, or allowed to touch, any part of the EWP or its load:

- The operator while not in contact with an electrical earth or another source of potential.
- An operator, while standing on the ground or while in an earthed situation, may operate the EWP under the following conditions:
 - the controls are effectively insulated³;
 - the operator wears insulating gloves where the voltage of any of the overhead power lines does not exceed 1000 volts; or
 - the operator stands on an equipotential metallic mat or tray/deck, electrically connected to all metalwork associated with the controls.
- Other personnel may be allowed in the safety observer danger zone on condition that:
 - their presence is essential to the particular operation of the crane or plant e.g. other workers helping to set up the EWP;
 - these persons are not required to have direct contact with any part of the EWP;
 - where direct contact is necessary, effectively maintained insulating gloves must be worn; and
 - when any indirect contact is required by these persons with the EWP, such contact must be via a non-conductive object e.g. hauling line, pole or tail rope used to control load movement.

B.2.3.6 Additional loading affecting movement or position of the EWP basket

When considering the risks associated with working on or near structures, you should allow for the fact that the mechanical loading of the structure can be significantly altered e.g. adding additional light fitting to a light tower, or applying or removing tension from aerial conductors or catenary systems.

A mechanical failure of this kind can compound risks and dramatically increase the risk and consequences. For example, if the tip loading of a pole is altered and a pole consequently fails, the falling pole may strike the EWP. At the same time, however, live mains may fall to the ground, creating risks for work crew, rescuers and the public.

³ Insulation must at least be effective against the maximum voltage of the particular overhead power line. The employer or self-employed person operating the crane is responsible for ensuring the effectiveness of the insulation in accordance with the relevant Standard.

The elevating work platform should not be subjected to mechanical forces for which it is not designed. For example, inappropriate conductor tensioning techniques or raising and lowering with a power winch could apply inappropriate force to an EWP.

B.2.3.7 Possible illusions as a result of using an EWP

Operators should be aware of a feeling of light-headedness as clouds move in the background or affect the operator's peripheral vision.

In addition, where work is performed near aerial conductors, operators should be aware of an illusion known as 'wire blindness'. This state occurs when an operator knows that a conductor exists but either cannot see it or loses sight of it. In these circumstances, adequate contingencies should be employed.

B.2.4 Working on or from poles and towers

Sources of risks when working on or from a pole or tower include:

- Electric shocks from multiple sources of potential, often uninsulated and uncovered. These sources include:
 - high voltage circuits;
 - low voltage circuits;
 - multiple and common earth systems, including aerial earths;
 - streetlight mains that test as both an active and a neutral depending on the status of the control contractor;
 - earthed metalwork and lighting arrestors; and
 - earthed catenary systems such as high voltage aerial bundled conductor, pilot wires and broadband communication cable (BBCC – cable TV).
- Clashing of conductors and conductors contacting other circuits.
- Step and touch potentials at ground level and above. These may be caused by a number of factors ranging from failing insulators to incorrect connections (including incorrect polarity).
- Failure of conductors, cross-arms or poles, creating rapid movements that can cause workers to touch energised parts.
- Injury and illness from 'suspension trauma'. If restrained after a fall, a person may suffer 'suspension trauma' if left hanging in the harness.
- Working near exposed live parts e.g. working on de-energised low voltage while the high voltage above is energised. This has risks associated not only with the high voltage but with high voltage causing induction in the low voltage.

- Effects that may be beyond the immediate control of the work group including:
 - lightning;
 - wind gusts causing movement as well as static effects; and
 - vehicles hitting poles.

Electrical work and associated work on or from a pole should be performed only after a risk assessment has been carried out and then only in line with an effectively implemented safe system of work.

Work should not begin until the pole has been examined and evaluated as safe to climb or work on. The requirement for an examination should apply regardless of:

- the type of structure i.e. wood, steel or concrete;
- whether a pole is owned by a supply entity or not; and
- whether the work is to be performed from the pole or from another device such as an elevating work platform.

As part of the examination and evaluation, a below ground inspection may be necessary.

Where the tip loading is being altered, work procedures should include methods that will prevent structural failure. Further, an engineering assessment should be conducted if the tip loading is to be altered permanently or where work procedures cannot ensure structural stability. If loading of a pole is altered consideration should be given to the effect this may have on adjacent poles.

Structures and insulators supporting live high voltage conductors should be checked to identify conditions that may result in leakage through the pole. Where leakage is suspected, further tests should be done to determine whether the structure is safe to climb.

B.2.4.1 Work practices

A safe system of work that is effective in ensuring electrical safety should ensure at least the following:

- clear instructions are given about working live and de-energised;
- isolation and access are introduced to create an electrically safe environment;
- requirements for altering loadings on structures are communicated; and
- the stability of the structure is assessed as adequate.

The following precautions should be taken when poles and towers are worked on:

- When conductors are released or tensioned, tension should be altered in a way that controls their effect on structural stability.
- In particular, conductors should not be cut and allowed to fall. This practice may cause dangerous whip, leading to structural failure.
- Additional or heavier mains should be tensioned so that an overall balance in tension is closely maintained on the cross arm and pole.
- Cross arms, arm checks, bolt holes, bolts and the pole head should be examined for deterioration or weakness before heavier or more heavily tensioned conductors are added.
- Work practices should also ensure that objects are not dropped or allowed to fall from heights.

B.2.4.2 Wooden poles

For wooden poles owned by an electricity entity, the examination should include a check for markings such as 'suspect' (one diagonal painted stripe) or 'unserviceable' (painted cross). For other poles, workers should consult the asset owner or operator. Fungus and loose sapwood should not obscure these markings.

Structural integrity can be checked by using an appropriate method such as a rope test. Where a rope test cannot be safely or practically completed, a suitable procedure for identifying pole defects should be used.

If a pole is not marked as suspect or unserviceable, it should be tested to ensure that the pole is safe to climb or access. In this case, the following tests should be considered:

- a rope test;
- a below ground inspection; and
- 'sounding' the pole by using a hammer or maul to detect unsound structures.

During these tests, appropriate action should be taken to ensure co-workers and others are safe from falling objects etc.

A 'ladder test' – or any other method of testing a pole by imposing pressure via a ladder – should not be used as an appropriate way of determining if a pole is sound.

B.2.4.3 Concrete poles

Concrete poles are conductive, especially when wet. The conductivity occurs both through metal fittings connected to the reinforcement and through the concrete surface. Therefore, the surface of a concrete pole and all metal work bolted, clamped or bonded to a concrete pole should be treated as conductive. Take appropriate risk treatment measures such as using barriers and insulated mats.

B.2.4.4 Steel poles

With steel poles, internal and external corrosion can create the risk of structural failure. Inspection and testing should include any signs of corrosion-induced structural damage.

This should include the following tests:

- a rope test; and
- a below ground inspection.

During these tests, appropriate action should be taken to ensure co-workers and others are safe from falling objects etc.

Steel poles have various shapes and sizes. Safe work practices when using a ladder and pole platforms need to ensure that the devices can be fitted soundly. Safe work practices should include preventing people from falling from heights.

B.2.4.5 Working on unserviceable or suspect poles

In some cases, additional strengthening and support may not be installed before work is done on an 'unserviceable' or 'suspect' pole.

When this happens, an appropriately experienced and qualified person should evaluate the pole's condition to decide whether the pole can be safely climbed, worked on, or both. Additional measures to ensure safety may include:

- Securing the pole's base by driving at least three long gads into the ground around the pole and then lashing them to it. The head of the pole should also be secured, using at least three stays attached as high as possible.
- Holding the pole at head and ground level with a pole lifter or crane of suitable size.
- Attaching suitable stay equipment that will hold the pole upright under all conductor tensions and subsequent twisting.

- When the replacement pole is close enough, perform work associated with the old pole by working from the new pole. The old pole should be lashed to the new one and stayed, so that when conductors are released, the old pole will not fall.

Pole buoys or pikes may provide a satisfactory temporary means of supporting badly deteriorated poles. When a pole has to be climbed, pole buoys require additional staying if used for support. Otherwise, pole buoys are not suitable for the task.

When releasing conductors from an unserviceable pole, hold the conductors under control and release them slowly so that you can note their effect on the pole before you release them completely. If pole stability depends on the conductors being released, additional stays should be installed to maintain or increase stability.

If the pole cannot be held or supported so that all the conductors can be safely removed, no attempt should be made to climb or work on the pole until it is safe to perform the work. The pole should be made as secure as possible with available equipment.

B.2.4.6 Electrical leakage procedures for poles

Before climbing any pole supporting live high voltage conductors, make a visual inspection for any evidence of leakage. If you see evidence of pole top fires or other fire damage, damaged or polluted insulators, or a conductor, tie wire or debris touching the pole or cross arm, you should ensure the pole is tested or inspected for damage or both.

When conductor attachments cannot be clearly assessed from the ground because of wet weather or poor visibility, a detection / inspection should be carried out.

Where leakage is suspected on poles supporting broadband communication cables (BBCC), appropriate procedures should be used to detect leakage. These procedures should address the risks associated with testing near exposed high and low voltage conductors. They should also look at whether any leakage through a BBCC supporting conductor might affect the detection's validity.

Where leakage is suspected, work should not be carried out until the pole has been confirmed safe to work on or from.

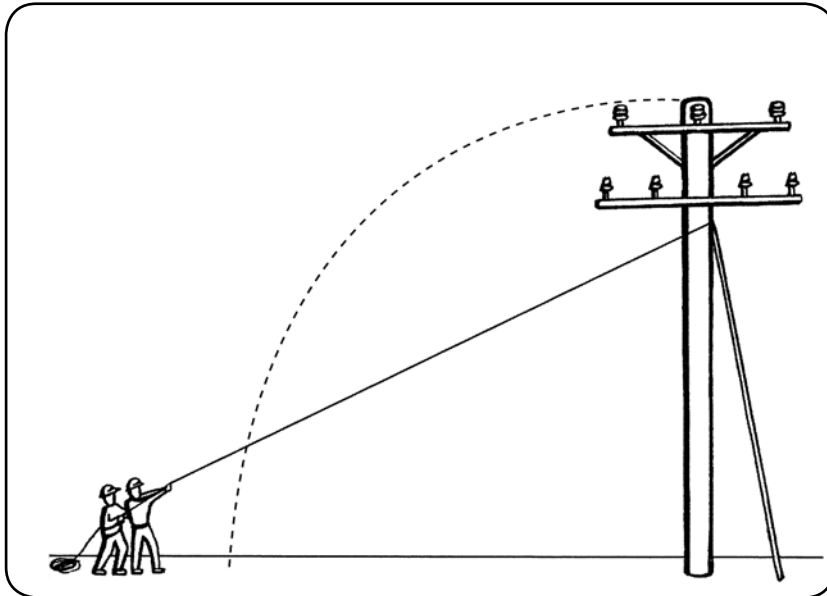


Figure 6: Rope pull test

B.2.4.7 Rope testing

The following items should be addressed when performing a rope test on a pole:

- Ensure members of the public and workers are safe.
- The following process should be considered:
 - extend a ladder with rope attached to the top stile or head of the ladder as far up the pole as practical;
 - apply pressure as close as possible to the head of the pole on the side or in the direction least supported by stays or conductors;
 - two people should pull on the rope or ropes while standing as far as practical from the base of the pole; the rope pullers should be located on the opposite side of the pole from the ladder (refer to Figure 6 – Rope pull test); and
 - during the test, pressure must be applied progressively or gradually; avoid aggressive or jerky actions.
- The rope must be long enough to ensure operators are safe if a pole should fail.

- Signs of failure include excessive movement, signs and sounds of splitting.
- Other people should be kept out of the area during the test.
- If, during a procedure to determine whether the pole is stable, there is any doubt about the pole's soundness, the pole must be regarded as 'suspect'. Provide pole support before proceeding further.

B.2.5 Tagging out of service

When equipment, parts or devices are not to be used, the item or items should be made safe (e.g. isolated) and tagged out of service. Examples of where tagging out of service should occur include:

- tools and equipment that are faulty, defective or out of test date; and
- plant and equipment that is unsafe, under repair or being maintained.

Tagging out of service is a risk treatment measure that physically excludes items from use and should form part of a safe system of work. Tags used should comply with an appropriate standard (refer to also Part 3.4.2).

B.2.6 Excavation near energised cables

Workers involved in excavation should be aware of the possibility of electric shock and explosions associated with damaged underground cables. It can be difficult to tell the difference between high voltage and low voltage cables. There is a potential for injury and death if low voltage and high voltage cables are damaged.

Even earthed, metal-sheathed cables can cause injuries if damaged, because protective systems may not always operate fast enough to prevent injury.

B.2.6.1 Precautions before excavation

Before excavation, you should contact the organisation Dial Before You Dig⁴, a free enquiry referral service for information on underground assets anywhere in Australia. For further information, contact Dial Before You Dig by any of the following methods:

⁴ Dial Before You Dig contacts member asset owners who have services at or near the proposed excavation site and will arrange for information about these services to be sent. Asset owners will usually respond within two working days and may provide copies of underground service plans. It must be emphasised that Dial Before You Dig is a referral and information service only and is not the legal owner of site information. Dial Before You Dig does not go on-site and find the physical location of the underground service.

- telephone 1100;
- fax 1300 652 077; or
- online at www.dialbeforeyoudig.com.au.

B.2.6.2 Using mechanical excavation equipment

A safe system of work should determine beforehand how close machinery, such as backhoes, excavators, horizontal borers and chain diggers, can excavate near:

- cables or cable joints;
- earth systems or grids;
- conduits or ducts;
- underground pillars, pits or equipment; and
- cable protection (mechanical) such as cover tiles, slabs or strips.

If it is necessary to excavate near the items above, the work should be done by hand excavation or with hand tools.

The plant operator should be guided by another worker positioned to warn the operator if the machine appears likely to venture too close or to cause damage.

Pneumatic or other powered excavation tools, such as jackhammers, should not be used near conduits that contain live cables.

When using powered tools to excavate beside or around direct-laid cables in rock or hard fill, existing cables should be protected in case the machine slips.

B.2.6.3 Excavating concrete-encased conduits

Excavating concrete-encased conduits containing live cables can be hazardous if appropriate precautions are not taken. Explosions and electric shock can result.

It is preferable to remove cables from the conduit while the work is done.

If the cables cannot be removed, they should be de-energised. Hand excavation should be used, at least until enough of an opening has been made in the conduit to permit the installation of mechanical protection.

B.2.7 Vegetation management, chainsaws and electrical workers

If an electrical worker is required to perform vegetation management near exposed live parts, a number of additional risks should be managed. Typically, this work ranges from clearing vines that have grown into a switchboard to trimming trees to maintain clearances from overhead powerlines.

In addition to risks associated with general vegetation management and chainsaw use, electrical risks include:

- A situation where objects fall against energised conductors. The conductors may or may not be bare e.g. tree trimming from ground level where the tree or part of the tree may touch exposed live parts, causing step and touch potentials at ground level or mains to clash or both.
- A situation where objects fall across or onto conductors e.g. when removing an unserviceable wooden pole located between energised mains, objects should not be allowed to fall across conductors. An incident of this kind can create electrical or mechanical risks or both, for example, by causing a live conductor to fall to the ground.
- The likelihood of a current path through the vegetation should also be addressed. A worker may receive an electric shock via the vegetation or cause a fault or both. Current may track to earth or between phases via the vegetation.

B.2.8 Use of tools

Poor use of tools can expose workers to electrical risks including:

- electric shock and explosion if an energised cable is cut, regardless of whether by cable cutters or a hacksaw;
- stripping cable can cause injuries ranging from electric shock to burns and cuts; and
- tightening connections can cause short circuits and explosions e.g. a spanner can slip and bridge two phases, resulting in burns.

These tools should be used according to manufacturer's instructions and an effective, safe system of work.

Tools should be restrained at the work position to prevent them from falling into live switchboards or jamming controls e.g. in an EWP. The use of lanyards around

wrists, tool holders and tool restraints including tool pouches and baskets, should be addressed.

Refer also to Part 4.4 for further information on tools, instruments and equipment.

B.3 General elements of a safe system of work

A safe system of work is specified in the Regulation and is described in AS/NZS 4836. Generally, for a safe system of work to exist, people should be able to demonstrate that they have identified and addressed risks associated with workers' safety.

Typically, there should be planning and pre-prepared actions, records and evidence that the actions have been addressed.

Refer to Part 4.3 for requirements for a safe system to perform live work.

Common elements of a safe system of work that should apply to all electrical work, both live and de-energised, include:

- the safe system of work should be drawn up with people, who are representative of electrical workers;
- the system should be consistent with, and should complement, other management systems such as general workplace health and safety, environmental systems, and quality systems; and
- a safe system of work should include practical guidance on at least the following:
 - electrical access;
 - physical access;
 - safe electrical work practices;
 - tools, instruments and safety equipment used for electrical work; and
 - testing and faultfinding.

B.4 High voltage isolation and access

B.4.1 General

Relevant risks listed in 4.3 of this Code also apply to high voltage. Additional sources of risks for high voltage isolation and access include:

- induction from other circuits and communications equipment such as radio transmitters;

- build up of static charges due to weather conditions;
- ferro-resonance;
- transferred earth potentials;
- feedback from secondary or tertiary systems;
- stored energy in high voltage capacitor banks; and
- working under or over other live conductors.

From an electrical safety perspective, the risks and consequences of an incident involving high voltage are significantly higher. Under fault conditions, the higher potentials (voltages) and fault current levels release massive quantities of energy. Risk treatment measures should be adopted to reduce exposure to these risks.

B.4.2 High voltage isolation and access system

People near exposed live high voltage parts must maintain the exclusion zone limits detailed in Appendix C of this Code. Under section 64 of the Regulation, where people intrude within the exclusion zone limits for exposed live high voltage parts, the parts **must** be de-energised and earthed and tested to confirm that it is isolated from all sources of electricity.

The principles in Part 2.3 of this Code also apply to high voltage. Elements of a safe system of work for high voltage isolation and access should include:

- A mechanism to instruct people on what to isolate to permit access to the high voltage parts as well as to surrender access and reverse isolation, and how to do it.
- Effective isolation to prevent lightning, switching surges or other events from compromising the isolation point or points. Electrical safety in the area for access should not be compromised.
- Work practices and devices used for earthing and short-circuiting should be capable of withstanding the various prospective fault current levels and clearing times or fault duration.
- Except in emergency situations, authority to access high voltage parts that have been earthed and short circuited should be provided by way of a written permit or authority. The permit or authority may be issued by telephone or radio etc.
- In emergency situations the actions taken should be recorded.
- Testing to prove de-energised.

- Where possible, work and access should occur with visible earths and short circuit devices.
- Placement of 'other precautions' should be a risk treatment measure for directing people to electrically safe work areas. Other precautions usually include:
 - taping or roping off;
 - safety signs; and
 - barriers.
- A mechanism or process implemented that demonstrates that the isolation and access process is being complied with at all levels.
- Having mechanisms in place to deal with protection operations that minimise exposure to electrical risks. If a feeder trips or 'locks out', whether or not after re-closing, the actions to energise the feeder should be outlined.
- Effective isolation to include control circuits and secondary systems. Unless fit for purpose, an open high voltage circuit breaker should not be considered an effective isolation point.
- Procedures or mechanisms to be in place to address worker and community safety in emergencies e.g. damage from cyclones, mains on the ground.

Earthing installed in a power system is one method used to prevent or minimise electric shocks. When operating a power system (e.g. to switch, de-energise, isolate, prove de-energised) additional risks could be present. For example, when a power system is operated, voltage transients of short duration can create lethal step and touch potentials. Transients can occur when network operations cause huge quantities of electrical energy to stop flowing suddenly.

As it is foreseeable that lethal levels of step and touch potential will exist, appropriate risk treatment measures should be used. Depending on the situation, methods, or a combination of methods, that should be considered include:

- Design and installation measures:
 - physically separate or isolate articles e.g. mount the equipment in a safe location such as above 2.4 metres; and
 - use alternative insulation, better earthing, or both.
- Operational measures:
 - use of insulating gloves or mats, or both, when performing system operations; or

- use of equipotential zones where conductive materials create a zone around the worker, so that the effects of step and touch potentials are negligible.

If insulating gloves or mats or both are chosen, they should be used in at least the following situations:

- operating high voltage isolators, switchgear and earth switches via handles, operating rods and similar equipment;
- applying and removing portable earths and short circuits; and
- using high voltage test devices, operating rods, measuring sticks etc on, or near, high voltage parts.

Appendix C: Exclusion zones for electrical parts

These tables are a reproduction of schedule 2 from the Regulation.

Part 1: Exclusion zones for exposed parts for UNTRAINED PERSONS and for operating plant and vehicles operated by untrained persons

Nominal phase to phase voltage of exposed part	Untrained person for the exposed part (mm)	Operating plant operated by untrained person for the exposed part (mm)	Vehicle operated by untrained person for the exposed part (mm)
Low voltage (with consultation with person in control of exposed part)	1 000	3 000	600
Low voltage (without consultation with person in control of exposed part)	3 000	3 000	600
Above low voltage, up to 33kV (with consultation with person in control of exposed part)	2 000	3 000	900
Above low voltage, up to 33kV (without consultation with person in control of exposed part)	3 000	3 000	900
Above 33 kV up to 50 kV	3 000	3 000	2 100
Above 50 kV up to 66 kV	3 000	3 000	2 100
Above 66 kV up to 110 kV	3 000	3 000	2 100
Above 110 kV up to 132 kV	3 000	3 000	2 100
Above 132 kV up to 220 kV	4 500	6 000	2 900
Above 220 kV up to 275 kV	5 000	6 000	2 900
Above 275 kV up to 330 kV	6 000	6 000	3 400

Nominal phase to phase voltage of exposed part	Untrained person for the exposed part (mm)	Operating plant operated by untrained person for the exposed part (mm)	Vehicle operated by untrained person for the exposed part (mm)
Above 330 kV up to 400 kV	6 000	8 000	4 400
Above 400 kV up to 500 kV	6 000	8 000	4 400
Nominal pole to earth dc voltage of exposed part			
+/- 25 kV	3 000	3 000	900
+/- 85 kV	3 000	3 000	2 100
+/- 150 kV	3 000	3 000	2 100
+/- 270 kV	4 500	6 000	2 900
+/- 350 kV	5 000	6 000	2 900
+/- 400 kV	6 000	6 000	3 400

Part 2: Exclusion zones for exposed parts for AUTHORISED AND INSTRUCTED PERSONS and for operating plant and vehicles operated by authorised or instructed persons

Nominal phase to phase voltage of exposed part	Authorised person or instructed person for the exposed part (mm)	Operating plant operated by authorised person or instructed person for the exposed part, with safety observer or another safe system (mm)	Vehicle operated by authorised person or instructed person for the exposed part (mm)
Low voltage (with consultation with person in control of exposed part)	(No exclusion zone prescribed)	1 000	600
Low voltage (without consultation with person in control of exposed part)	(No exclusion zone prescribed)	1 000	600
Above low voltage, up to 33kV (with consultation with person in control of exposed part)	700	1 200	700

Nominal phase to phase voltage of exposed part	Authorised person or instructed person for the exposed part (mm)	Operating plant operated by authorised person or instructed person for the exposed part, with safety observer or another safe system (mm)	Vehicle operated by authorised person or instructed person for the exposed part (mm)
Above low voltage, up to 33kV (without consultation with person in control of exposed part)	700	1 200	700
Above 33 kV up to 50 kV	750	1 300	750
Above 50 kV up to 66 kV	1 000	1 400	1 000
Above 66 kV up to 110 kV	1 000	1 800	1 000
Above 110 kV up to 132 kV	1 200	1 800	1 200
Above 132 kV up to 220 kV	1 800	2 400	1 800
Above 220 kV up to 275 kV	2 300	3 000	2 300
Above 275 kV up to 330 kV	3 000	3 700	3 000
Above 330 kV up to 400 kV	3 300	4 000	3 300
Above 400 kV up to 500 kV	3 900	4 600	3 900
Nominal pole to earth dc voltage of exposed part			
+/- 25 kV	700	1 200	700
+/- 85 kV	1 000	1 800	1 000
+/- 150 kV	1 200	1 800	1 200
+/- 270 kV	1 800	2 400	1 800
+/- 350 kV	2 500	3 200	2 500
+/- 400 kV	2 900	3 600	1 900

Part 3: Exclusion zones for low voltage overhead insulated electric line for UNTRAINED PERSONS and for operating plant or vehicles operated by untrained persons

Low voltage overhead insulated electric line	Untrained person (mm)	Operating plant operated by untrained person for the electric line (mm)	Vehicle operated by untrained person for the electric line (mm)
With consultation with, and insulation verified by, an authorised person for the electric line	(No exclusion zone prescribed)	1 000	300
Without consultation with, and without insulation verified by, an authorised person for the electric line	3 000	3 000	600

Part 4: Exclusion zones for low voltage overhead insulated electric line for AUTHORISED OR INSTRUCTED persons and for operating plant or vehicles operated by authorised or instructed persons

Low voltage overhead insulated electric line	Authorised person or instructed person for the electric line (mm)	Operating plant operated by authorised person or instructed person for the electric line, with safety observer or another safe system (mm)	Vehicle operated by authorised person or instructed person for the electric line (mm)
With consultation with, and insulation verified by, an authorised person for the electric line	(No exclusion zone prescribed)	(No exclusion zone prescribed)	(No exclusion zone prescribed)
Without consultation with, and without insulation verified by, an authorised person for the electric line	(No exclusion zone prescribed)	1 000	600

Part 5: Exclusion zones for high voltage overhead insulated electric line for UNTRAINED PERSONS and for operating plant or vehicles operated by untrained persons

Nominal phase to phase voltage of high voltage overhead insulated electric line	Untrained person for the electric line (mm)	Operating plant operated by untrained person for the electric line (mm)	Vehicle operated by untrained person for the electric line (mm)
Above low voltage, up to 33kV (with consultation with person in control of electric line)	2 000	3 000	900
Above low voltage, up to 33kV (without consultation with person in control of electric line)	3 000	3 000	900
Above 33 kV up to 50 kV	3 000	3 000	2 100
Above 50 kV up to 66 kV	3 000	3 000	2 100
Nominal pole to earth dc voltage of electric line			
+/- 25 kV	3 000	3 000	900
+/- 85 kV	3 000	3 000	2 100

**Part 6: Exclusion zones for high voltage overhead insulated electric line for
AUTHORISED AND INSTRUCTED persons and for operating plant and
vehicles operated by authorised or instructed persons**

Nominal phase to phase voltage of high voltage overhead insulated electric line	Authorised person or instructed person for electric line (mm)	Operating plant operated by authorised person or instructed person for electric line, with safety observer or another safe system (mm)	Vehicle operated by authorised person or instructed person for electric line (mm)
Above low voltage, up to 33kV (with consultation with person in control of electric line)	700	700	700
Above low voltage, up to 33kV (without consultation with person in control of electric line)	700	700	700
Above 33 kV up to 50 kV	750	750	750
Above 50 kV up to 66 kV	1 000	1 000	1 000
Nominal pole to earth dc voltage of electric line			
+/- 25 kV	700	700	700
+/- 85 kV	1 000	1 000	1 000

Appendix D: *Electrical Safety Act 2002*

The Act imposes electrical safety obligations on persons for the electrical safety of others. A person can have an electrical safety obligation in more than one capacity. For example, a corporation may have an obligation not only as a generation entity but also as an employer, supplier or person in control.

Where the *Workplace Health and Safety Act 1995* and the *Electrical Safety Act 2002* both apply, the *Electrical Safety Act 2002* takes precedence.

The following are sections of the Act which have been referenced in this Code. For detailed information, please see the appropriate section of the Act.

Part 2 Electrical safety obligations

Division 2 Electrical safety obligations

- Section 29 Obligation of electricity entity
- Section 30 Obligation of employer or self-employed person
- Section 31 Obligation of designer of electrical equipment
- Section 32 Obligation of manufacturer of electrical equipment
- Section 33 Obligation of importer of electrical equipment
- Section 34 Obligation of supplier of electrical equipment
- Section 35 Additional obligation of designer, manufacturer, importer or
supplier of electrical equipment
- Section 36 Obligation of installer of electrical equipment or electrical
installation
- Section 37 Obligation of repairer of electrical equipment or electrical
installation
- Section 38 Obligation of person in control of electrical equipment
- Section 39 Obligations of worker
- Section 40 Obligations of other person

Part 4 Licences

Division 1 Requirements for electrical licences

- Section 55 Requirement for electrical work licence

Appendix E: *Electrical Safety Regulation 2002*

The Regulation ensures the electrical safety of licensed electrical workers, other workers, licensed electrical contractors, consumers and the general public. It does this by prescribing how obligations set down under the Act can be met.

The following are sections of the Regulation which have been referenced in this Code. For detailed information, please see the appropriate section of the Regulation.

Part 2	Electrical work
Division 2	Basic requirements for electrical work
Section 11	Requirements for electrical work
Section 12	Requirements for performance of live work
Division 4	Testing of work
Section 14	Testing of electrical equipment after electrical work
Section 15	Certificate of testing and safety
Division 5	Requirements applying to employers and self-employed persons
Section 16	Application of div 5
Section 17	Testing and maintenance of safety equipment
Section 18	Employer or self-employed person to ensure suitability of testing instruments
Division 6	Other requirements
Section 19	Electrical equipment with serious defect not to be connected to electricity source
Section 20	Signs on switches and disconnection points
Section 21	Rescue and resuscitation training
Division 7	Documents about electrical work
Section 22	Application of div 7
Section 23	Who may sign documents about electrical work
Section 24	Misrepresentations about electrical equipment or work
Section 24A	Misrepresentations about lawful authority to contract for the performance of electrical work
Part 4	Working around electrical parts
Division 1	Preliminary
Section 58	Purpose of pt 4

Section 59	Definitions for pt 4
Section 61	Meaning of <i>exclusion zone</i>
Section 62	Employer or self-employed person to ensure work is performed in accordance with requirements
Section 62A	Principal contractor for construction workplace – excavating and underground electrical services
Section 62C	Employer or self-employed person at construction workplace – excavating and underground electrical services
Section 62D	Employer or self-employed person not at construction workplace – excavating and underground electrical services
Section 63	Work involving direct contact with electrical part
Section 64	Work within exclusion zone for electrical part
Division 3	Consultation with persons in control of electrical lines
Section 64A	Requirement to consult
Part 5	Electrical installations
Division 1	Performing electrical work
Section 69	Work involving electric motor forming part of vehicle
Division 5	Workplace electrical installations
Section 82	Purpose of div 5
Section 83A	Meaning of <i>rural industry work</i>
Subdivision 2	All work
Section 84	Application of div 2
Section 85	Cord extension sets and flexible cables
Subdivision 3	Construction work
Section 87	Requirements for construction wiring and electrical equipment
Subdivision 4	Manufacturing work
Section 89	Double adaptors and piggyback plugs prohibited
Section 90	Specified electrical equipment
Section 90A	Manufacturing work – safety switch
Section 90B	Exemption for safety switches
Section 91	Safety switches, including portable safety switches
Subdivision 5	Service work or office work
Section 93	Specified electrical equipment
Section 94	Safety switches, including portable safety switches

Subdivision 6 Amusement work

- Section 94B Double adaptors and piggyback plugs prohibited
- Section 94C Specified electrical equipment
- Section 94D Amusement devices and amusement rides
- Section 94E Safety switches, including portable safety switches

Subdivision 7 Rural industry work

- Section 94G Requirements for rural industry work

Part 8 Electricity supply

Division 1 Connection to source of electricity

- Section 149 Electrical installation with serious defect not to be connected to electricity source
- Section 150 Electrical installation not to be connected to electricity source if work not tested
- Section 151 Electrical installation not to be initially connected to electricity source without examination and testing
- Section 152 Reconnection of electrical installation to electricity source
- Section 154 Licensed electrical contractor not to connect electricity source without being satisfied of compliance with Act and Regulation
- Section 155 Disconnection and reconnection of low voltage electrical installation

Division 3 Testing

- Section 158 Notice by licensed electrical contractor of test
- Section 159 Certificate of testing and compliance
- Section 160 Performance of examination or test

Part 12 Incident notification and reporting

- Section 196 Employer or self-employed person to advise chief executive of serious electrical incident or dangerous electrical event
- Section 201 Scene not to be interfered with

Part 13 Miscellaneous provisions

Division 3 Other matters

- Section 208 Climbing poles of electricity entity prohibited
- Section 209 Obligations of employer about supervising training person

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