

Victorian Traction Industry Electrical Safety Rules 2019

The Orange Book



The Victorian Traction Industry Electrical Safety Rules 2019 have been developed with the assistance of:



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Statement from the chair

Energy Safe Victoria (ESV) is the custodian of the Victorian Traction Industry Electrical Safety Rules 2019 (The Orange Book) and makes available electronic copies at www.esv.vic.gov.au.

The Victorian Traction Industry Electrical Safety Rules 2019 have been prepared by the Victorian Railway and Tramway Electrical Safety Committee (VRTESC). This committee has been established under section 8 of the Energy Safety Victoria Act 2005. The Victorian Traction Industry Electrical Safety Rules 2019 will be reviewed on an annual basis unless there is a need for them to be reviewed prior to this date.

The Victorian Traction Industry Electrical Safety Rules 2019 provide the guiding electrical safety principles that support the development and review of companies policy and procedures relating to electrical safety.

The Victorian Railway and Tramway Electrical Safety Committee recognises that railway and tramway companies and their contractors need time to train all relevant workers of the requirements of the Victorian Traction Industry Electrical Safety Rules 2019.

Energy Safe Victoria endorses the Victorian Traction Industry Electrical Safety Rules 2019 and commends the railway and tramway electrical safety committee members and those industry organisations involved with the development of these Electrical Safety Rules.

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Definitions

For the purpose of these electrical safety rules, the following definitions shall apply:

Access authority means any form of authorisation which allows access to, work on or near, or testing of electrical apparatus.

- » **Electrical access permit** means a form of authorisation which allows access to, and work upon, electrical apparatus.
- » **Sanction for testing** means a form of authorisation to allow energisation of electrical apparatus for testing purposes.
- » **Permit to work adjacent to network assets** means a document providing written permission to persons to work within safe approach distances, near, or in the vicinity of the network operator's electrical apparatus.

Alive see live

Appliance means any instrument or device designed for the use near or in direct contact with live high voltage conductors.

Approved means having appropriate organisation endorsement in writing for a specific function.

Authorised person means a person with technical knowledge or sufficient experience who has been approved, or has the delegated authority to act on behalf of the organisation, to perform the duty concerned. Examples used within these rules are:

- » **Authorised applicant** means an approved person who has been assessed as competent against an approved training standard to make application for specified types of access authorities.
- » **Authorised electrical operator (electrical operator)** means an approved person who has been assessed as competent against an approved training standard to carry out switching operations on high voltage and/or traction electrical apparatus.
- » **Authorised recipient** means an approved person who has been assessed as competent against an approved training standard to receive an electrical access authority.
- » **Authorised tester** means an authorised recipient who has been assessed as competent against an approved training standard, and is approved to receive sanction for testing.

Authorised live HV worker means an approved person who has been assessed as competent against an approved training standard to carry out particular work on or near exposed, live high voltage conductors.

Authority to work in the vicinity of electrical apparatus means a form of authorisation to be used where applicable to allow work in the vicinity of electrical apparatus.

Barrier means a physical device used to prevent access to, or contact with, electrical apparatus. Barriers must be approved for their intended application. Barriers can include approved insulating materials used to provide an insulating screen, of approved design, between persons and electrical apparatus.

Bonded means connected together in such a manner as to ensure that all connected parts are maintained at the same potential.

Cable means an insulated conductor or two or more such conductors laid together, whether with or without fillings, reinforcements or protective coverings.

Circuit breaker means a device capable of making, carrying and breaking currents under normal and abnormal circuit conditions, such as short circuit.

Competent means having the skills, knowledge and attributes a person needs to complete a task.

Conductor means a wire or form of metal designed for carrying electrical current.

Connected means joined together by a conductor capable of carrying electrical current for its required function or purpose. This could be by either physically clamping or bolting conductors together or closing a circuit breaker, switch or similar device.

De-energised means not connected to any source of electrical supply but not necessarily isolated.

Discharged means having been connected to the general mass of earth or short circuited in such a manner as to remove any residual electrical energy in a conductor.

Earthed means directly electrically connected to the general mass of earth so as to ensure and maintain the effective dissipation of electrical energy.

Earthing and phase shorting (for DC refer to short circuiting) polyphase AC apparatus is deemed to be earthed and phase shorted if it is isolated, has all phases shorted to each other, and is connected to earth in such a manner as to ensure and maintain effective dissipation of electrical energy.

Earthing and phase shorting device

(AC) means an approved device used for earthing and phase shorting of AC electrical apparatus.

Electrical apparatus means any electrical equipment, including overhead lines and underground cables, the conductors of which are live or can be made live.

Electrical Traction Control Officer means the officer responsible for control of all operations on the AC and DC networks of the traction system. This includes electrical system officer (train) and power control officer (tram).

Energised means connected to a source of electrical supply.

Equipotential work zone means a work zone (area, site) where all equipment is interconnected by hoppers, earths, earth rods, and/or earth grids that will provide acceptable potential differences between all parts of the work zone under worst-case conditions of energisation.

Exposed conductor means an electrical conductor, approach to which is not prevented by a barrier of rigid material, or by insulation which is adequate under a relevant Australian standard specification for the voltage concerned.

High voltage or **HV** means a nominal voltage exceeding 1000 volts AC, or exceeding 1500 volts DC.

High voltage electrical apparatus

means electrical apparatus that is required to operate at high voltage. This definition shall not include the secondary wiring of instrument transformers or control devices that may operate on occasions above 1000 volts.

High voltage customer means any user of electricity (excluding the licensed generators, transmission and distribution companies) directly connect at high voltage to the transmission or distribution networks.

In service means the status of electrical apparatus connected to the electrical traction system, or in a condition fit to be connected to the system by closing of installed isolators and/or circuit breakers.

Instructed person means a person adequately advised, inducted or supervised by an authorised person to enable them to avoid the dangers that electricity may create.

Insulated mobile plant means mobile plant approved and tested for carrying out work on or near electrical apparatus.

Insulated means separated from adjoining conducting material by a non-conducting substance. This provides resistance to the passage of current, to disruptive discharges through or over the surface of the substance at the operating voltage. It aims to mitigate the danger of shock or injurious leakage of current.

Insulating stick means a stick approved and tested for carrying out operating and live work on live electrical apparatus.

Isolated means not connected to any possible sources of electricity supply by means that will prevent unintentional re-energisation of the electrical apparatus. It is assessed as a suitable step in the process of making safe for access purposes.

Isolator means a non-load breaking device that when opened, provides the appropriate designed clearances from electrical conductors. It aims to prevent accidental or inadvertent energisation of some part of the circuit.

Live means energised or subject to hazardous induced or capacitive voltages.

Live line detector means an approved device for determining whether the electrical apparatus is live or not live.

Live work means all work performed on components of electrical apparatus not isolated, not proved de-energised and not earthed or short circuited.

Low voltage or **LV** means nominal voltage exceeding 50V AC or 120V DC ,but not exceeding 1000V AC or 1500V DC.

Mobile plant means cranes, elevating work platforms, tip trucks, any equipment fitted with a jib or boom, and any device capable of raising or lowering a load. Mobile plant can only be considered as a vehicle when in the normal travelling mode, not in the working mode when determining safe approach distances.

Near means a situation where there is a reasonable possibility of a person, either directly or through any conducting medium, coming within the relevant safe approach distances.

Negative means the electrical return path of a traction DC network.

Negative conductor means rail, negative bus connections or cabling, poles/structures bonded to the negative rail.

Network asset means any asset that is owned or operated by a network operator for the purposes running the train/tram electrical traction system of the network operator.

Network operator means the owner, controller or operator of an electricity network, or a railway or tramway system.

Nominal voltage means the AC (phase to phase RMS) or DC voltage by which a system of supply is designated.

Not electrically connected means dis-connected from all sources of supply by the removal or absence of conductors, appropriate to the voltage and insulating medium. It is not able to be made live by normal operating means and identified in accordance with approved procedures.

Operating authority means an organisation or an authorised person who is responsible for operational control of the electrical apparatus concerned.

Ordinary person means a person without sufficient training or experience to enable them to avoid the dangers which electrical apparatus may create.

Note: ordinary person within these electrical safety rules refers to a person under the control of a network operator.

Organisation means a business, enterprise, company, or corporation.

Out of commission means the condition of electrical apparatus that is not electrically connected. It is declared to be so in writing to the operating authority responsible for the electrical apparatus.

Personal protective equipment means approved clothing, equipment and/or substances, which when worn or correctly used, protect parts or all of the body from foreseeable risk of injury or disease, at work or in the workplace.

Practicable see reasonably practicable.

Procedure means the documentation of a systematic series of actions (or activities) directed to achieve a desired result.

Rail means part of the return circuit of traction power supply system that is connected to the negative bus at the source of supply.

Reasonably practicable means having regard to:

- a. the likelihood of the hazard or risk concerned eventuating
- b. the degree of harm that would result if the hazard or risk eventuated
- c. what the person concerned knows, or ought to reasonably know, about the hazard or risk and any ways of eliminating or reducing the hazard or risk
- d. the availability and suitability of ways to eliminate or reduce the hazard or risk
- e. the cost of eliminating or reducing the hazard or risk.

Recipient means a person who has signed on an access authority.

Recipient in charge means an authorised recipient to whom an access authority has been issued, and who is in charge of all recipients signed on that access authority.

Safe approach distance (SAD) means the minimum distance in air from exposed conductors that shall be maintained by a person, vehicle or mobile plant when approaching electrical apparatus other than for work in accordance with an access authority. This includes its load, controlling ropes and any other accessories. It excludes rail in the DC work environment.

Safety observer means a person with sufficient knowledge of the task being performed and competent for the duty of observing and warning against unsafe approach to electrical apparatus.

Shall—is to be interpreted as mandatory.

Short circuit, short circuited (for AC refer to earthing and phase shorting)

means the connection by a low resistance path between two or more points in an electrical circuit. In the DC traction system, a connection by an approved device between the positive conductor of traction voltage apparatus to rail or rail-connected negative conductor of the apparatus.

Short circuiting device (DC) means an approved device used for short circuiting of DC electrical apparatus

Should is to be interpreted as advisory or discretionary.

Statement of condition of apparatus and/or plant (SCAP)

means a statement issued by the network operators to other network operators to confirm the condition of specified apparatus and/or plant during the currency of the statement. A SCAP does not authorise access to or work upon the apparatus or plant.

Substation means any enclosed or fenced location in which high voltage supply is generated, converted, controlled or transformed.

Switch means a device capable of making and breaking load currents. A switch may also serve as an isolator.

Tester in charge means an authorised tester to whom a sanction for testing has been issued and who is in charge of all members of the work party signed on that sanction for testing.

Traction voltage means a nominal voltage of 600V DC (for trams) and 1500V DC (for trains).

Tie station means substation.

Vehicle means a truck, car, utility, or other general purpose conveyance used for the carriage of persons or goods. (See also mobile plant)

Vicinity means a situation where it is unlikely that a person will, either directly or through any conducting medium (e.g. via mobile plant), come within the relevant safe approach distances.

Written (in writing) means recorded on paper or in electronic form.

1. Purpose

Work health and safety law places duties on businesses and workers to ensure, so far as is *reasonably practicable*, the health and safety of workers and that of other persons are not put at risk from the work.

The purpose of these electrical safety rules is to provide practical guidance in maintaining safe systems of work in relation to control of risks associated with work on, *near* or in the *vicinity of high voltage* or traction electrical apparatus in Victoria.

Figure 1 – Hierarchy of documentation for electrical safety



2. Scope

These electrical safety rules define the:

- » principles
- » electrical safety *procedures*.

These principles and electrical safety *procedures* apply to all persons working on, near, or in the vicinity of high voltage or traction electrical apparatus capable of being energised.

The electrical safety *procedures* defined within these rules apply within the traction industry.

These electrical safety rules are also applicable to not electrically *connected* apparatus. This may be in situations where the required level of isolation, as defined, cannot be confirmed prior to work commencing, for example, on abandoned underground *cables*.

These electrical safety rules set a minimum standard and *should* be enhanced by *approved procedures*. Such *procedures* may utilise other published standards and guidelines to enhance the level of safety.

In order to comply with the electrical safety *procedure* requirements of these rules, an *organisation* shall either:

- a. apply the *procedures* contained within these rules; or
- b. vary the *procedures* by:
 - » completing a hazard identification and risk assessment
 - » ensuring the electrical safety outcomes are equal to, or better
 - » documenting the process
 - » advising ESV in writing of outcomes and reasons for variation(s) prior to implementing the variation
 - » or utilising an Electricity Safety Management Scheme (ESMS) process.

3.

General safety requirements

Principle

An organisation shall have procedures relevant to providing a comprehensive safe working environment.

3.1 Hazard identification, risk assessment and control

An *organisation's* safe system of work *shall* include appropriate risk management processes to ensure hazards associated with work within *safe approach distances* or *near electrical apparatus* are identified, assessed and controlled.

Prior to working 'on' or 'near' any *electrical apparatus*, the persons performing the work *shall* apply the safe system of work to identify, assess and control the associate hazards and risks.

The hazard identification and risk assessment process *shall* be regularly reviewed and audited to ensure compliance.

3.2 First aid

Persons who are required to work where there is a risk of injury from *live* electrical conductors *shall* be given appropriate training on commencement and thereafter subject to annual competency assessment.

Training *shall* cover skills in cardio-pulmonary resuscitation, shock, burns and their role in incident assessment and management, in accordance with relevant National Competency Standard Units.

3.3 Communications

All communications relating to the operation of, or access to, *electrical apparatus* shall be clear and definite. *Electrical apparatus* shall be referred to by name and sufficient detail to give positive identification. Verbal instructions and statements issued over phones or radios shall be confirmed by repeating back to avoid misunderstanding.

3.4 Forms

As a minimum, forms shall contain minimum information as prescribed in Appendix A.

3.5 Use and testing of operating and live-line equipment

All sticks, gloves, sleeves, mats, protective *barriers* or covers, *earthing* trucks, portable *earthing* devices, insulating platforms, *insulated* elevating work platforms or other equipment used for operating *high voltage*, DC traction *electrical apparatus* or performing *live-line* work shall be specifically *approved* for the particular application.

All equipment including protective equipment used on *high voltage* and DC traction *electrical apparatus* that requires regular

testing to prove the effectiveness of insulation, shall be tested at specific intervals as per *approved procedures* and marked to show the date of the next routine test. Visual inspection shall be made for physical damage or contamination immediately prior to use.

Gloves, sleeves, mats and protective *barriers* or covers used for operating *high voltage* and DC traction *electrical apparatus* or for performing *live work* shall not be relied upon as the sole means of insulation/protection.

Equipment shall not be used after the marked date.

3.6 Insulating sticks

3.6.1 *Insulating sticks* shall have a length that provides appropriate insulation from *live* parts. It enables a person using the stick to maintain the applicable *safe approach distance* at all times. (Refer to 6.2)

3.6.2 When an *insulating stick* is to be used in wet conditions, consideration shall be given to the potential for hazardous surface leakage currents.

3.7 Live line detectors

An *approved live line detector shall* be used before applying an *earth* or a *short circuiting device to electrical apparatus*.

The detectors *shall* be tested immediately before and after use, in accordance with *organisational procedures*.

3.8 Labelling of electrical apparatus

For the purposes of identification and description, *electrical apparatus shall*, wherever *practicable*, be clearly labelled.

3.9 Ladders

Conductive ladders (including wired reinforced) *shall not* be used on, *near* or in the *vicinity of*, *exposed live electrical apparatus*, unless in accordance with *organisational procedures*.

3.10 Personal protective equipment

All persons who may be exposed to possible electric shock, flash or other injury from *electrical apparatus shall use approved personal protective equipment*. *Personal protective equipment shall* include clothing

with wrist to ankle cover and fully enclosed footwear. Additional *personal protective equipment shall* be used in accordance with the type of work and the risks involved.

All protective equipment and apparel *shall* comply with relevant published standards.

General PPE requirements

1. Working on, *near* or in the *vicinity of electrical apparatus approved safety*:
 - » headwear, and
 - » natural fibre clothing or alternative arc flash protective clothing, and
 - » footwear.
2. For operating *electrical apparatus approved safety*:
 - » headwear, and
 - » footwear, and
 - » natural fibre clothing or alternative arc flash protective clothing, and
 - » hand protection, and
 - » face/eye protection.
3. The person responsible for supervising visitors whose movements are confined to normal access ways (e.g. roads, paths and stairs) *shall* ensure that the visitors *shall* utilise the following *approved* items:
 - » safety headwear, and
 - » fully enclosed footwear, and
 - » wrist to ankle clothing.

3.11 Tapes and other measuring devices

Only approved non-conducting tapes and rulers should be used in the vicinity of *live electrical apparatus*.

Conductive tapes *shall* not be used *near* exposed *live electrical apparatus*, unless *approved* for use in accordance with *approved procedures*.

- » be positioned to effectively observe and immediately communicated with persons performing the work, and
- » monitor the work and warn against potential infringement of *safe approach distances*, and
- » be capable of providing assistance in the case of emergency, as well as being *competent* to performing electrical rescue and cardio-pulmonary resuscitation, as required.

3.12 Use of safety observers

Following a risk assessment, a *safety observer shall* be posted where it is considered that a person, equipment or *mobile plant* might inadvertently infringe *safe approach distances*.

Under no circumstances *shall* the *safety observer* be diverted to other work while the possibility of infringing the *safe approach distances* exists.

A person acting as a *safety observer shall*:

- » understand the task, work process and sequence of work, and
- » have the authority to temporarily suspend the relevant work at any time, and
- » be specifically instructed in the duties and workplace hazards applicable, and

3.13 Fit state for work

Alcohol, drugs, diminished mental alertness and physical condition of a person may impede their ability to work safely in an electrical environment.

Persons who are required to work on, *near*, or in the *vicinity of electrical apparatus shall* not consume or be under the influence of alcohol or drugs that diminish work skills during work hours. This *shall* be taken to include meal or rest breaks.

Appropriate policies *shall* be implemented by *organisations*.

3.14 Work within electric and magnetic fields

3.14.1 General

Persons working within electric and magnetic fields *shall* be appropriately protected from the annoyance. This is due to electric discharge effects of strong electric fields, and the possible biological effects associated with extremely strong electric and magnetic fields.

Persons using implantable medical devices, including cardiac pacemakers, *should* consult their doctors and the relevant *organisational* officer for information on possible electromagnetic interferences with the medical devices, prior to entering areas of strong electric and magnetic fields.

Advisory occupational exposure limits provided in National Health and Medical Research Council (NHMRC) Interim Guidelines are listed in the following sections.

Organisations should establish appropriate exposure limits in accordance with industry guidelines e.g. Energy Network Australia EMF Management Handbook.

3.14.2 50 Hz electric fields

Advisory occupational exposure limits for electric fields based on the National Health and Medical Research Council (NHMRC) interim are as follows:

| | |
|----------------------|-------------------------|
| Unrestricted | Less than 10 kV/m |
| Short term | 10 kV/m to 30 kV/m |
| Alternative controls | Greater than 30 kV/m |

No time limits apply for exposures below 10 kV/m.

Short term exposure to fields from 10 kV/m to 30 kV/m is permitted, provided the strength (in kV/m) multiplied by the duration of exposure (in hours) does not exceed 80 for the whole day. For example, exposure to an electric field of 20 kV/m would be permitted for four hours.

For work situations with field strengths greater than 30 kV/m, alternative controls *shall* be used. Such controls may include wearing appropriately *earthed* or *bonded* conducting suits, the screening and *earthing* of vehicles, the screening of work platforms and access ways, and de-energising adjacent *electrical apparatus*.

The person responsible for planning the work *shall* include in the work instructions details of any appropriate measures to be taken.

3.14.3 Magnetic fields

The NHMRC's guidelines for limits of occupational exposure to magnetic fields are as follows:

a. 50 Hz magnetic fields

| | |
|--|---------------------------------------|
| Whole working day | 0.5 milliTesla (5000 milliGauss) |
| Short term (Two hours per day) | 5 milliTesla (50,000 milliGauss) |
| Limit for limbs (e.g. extended arm) | 25 milliTesla (250,000 milliGauss) |

b. Static or direct current (DC) magnetic fields

The 2009 International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines for limits a, b and c of occupational exposure to static or DC magnetic fields are as follows:

| | |
|----------------|-----------------|
| Head and trunk | 2000 milliTesla |
| Limbs | 8000 milliTesla |

Notes:

1. Caution: due to the potential indirect adverse effects, ICNIRP recognises that practical policies need to be implemented to prevent inadvertent harmful exposure of persons with implanted electronic medical devices and implants containing ferromagnetic material. This requirement may lead to much lower restriction levels such as 0.5 milliTesla.
2. For specific work applications, exposure up to 8000 milliTesla can be justified, if the environment is controlled and appropriate work practices are implemented to control movement-induced effects.
3. When magnetic flux densities exceed 5 milliTesla (static or DC magnetic fields), precautions should be taken to prevent hazards from flying metallic objects.

3.15 Victim rescue

Persons *shall* be trained in victim rescue techniques appropriate to the job function being performed.

Before performing victim rescue on or *near live exposed conductors*, the rescuer *shall* consider all hazards and methods to control the hazards to ensure the rescue can be performed safely. Such controls may include *de-energisation* of the circuit, the use of *insulated sticks* and maintaining *SAD* during the rescue.

Immediately contact the *Electrical Traction Control Officer (ETCO)* to arrange *isolation* or *de-energisation* of equipment, and wait for confirmation of *de-energisation* before attempting to move the victim.

Victim rescue assessment and/or instruction *shall* be undertaken by relevant personnel in accordance with appropriate National Competency Standard Units.

3.16 Fire, smoke from high voltage apparatus

Breakdown of electrical equipment may result in fire and issue of a large amount of smoke. Fire or electrical breakdown of some types of electrical insulation may also result in release of toxic fumes. Fire extinguishers and hoses are not designed for use on *live high voltage* equipment. Immediately contact the ETCO to arrange *de-energisation* and/or *isolation* of equipment.

3.17 Fire extinguishers

Fire extinguishers that are marked 'suitable for use on electrical fires,' are intended for use on circuits of a voltage lower than those encountered in traction, signal and industrial power supply installations.

Fire extinguishers or fire hoses of any kind MUST NOT be used on live electrical apparatus in traction, signal and industrial power supply installations.

3.18 Unnecessary approach to electrical apparatus

Unnecessary approach to apparatus *shall* be avoided at all times. Unnecessary contact with metallic items associated with the equipment such as transformer tanks, overhead structures, frames, covers etc. *shall* be avoided. When necessary, the approach to *electrical apparatus shall* be restricted to the period required to perform the work.

3.19 Lightning storms

Staff are warned against hazards of working on, or in the *vicinity* of *electrical apparatus* forming part of the traction system during electrical storms.

3.20 Current transformer secondary circuits

The secondary circuit of a current transformer *shall* not be open circuited whilst *in service*, as a dangerous voltage may be induced on the secondary circuit.

3.21 Interference with earthing or negative connections

Interference or disconnection of *earthing* or *negative cables* installed on *electrical apparatus* may result in serious injury or death.

3.22 Voltage transformers

Extreme care must be taken when working on circuits involving voltage transformers. Following the *isolation* of the *high voltage* supply of a transformer, it is possible to obtain a back-feed from the secondary winding.

3.23 Epoxy resin insulated transformers

Particular care must be taken when approaching epoxy resin-*insulated* transformers installed in a number of the traction network operator's traction *substations*. The dielectric strength of the epoxy insulation may not be sufficient to prevent electric shock on direct contact.

3.24 Negative and electrolysis return circuits

Consideration must be given when working on *negative* return circuits and electrolysis circuits, as hazardous voltages may be present in abnormal circumstances. Hence, some works on these circuits may need to be performed in accordance with the access authorities defined within these rules. *Organisational procedures shall* be used when working on such circuits.

4.

Training and authorisation

Principle

Persons working on or near electrical apparatus shall have appropriate training, authorisation and currency of competency for the duty to be performed.

4.1 General

An organisation's safe system of work *shall* include appropriate training, competency and authorisation for all persons working on, near high voltage or DC traction *electrical apparatus*.

A person's authorisation *shall* be current for the task being performed.

Persons holding authorisations *shall* be competency assessed at no more than a nominal three-yearly interval. Training *shall* be given to restore competency where appropriate.

A person may perform a task that normally requires authorisation or approval without that authorisation or approval (e.g. *HV* operating), only when that task is performed under a training program and the person is effectively supervised.

4.2 Approved training standard

4.2.1 Introduction

Training will consist of identified learning outcomes that will be knowledge, skill (task), and attitude based, and where appropriate, reflect National Competency Standards.

- » There *shall* be assessment criteria established and documented for each learning outcome.
- » Details of assessment method *shall* be documented.
- » There *shall* be a documented process for recognition of prior learning.
- » Persons undergoing training must be assessed for competency against learning outcomes and such assessment must be documented.

4.2.2 Learning outcomes

Learning outcomes *shall* include, but not be limited to, the following:

- » working knowledge of the relevant sections within these electrical safety rules
- » knowledge of communication processes required
- » knowledge of the relevant *approved procedures*
- » knowledge of the consequences of any physical tasks performed
- »

- » working knowledge and skill associated with the relevant:
 - » forms and documentation
 - » risk assessment
 - » work practices
 - » equipment and plant
- » demonstration of acquired knowledge through practical exercises
- » a clear understanding of the responsibilities associated with relevant authorisations, e.g. the range of responsibilities associated with a *recipient in charge*
- » other training requirements as specified herein.

4.2.3 Approved training courses and processes

Organisations shall confirm that training courses and the service providers meet their recognised needs. Where appropriate, training *shall* be consistent with National Competency Standards.

4.3 Records

Organisations shall develop and maintain an appropriate management system for recording of all training and authorisations.

5.

Work in the vicinity of electrical apparatus

Principle

Work in the vicinity of electrical apparatus shall be carried out in a safe manner. Control measures taken shall be consistent with the risk and work performed.

5.1 General

For all works in the *vicinity of electrical apparatus*, either specific *written work instructions shall* be used or *approved procedure shall* apply in conjunction with the use of instructed or *authorised persons*.

Where the risk assessment requires a record of the control measures, then instructions *shall* be issued to the work party in accordance with *approved procedures*.

The control measures implemented *shall* minimise the risks involved and may include:

- » defining the work area
- » defining access routes
- » isolating and *earthing/short circuiting the electrical apparatus*
- » the use of *barriers* and signs
- » the use of *approved covering*
- » the use of safety observers
- » the issue of the appropriate *access authority* or authority to work in the vicinity of *electrical apparatus*.

5.2 Handling objects/loads

When objects are handled manually or by mechanical equipment, care *shall* be exercised to prevent the objects or the mechanical equipment infringing *safe approach distances*.

For manual handling, appropriate work methods and an appropriate number of persons *shall* be used to maintain *safe approach distances*.

For mechanical handling, where there is a risk of infringing the *safe approach distances* (refer to section 6) to electrical *conductors*, the movement of loads *shall* be controlled by means of *approved* non-conducting ropes or other *approved* means.

No person *shall* contact the load or any attached conducting objectives until the risk of SAD infringement is removed. Only the plant operator *shall* contact the *mobile plant* controls in accordance with safe work *procedures*. Refer to 5.4 for protection of other persons.

5.3 Erection or dismantling of overhead conductors

When overhead lines, other than *insulated low voltage* service lines, are erected, dismantled, or replaced and there is any possibility of contact with, or induction from, adjacent *live conductors* of any description, such *conductors* moved *shall* be *earthed/short circuited* by an *approved* device before work is commenced. This *shall* remain *earthed* until the work is completed. A *conductor* erected *shall* be *earthed* before it is lifted from the ground.

Consideration *shall* be given to the use of appropriate restraining devices to control such *conductors* when moved.

When *earthing* is considered to be impractical or a safer control measure may be appropriate, alternative safety precautions *shall* be applied, subject to the following controls.

- a. Applied to a specific task or process which has been subject to a formal risk assessment carried out in advance of the work using a consultative process with a subject matter experts.
- b. Documented as an *approved* procedure specific to the task or process.

5.4 Use of mobile plant

Mobile plant *shall* only be used in the *vicinity* of *live conductors* and/or *electrical apparatus* once precautions appropriate to the particular circumstances have been considered, and action taken to control the associated hazards and risks.

The control measures to be considered within a risk assessment *should* include:

- » isolating and *earthing/short circuiting electrical apparatus*
- » positioning the *mobile plant* such that the *safe approach distance* can be maintained in all circumstances

- » the use of safety observers, *barriers* and signs
- » the use of other precautions including physical restrictions or control devices in conjunction with *barriers*
- » the suppression of auto-reclose the alteration of protection and control settings
- » de-energising the *electrical apparatus*
- » mechanical limitation devices options on *mobile plant*.

Mobile plant, and where appropriate *vehicles*, shall be fitted with a trailing *earthing conductor* when hazards are presented by induced voltages.

When *mobile plant* may come *near* (refer to section 6) *live electrical apparatus*, the *mobile plant* may be *earthed* or *short circuited* if deemed necessary. This shall be achieved by an *approved earthing/short circuiting* system.

When *mobile plant* is operated from outside the *mobile plant*, precautions shall be taken to protect the operator from hazardous step and touch potentials. No person other than the *mobile plant* operator shall touch the *mobile plant* whilst in operation.

Where *mobile plant* (e.g. EWP), is not entirely *insulated*, the insulation level of each part shall be labelled in accordance with the appropriate standard (e.g. AS 1418.10), and the following permanent sign shall be fixed at all plant operator's control.

DANGER—BEWARE OF POWER LINES

This appliance is not fully insulated. Do not permit any uninsulated part of this appliance to be in close proximity to live conductors.

Insulated mobile plant shall be tested at specific intervals as per *organisational procedures*, and marked to show the date of the next routine test.

5.5 Work by ordinary persons

Where *ordinary persons* are required to work in the *vicinity* of *electrical apparatus*, the *ordinary person* performing the work, the person in charge of the work, and the person in charge of the *electrical apparatus* shall all cooperate to ensure that the work is performed safely and that specific precautions are taken.

5.6 Work within substations or on multi-circuit overhead lines with multiple asset ownership

For work within stations or on multi-circuit overhead lines where *electrical apparatus* is owned by more than one *organisation* and work is adjacent to another *organisation's* exposed *electrical apparatus*, there *shall* be joint consideration and agreement reached to carry out the work in a safe manner. (See also 6.10 and 9.2.4)

6.

Approach to electrical apparatus

Principle

Persons shall observe appropriate safe approach distance when working, operating vehicles or mobile plant, on or near electrical apparatus.

6.1 General

The *safe approach distances* are based on an exclusion zone principle. This principle defines an area around the *electrical apparatus* into which no part of the person, *mobile plant* or object, other than *approved insulated* objects, may encroach unless in accordance with section 9. (Refer to Figures 2A, 2B and 3)

Work practices *shall* be established to ensure persons, *mobile plant* and unapproved objects do not encroach on the *safe approach distances*. These *shall* include the consideration of:

- » working beyond reach of the exclusion zone wherever *practicable*
- » precautions to be applied when use of controlled movement is necessary
- » the work space required including the expected reach of persons performing the work, and
- » the movement of *mobile plant* used for the work.

Expected reach *shall* include all intentional and expected movements such as adopting a work position, adjusting a hard hat, manoeuvring tools and reaching for items being pass to the employee.

Unnecessary approach to *electrical apparatus*, or unnecessary contact with parts not regarded as *live shall* be avoided.

Necessary approach to *electrical apparatus* shall be kept to a minimum, and shall be restricted to the period required to perform the work.

Figure 2A: Safe approach distance—beyond reach

SAD is based on the exclusion zone principle and is measured out from the *energised conductor*. Proper application requires consideration of the work space necessary and either working beyond reach or the use of controlled movements to stay outside the SAD.

(For Illustration purpose only).

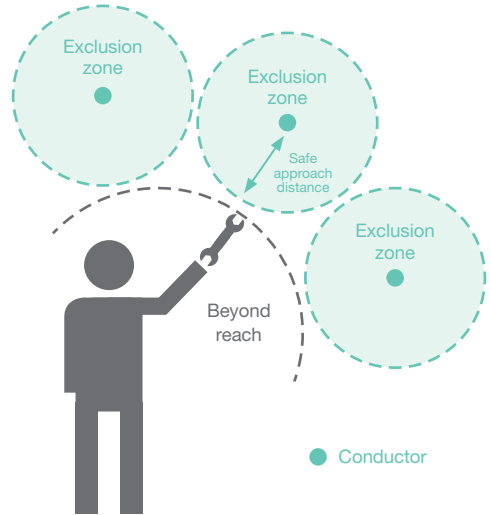


Figure 2B: Safe approach distance—expected reach

SAD is based on the exclusion zone principle and is measured out from the *energised conductor*. Proper application requires consideration of the work space necessary and either working beyond reach or the use of controlled movements to stay outside the SAD.

(For Illustration purpose only).

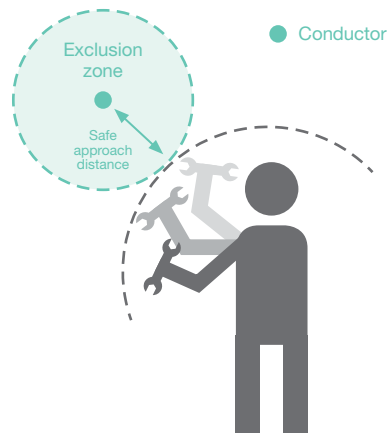
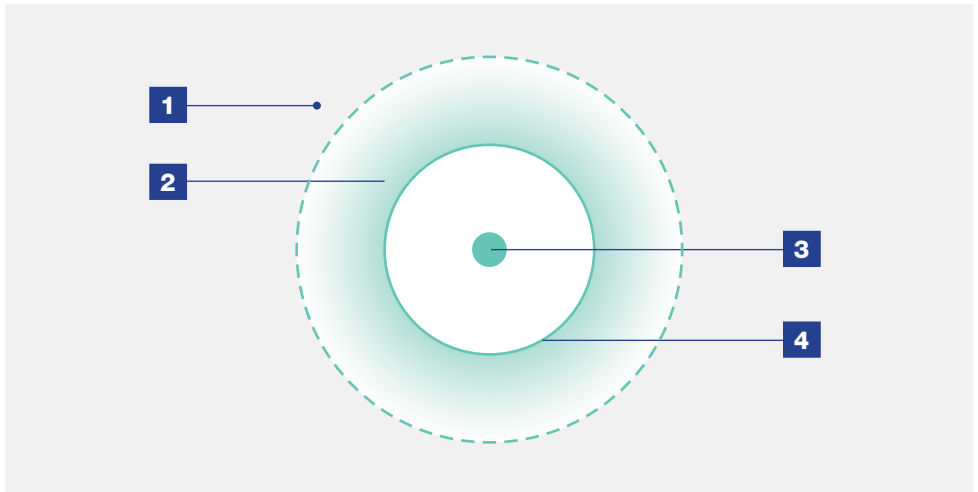


Figure 3: Illustration of differences between safe approach distance, near and vicinity



1

Vicinity means a situation where it is unlikely that a person will, either directly or through any conducting medium (e.g. via *mobile plant*), come within the relevant **safe approach distances**.

2

Near means a situation where there is a reasonable possibility of a person, either directly or through any conducting medium (e.g. via *mobile plant*) coming within the relevant **safe approach distances**.

3

Conductor means a wire, *cable* or form of metal designed for carrying electrical current.

4

Safe approach distance means the minimum distance in air from *exposed conductors* that *shall* be maintained by a person, **vehicle** or **mobile plant** (including its load, controlling ropes and any other accessories) when approaching **electrical apparatus** other than for work in accordance with an **access authority**. This excludes *rail* in the DC work environment.

6.2 Safe approach distance—persons

6.2.1 Safe approach distance

The *safe approach distances* for persons conducting general work are as shown in Table 1.

Instructed persons' safe approach distances apply while undertaking duties under supervision, or as instructed by an *authorised person*.

There are elements of *electrical apparatus* that have semi-conductive insulation. Such apparatus *shall* be treated the same as *live* apparatus, in consideration of *safe approach distances*. *Organisational specific procedures shall* be in place to enable activities to be safely performed on semi-conductive *insulated* apparatus.

Table 1: Safe approach distance for persons to exposed conductors

| Nominal phase to phase AC voltage | Ordinary persons (Note 1) | Instructed persons or authorised persons (Note 1 and 2) |
|--|-------------------------------------|---|
| kV | Millimetres | Millimetres |
| LV aerial lines | 1500 | Instructed persons—300 Authorised persons—insulated contact only |
| Not less than 1.0 Not greater than 2.2 | 2000 | Instructed persons — 600 Authorised persons—insulated contact only |
| 6.6 | 2000 | 700 |
| 11 | 2000 | 700 |
| 22 | 2000 | 700 |
| 33 | 2000 | 700 |
| 50 | 2000 | 750 |
| 66 | 2000 | 900 |
| 110 | 3000 | 1000 |
| 132 | 3000 | 1200 |
| 220 | 4000 | 1700 |
| 275 | 5000 | 2300 |
| 330 | 6000 | 2700 |
| 400 | 6000 | 3300 |
| 500 | 6000 | 3600 |
| Nominal DC voltage | | |
| LV DC aerial lines (less than 600V) | 1500 | Instructed persons—300 authorised persons—insulated contact only |
| Dc (not less than 600V not greater than 1500V) | 2000 | Instructed persons—300 authorised persons—insulated contact only |

Notes:

1. See definition for 'ordinary person'. Persons not under control of the asset owner (network operator or high voltage customer) shall refer to the WorkSafe/ESV No Go Zone Rules and section 12 of these rules.
2. Deliberately avoid movements that could result in distances being infringed.
3. These distances specified are based on work from a stable surface. Appropriate allowance shall be made for conductor sag and sway.

6.2.2 Safe approach distance special

Safe approach distance—special is the minimum distance to an *exposed conductor* from any outstretched part of a person's body, or any conducting or unapproved object touching any part of the person's body.

Safe approach distance—special, as shown in Table 2, has been determined using risk analysis methodology and consideration of power frequency and switching surge distances, plus a reduced provision for inadvertent movement.

Safe approach distance—special shall be used only by *authorised persons* performing *approved tasks*, after consideration of *SAD normal*, access permit and *live work methods*.

These *safe approach distances shall* be used only in conjunction with the following control measures.

- » *Approved safe work practice* to ensure no part of the person's body or any conducting or unapproved object touching any part of the person's body infringing the relevant *safe approach distances—special*.
- » Positioning of the worker to minimise the risk of the specified distance being infringed. This includes any unapproved object or tool being held by the worker.
- » Using a person specifically trained and authorised to perform the work at the *safe approach distances—special*.

- » Work crew on-site risk assessments are conducted.
- » Safety observers are used to monitor the work activities.
- » Minimise the exposure at the *safe approach distances—special*.
- » Addressing adverse impact of external influences on plant and equipment e.g. traffic, boom movement, footing.
- » Addressing adverse impact of weather and environmental conditions e.g. rain, lightning, wind, light, sag or sway of *conductors*.

The work party *shall* consider the suppression of the auto reclose function as part of the pre-work planning.

If these controls are not achieved, either an *access authority shall* be issued, or *live work techniques shall* be applied, or alternative *safe approach distances—special shall* be developed in accordance with section 6.2.3.

Table 2: Safe approach distance—special for authorised persons only to exposed conductors

| Nominal phase to phase AC voltage | Authorised persons |
|--|---------------------------|
| kV | Millimetres |
| LV | Insulated contact only |
| Not less than 1.0 Not greater than 2.2 | 450 |
| 6.6 | 450 |
| 11 | 450 |
| 22 | 450 |
| 33 | 500 |
| 50 | 700 |
| 66 | 700 |
| Nominal DC voltage | |
| 600V | 300 |
| 1500V | 300 |

6.2.3 Guidelines for the development and use of alternative safe approach distances—special

An alternative *safe approach distance*—special may be required where the distances advised in Table 2 are not suitable for a particular task or process.

Alternative distances may be lesser or greater, subject to consideration of the overvoltage hazards and/or inadvertent movement controls particular to the situation.

Determination and use of an alternative distance *shall* be subject to the following controls, which *shall* in addition to the requirements of section 6.2.2 be:

- » determined in accordance with Energy Network Australia (ENA) National Guidelines for *safe approach distances to electrical apparatus* (ENA NENS 04) and related standards and guidelines may be appropriate, and
- » applied only to a specific task or process that has been subject to a formal risk assessment carried out in advance of the work using a consultative process with subject matter experts, and
- » documented as an *approved* procedure specific to the task or process.

6.3 Safe approach distances—vehicles

6.3.1 Ordinary persons

An *ordinary person* in charge of any *vehicle*, excepting *mobile plant* when in working mode, *shall* ensure that no part of the *vehicle*, or its load, is placed or moved within the distances shown Column 2 of Table 3.

6.3.2 Authorised and instructed persons

Authorised and *Instructed persons* in charge of any *vehicle*, excepting *mobile plant* when in working mode, *shall* ensure that no part of the *vehicle*, or its load, is placed or moved within the distances shown in Column 3 of Table 3.

Table 3—Safe approach distance for vehicles to exposed live conductors (excepting mobile plant when in the working mode)

| Nominal phase to phase voltage (AC) | Safe approach distance— for vehicles under the control of ordinary persons (Note 1 and 2) | Safe approach distance— for vehicles under the control of instructed persons or authorised persons (Note 1) |
|--|---|--|
| kV | Millimetres | Millimetres |
| Low voltage | 600 | 600 |
| HV up to and including 33 | 1000 | 700 |
| 50 | 1000 | 750 |
| 66 | 1000 | 1000 |
| 110 | 1500 | 1000 |
| 132 | 1500 | 1200 |
| 220 | 4600 | 1800 |
| 275 | 4600 | 2300 |
| 330 | 5500 | 2300 |
| 400 | 6400 | 3300 |
| 500 | 6400 | 3900 |
| Nominal DC voltage | | |
| 600 V | 700 | 600 |
| 1500 V | 700 | 600 |

Notes

1. All distances specified are based on work from a stable surface. Appropriate allowance shall be made for conductor sag and sway and for uncontrolled movement of vehicle or plant due to any reason.
2. See definition for 'ordinary person'. Persons not under control of the asset owner (network operator or high voltage customer) shall refer to the WorkSafe/ESV No Go Zone Rules and section 12 of these rules.

6.4 Safe approach distances—uninsulated mobile plant

6.4.1 General

Due to the physical capabilities of, and potential hazards with *mobile plant* working adjacent to *live conductors* and/or *electrical apparatus*, specific consideration *shall* be given to its use during planning of the work. This includes *earthing* and *short circuiting*. Refer to 5.4.

6.4.2 Ordinary persons

An *ordinary person* (under the control of the asset owner) in charge of the work *shall* ensure that the *mobile plant*, its gear and load, are not placed or moved within the distances shown in Table 4 (see page 51).

A person not under the control of the asset owner *shall* comply with No Go Zone Rules. The asset owner *shall* comply with section 12 of these Electrical Safety Rules.

6.4.3 Instructed persons or authorised persons

An *instructed person* or *authorised person* in charge of the work *shall* ensure that the uninsulated *mobile plant*, its gear and load, *shall* not approach *live conductors* and/or *electrical apparatus* within the distances as shown in Table 4 (see page 51).

When the work requires a closer approach to *live conductors* than the normal *safe approach distances* provided in Table 4 (see page 51), special *safe approach distances* for uninsulated *mobile plant* may be developed and applied with consideration of the requirements set out in section 6.2.3.

6.5 Safe approach distance—insulated mobile plant

Only *instructed persons* or *authorised persons* may operate *insulated mobile plant*, in accordance with Table 5 (see page 52) and *organisational procedures*.

The *insulated* portion of *mobile plant* may contact or encroach at distances less than the *safe approach distance* to a *live conductor* specified in Table 5 (see page 52), provided it is rated for that use.

6.6 Emergency approach

In emergency situations where there is likely risk of electric shock to persons from electrical *conductors* or *electrical apparatus* e.g. fallen *conductor*, prompt action *shall* be taken to ensure people are kept well clear of the hazard accordance with *organisational procedures*.

All *electrical apparatus* shall be considered *alive* until proven *isolated* and *earthed/short circuited* by *approved* means.

6.7 Contact with live high voltage conductors by means of appliances

Only *approved* and tested *appliances* shall be permitted to be brought within the *safe approach distance* or into direct contact with *live high voltage conductors*.

Table 4—Safe approach distance for mobile plant to exposed live conductors when in the working mode

| Nominal phase to phase voltage (AC) | Safe approach distance— for mobile plant under the control of ordinary persons (Note 1 and 4) | Safe approach distance— for mobile plant under the control of instructed persons or authorised persons (for insulated mobile plant refer Table 5) (Notes 1 and 2) | Safe approach distance— for mobile plant under the control of glove and barrier live-line work authorised persons (for insulated mobile plant refer Table 5) (Notes 1, 2 and 3) |
|--|---|---|---|
| kV | Millimetres | Millimetres | Millimetres |
| Low voltage | 2000 | 1000 | 380 |
| HV up to and including 33 | 2000 | 1200 | 1000 |
| 50 | 2000 | 1300 | |
| 66 | 2000 | 1400 | |
| 110 | 4000 | 1800 | |
| 132 | 4000 | 1800 | |
| 220 | 4600 | 2400 | |
| 275 | 4600 | 3000 | |
| 330 | 5500 | 3700 | |
| 400 | 6400 | 4000 | |
| 500 | 6400 | 4600 | |
| Nominal DC voltage | | | |
| 600 V | 2000 | 1200 (Note 5) | |
| 1500 V | 2000 | 2000 (Note 5 not less than 500mm) | |

Notes

1. All distances specified are based on work from a stable surface. Appropriate allowance shall be made for conductor sag and sway and for uncontrolled movement of vehicle or plant due to any reason.
2. A safety observer is required unless the mobile plant is incapable of infringing the safe approach distance.
3. When lifting a load the conductors are suitably insulated in accordance with organisational procedures.
4. Including insulated elevating work platforms.
5. See definition for ordinary person. Persons not under control of the asset owner (network operator or high voltage customer) shall refer to the WorkSafe/ESV No Go Zone Rules and section 12 of these rules.

Table 5—Safe approach distances to exposed live conductors for insulated mobile plant operated by persons who are instructed or authorised to work on or near exposed conductors.

| Nominal phase to phase AC voltage kV | Safe approach distances (Note 1, 2 and 3) | | Working within safe approach distance (Note 1, 3 and 4) | |
|---|--|----------------------|---|----------------------|
| | Insulated portions | Uninsulated portions | Insulated portions | Uninsulated portions |
| Low voltage | Contact allowable | 1000 | Contact allowable | 1000 |
| HV up to and including 33 | 700 | 1200 | Contact allowable | 1000 |
| 66 | 1000 | 1400 | Contact allowable | 1000 |
| 220 | 1800 | 2400 | Contact allowable | 1800 |
| 275 | 2300 | 3000 | Contact allowable | 2300 |
| 330 | 3000 | 3700 | Contact allowable | 3000 |
| 500 | 3900 | 4600 | Contact allowable | 3900 |
| Nominal DC voltage kV | | | | |
| 600 V | 700 | 1200 | Contact allowable | 1000 |

Notes

1. These distances specified are based on work from a stable surface. Appropriate allowance shall be made for conductor sag and sway, and for uncontrolled movement of the mobile plant for any reason.
2. For ordinary persons refer to Table 4.
3. For safe approach distance where contact is allowed, care shall be exercised to prevent unsafe movement of conductors.
4. For live work in accordance with approved procedures.
5. Alternative live work minimum approach distances as per 9.6 may be applied in accordance with organisational procedures.
6. A safety observer is required unless the mobile plant is incapable of infringing the safe approach distance.

6.8 Approach to live high voltage insulated cables

6.8.1 General

When work is performed *near live high voltage insulated cables*, appropriate precautions *shall* be taken to ensure that the insulation of the *cables* is not damaged.

Cables that are specifically designed for movement whilst *live* may be moved in accordance with *approved procedures*.

Slight movement of other types of *live cables* may be permitted, but only after detailed consideration of all related circumstances by a person with a detailed knowledge of the *cables* concerned, who *shall* fully detail all precautions to be taken.

6.8.2 Earthed metallic sheathed or screened high voltage cables

Contact by persons may be made to external non-conductive surfaces of *live high voltage cables* with *earthed* metallic sheaths or screens. Contact with exposed metallic sheath or screen *shall* only be undertaken after consideration of transferred earth potentials and induced voltages.

6.8.3 Non-metallic screened high voltage aerial bundled cable

No body contact *shall* be made to external surfaces of *live* non-metallic screened *high voltage aerial bundled cable* or exposed support *conductors*. Suitable *live* line techniques only *shall* be used for this purpose.

Access to *de-energised* but not *earthed* non-metallic screened *high voltage aerial bundled cable* may be permitted in accordance with *approved procedures*.

For the purposes of *insulated mobile plant* work in the *vicinity* of *live* non-metallic screened *high voltage aerial bundled cable* the *safe approach distance* *shall* be the same as exposed *high voltage conductors*. (Refer to Table 5)

6.9 Work in substations/ tie stations

A person *shall* not perform work in any station or allow *mobile plant* to enter any station without first obtaining the permission of the person in charge of the station or appropriate *authorised person* and accepting all the conditions imposed by that person.

Where work is carried out in the *vicinity* of *electrical apparatus*, an *access authority* and/or authority to work in the *vicinity* of *live* apparatus (refer to section 5.1) *shall* be issued, where:

- » *mobile plant*, elevating platform or other large *vehicles* will be used, or
- » the work involves excavation or use of explosives.

6.10 Work outside of substations/tie stations

Work on or *near electrical apparatus* outside of *substations/tie stations* *shall* be performed after obtaining the permission and direction of the *person in charge* of the *electrical apparatus*.

7.

**Operation of
high voltage
and DC traction
electrical apparatus**

Principle

Only authorised persons shall undertake switching and associated duties on high voltage and DC traction electrical apparatus.

Associated duties include

Isolating, *earthing* and *short circuiting* of *electrical apparatus*.

7.1 Persons authorised to operate high voltage and DC traction electrical apparatus

Switching and associated duties on *high voltage* and DC traction *electrical apparatus* shall be performed by *authorised electrical operators* whose training, duties and instructions cover the particular *electrical apparatus*.

However, an unauthorised person may perform operations in the following circumstances:

- » when specifically instructed by, or authorised by, the appropriate *operating authority*
- » when specifically instructed by an *authorised operator* as part of *electrical operator* training
- » in an emergency involving serious risk to persons or property
- » where they operate *high voltage* and DC traction *electrical apparatus* as part of process control.

7.2 Written high voltage switching instructions

Wherever *practicable*, *written* instructions *shall* be used when operating *high voltage* electrical or DC traction *electrical apparatus*.

7.3 High voltage and DC traction switching

Prior to a *high voltage* or DC traction switching operations, the available information regarding circuit conditions *shall* be taken into account and no *electrical apparatus shall* be operated, if it is inappropriate for the duty to be performed. After switching, correct operation of the *electrical apparatus should* be confirmed whenever possible.

When *high voltage* or DC traction *electrical apparatus* is operated, the person undertaking the task shall be protected in an *approved* manner from electric shock, flash or other hazards. Also refer to 3.10.

7.4 Authority to operate

Under no circumstances *shall* any *circuit breaker, switch* or *isolator* be closed without the prior approval and coordination of the electric traction control officer.

No *circuit breaker, switch* or *isolator* shall be opened without the permission of the electric traction control officer except in an emergency involving an accident or serious risk of injury.

All switching operations *shall* be reported to the electric traction control officer as soon as possible after each operation, unless permission has been given by the electric traction control officer to carry out specific operations on defined *electrical apparatus*.

Localised maintenance systems (e.g. interlocked sidings or depot road *isolators*) may be exempted from this requirement provided appropriate *approved procedures*, training and controls are implemented.

7.5 Operation of circuit breakers and switches

Only the *approved* handle or mechanism *shall* be used for manual operation of a *circuit breaker* or *switch*.

The manual operation of a *circuit breaker* or *switch* *should* be performed in an unhesitating and controlled manner.

After opening or closing a *circuit breaker* or *switch*, its correct operation *shall* be confirmed by inspection of the *circuit breaker* or *switch* contacts if *practicable*, or by observation of the indicating devices or lamps provided for the purpose.

Where provided, the status of the *circuit breaker* or *switch* *shall* also be confirmed through the direct observation of the output of the *circuit breaker* or *switch*.

7.6 Operation of isolators

An *isolator* *shall* only be opened after it has been ascertained that the circuit has been opened elsewhere. This may be by means of a *circuit breaker* or *switch*, and the *isolator* *shall* be closed before the *circuit breaker* or *switch* is closed.

Notwithstanding the foregoing, an *isolator* may be used to make or break the excitation current of transformers, the charging current of transmission lines and underground *cables*, and DC *circuit breaker* control current when, in the opinion of the electric traction control officer, it is safe to do so.

Only the *approved* handle, mechanism or operating stick *shall* be used for operating *isolators*.

Where *practicable*, the correct operation of the *isolators* *shall* be confirmed by visual inspection.

When opening an *isolator* by means of an operating stick, the operator *shall* be in control of the *isolator* and the *isolator* is to be reclosed immediately, *should* severe arcing occur across the open contacts.

After closing a latching type *isolator*, a check must be made to ensure the *isolator* is effectively latched in.

8.

**Earthing or short
circuiting of high
voltage and DC
traction electrical
apparatus**

Principle

Earthing or short circuiting devices shall be applied by an authorised person following a safe to earth (or short circuit) confirmation and placed to ensure the safety of the work party.

Electrical safety procedures

8.1 General

8.1.1 *Earthing and/or short circuiting devices shall be approved. Only authorised persons shall apply them after the circuit or electrical apparatus is isolated and after confirmation by tests and inquiry, or visual inspection that the conductors are de-energised.*

The operation of the voltage detector *shall* be checked immediately before the test and, if *practicable*, immediately after the test. Only *approved* testers *shall* be used.

Before attempting to *earth* or *short circuit* electrical apparatus, the operator must ensure that the *short circuit* or *earthing* and *phase shorting* devices can be applied safely.

When *earthing*/or *short circuiting* is achieved by means of an *isolator* or *switch* that can be moved to or from the earth or *rail/negative* position, the *isolator* or *switch* *shall* be visually inspected to confirm that it has operated correctly.

When it is required that *traction voltage* apparatus is *short circuited* to steel overhead structures or poles, care must be taken to ensure that the structure or pole is effectively *bonded* to the *rail*. Bonding *shall* not be damaged, of good quality and of appropriate cross sectional area.

Additional *earths* and/or *short circuits* may be installed or removed in accordance with *organisational procedures*.

8.1.2 *Earthing/short circuiting* devices shall be suitably rated and *approved*. They shall be inspected and/or tested in accordance with *organisational procedures*.

Only *authorised persons* shall apply *earthing/short circuiting* devices, and only after completion of a safe to earth confirmation that the *electrical apparatus* is *isolated* and *de-energised*.

Confirmation of *isolation* shall be:

- » by visual inspection of *isolation/s* and testing of the *conductors*
- » where visual inspection of *isolation/s* is not *practicable*, inquiry and testing shall be used
- » where testing is not *practicable*, *earthing/short circuiting* may take place only in accordance with *approved procedures*.

8.1.3 In applying an *earthing/short circuiting* device, it shall be connected to earth (*rail/negative conductor*) before it is applied to the *conductors*. It shall be removed from the *conductors* before it is disconnected from earth (*rail/negative conductor*).

8.1.4 Wherever *practicable*, an earth and/or *short circuit* shall be applied and removed by an *approved device*.

When hand application or removal is unavoidable:

- » all phases shall be *discharged*
- » another earth and/or *short circuit* shall be held in contact with the *conductor* using an *approved device*, while the hand earth and/or *short circuit* is attached or removed
- » as per other specific *organisational procedures*.

Before using an *earthing* and/or *short circuiting* device, the operator shall examine it to ensure that it is in good order.

8.1.5 When applying a portable *earthing* and/or *short circuiting* device that is not *connected* to a permanently installed *earthing/short circuiting* system, it shall be regarded as being liable to become *live* until the circuit *earthing* is complete.

8.1.6 There are some situations when applying *earths* to *electrical apparatus* during preparation for access (e.g. discharging capacitor banks) that an *authorised electrical operator* cannot comply with the clearances specified as *safe approach distances*.

In these instances, *approved procedures* may permit only to that part of the *electrical apparatus* that already has local *isolation* and *earthing/short circuiting*.

8.2 Earthing and short circuiting for access to high voltage and DC traction electrical apparatus

Earths and/or short circuits shall be applied at locations where conductors within the work area are effectively earthed and/or short circuited in the event of energisation from any source of supply or hazardous occurrences, and be so placed as to remain effective if adjoining conductors are disconnected.

Wherever practicable, *earths and/or short circuits shall be placed at the site of the work.*

8.3 Removal of earth or short circuits when working under an access authority

During work under an *access authority*, the *recipient in charge* may authorise the removal of an earth and/or *short circuit* for insulation testing, reconductoring, or other purposes. This action is only acceptable if considered necessary and safe, and provided:

- » the *operating authority* that has operational control of the earth and the *operating authority* who applied the earth agrees

- » in cases where the earth is listed on the *access authority*. The *operating authority* who issued the *access authority* is consulted, to confirm that the removal of the earth will not affect any other access authorities on issue
- » persons likely to be affected by the removal of the earth are notified
- » consideration is given to induced voltages.

The earth removed *shall* be replaced in the same or other equally effective position as soon as *practicable*.

8.4 Earthing and short circuiting of overhead lines

Where an overhead line can only be *earthed* using temporarily driven earth spikes, the work planning *shall* consider protection from the hazards resulting from energisation and step and touch potentials in the event of energisation by any means. This includes direct connection, equipment failure, induction or lightning.

Where work under an *access authority* involves the connection, cutting or disconnection of *conductors*, *approved* bridging leads *shall* be applied across the proposed *conductor* break. Alternatively, *earths* and/or *short circuits* *shall* be applied to both sides of, and as close as *practicable* to, the proposed break and individually *connected* to a common earth or *negative*.

In situations where there is the risk of a worker becoming subject to different potentials across or between different *earths*, the hazard will be reduced by the application of *equipotential work zone* principles.

During the discharge, *earthing* and bonding of overhead lines, no person/s other than the one/s applying the earth *shall* approach within six metres (AC). They *should* maintain two metres (DC) clear of the *earthing device*, its connections or ladders, poles or structures from which the *earthing device* is being applied.

8.5 Overhead lines earthing systems

8.5 AC priority earthing

The choice of connection for a portable *earthing device shall* be made to achieve the most effective *earthing* of the work zone.

In accordance with the system being worked on, *earths should* be applied on the basis of the following order of preference.

1. Permanently installed *earthing* system (including CMEN).
2. *Earthing* ferrule in a concrete pole.
3. The ground rod of an installed pole stay or permanently driven pole stakes.
4. A temporarily driven spike at the work site.

8.5 DC overhead lines

Where the connection is between the *negative conductor* and positive *conductor*, this *shall* be defined by the company's electrical access *procedures*.

Where *practicable*, *earths/short circuits should* be applied either side of the work site.

During the discharge and shorting of overhead lines, person/s other than the person/s applying the bond *should* remain two metres clear of the immediate work area for duration of the bonding process.

The *negative conductor* may be:

- » *rail*
- » *negative bus* in *substations/tie stations*
- » conductive poles/structures boded to the *negative rail*.

8.6 High voltage and DC traction metal-clad switch units

The *earthing* of metal-clad switchgear and *connected* circuits by the use of probes or contact extension devices requiring manual application presents additional hazards.

Approved procedures shall define methods of operation and *earthing* to minimise the risk to the operator. The location and number of *earths* to be applied *shall* be considered.

An authorised person shall be present during such *earthing*, unless specifically detailed by *approved procedures* for application by one person.

8.7 Discharge of high voltage and DC traction capacitors

A safe method of discharging *high voltage* capacitors prior to access *shall* be included in *approved procedures*.

When *earthing high voltage* capacitors, the actives and, where available, the neutrals *shall* be *earthed* and, in addition, each capacitor *shall* be *de-energised* before it is touched.

The same precautions *shall* be taken for work on *electrical apparatus*, which incorporates *high voltage* capacitors e.g. capacitor voltage transformers and carrier coupling capacitors.

9.

**Access for work on
or near high voltage
and DC traction
electrical apparatus**

Principle

An appropriate safe access system shall be applied to ensure the safety of work crews for work on or near high voltage and DC traction electrical apparatus, or associated with the testing of high voltage or DC traction electrical apparatus.

Electrical safety procedures

9.1 General

No person shall touch or work near the high voltage and DC traction conductors of any electrical apparatus unless:

- » the person is a recipient of an electrical access permit covering that electrical apparatus. The high voltage and DC traction conductors have been de-energised, short circuited and/or earthed at the work site. The electrical access permit is available for reference at the site of the work, or
- » the person is a recipient of an electrical access permit covering the conductors of a high voltage or DC traction cable. The de-energised state of the cable at the work site is confirmed in accordance with clause 9.8, and the electrical access permit is available for reference at the site of the work, or
- » in the case of a rackable circuit breaker or rackable voltage transformer, the electrical apparatus is removed from its rack or cubicle position, and placed in a designated maintenance position, or
- » the person is working under the terms of a sanction for testing or alternative approved procedure on that electrical apparatus in accordance with clause 9.3.1, or
- » the electrical apparatus has been declared as out-of-commission in accordance with clause 9.4, or

- » the person is performing *live work* in accordance with *approved procedures*, or
- » the person is working in accordance with the requirements of a person who has received an appropriate *permit to work adjacent to network assets*, authority (refer to section 12), or
- » the person is working in accordance with the requirements of section 6.

9.2 Electrical access permit procedure

A trainee under the direct supervision and with the countersignature of an *authorised electrical operator*, may issue and cancel an *electrical access permit* with the prior permission of the electric traction control officer.

Electrical access permits may only be issued on *de-energised, isolated, short circuited* and/or *earthed* and *phase shorted electrical apparatus*. Unless *organisational procedures* determine otherwise.

9.2.1 Planning for an electrical access permit

Before making application for an *electrical access permit*, the *authorised applicant* shall establish that the proposed work has been properly planned and can be carried out safely.

The *electrical apparatus* to be covered and its location shall be accurately defined and the work to be undertaken adequately described.

9.2.2 Multiple working parties

There shall be coordination in planning and performing the work to ensure that the actions of one party shall not endanger the safety of others when more than one *electrical access permit* is issued on the same *electrical apparatus*, or where separate parties are working under the terms of one *electrical access permit*.

9.2.3 Multiple ownership

Where the operational control of the scope of *electrical apparatus* to be covered is owned by more than one *organisation*, a protocol shall be established between these *organisations* for processing the application and outage requirements.

9.2.4 Issue, receipt and cancellation of electrical access permits

9.2.4.1 An *electrical access permit* shall be issued and cancelled only by an *authorised electrical operator*. *Electrical access permits* may be issued or relinquished by telephone or radio subject to the statements between the *authorised electrical operator* and the *recipient in charge*, and only with the permission of the electric traction control officer.

9.2.4.2 At the time of issue of an *electrical access permit*, the *authorised electrical operator* shall describe and show, where *practicable*, the *recipient in charge* and all the initial *recipients*:

- » the *electrical apparatus* covered by the *electrical access permit*, and
- » the precautions taken, and
- » the nearest points of supply, and
- » any adjacent *live electrical apparatus*.

9.2.4.3 An *electrical access permit* shall be cancelled prior to the issue of a *sanction for testing* or the use of an alternative *approved procedure* for testing on the same *electrical apparatus*.

9.2.4.4 *High voltage live work* and work under an *access authority* shall not be performed concurrently on the same structure.

9.2.4.5 Each *electrical access permit* shall be issued to a *recipient in charge*. The *recipient in charge* shall ensure that all members of the work party who approach the *electrical apparatus*, will sign on the *electrical access permit*.

9.2.4.6 The issuer and *authorised recipients* all have a responsibility to ensure that the scope and condition of the *electrical apparatus*, covered by the *electrical access permit*, is such that it shall be safe for the proposed work to be undertaken.

9.2.4.7 All *recipients* shall be satisfied with the precautions taken, the location of the points of supply and the proximity of any adjacent *live electrical apparatus*.

9.2.4.8 Any person involved in the issue or *receipt* of an *electrical access permit* who is not satisfied with the conditions, may apply to have additional precautions taken. This may be before the *electrical access permit* is issued or during the currency of the work.

9.2.4.9 After the issue of an *electrical access permit*, no additional *recipients* are allowed to sign onto the permit unless appropriate instructions are given by the *recipient in charge*, as per section 9.2.4.5. An *authorised electrical operator*, acting with the knowledge of the *recipient in charge*, may undertake this activity.

9.2.5 Persons permitted to sign onto electrical access permits

Persons permitted to sign onto *electrical access permits* shall be *authorised recipients* or *instructed persons* assigned to work under that specific *electrical access permit*.

In the latter case, it shall be the responsibility of the *recipient in charge* to ensure that such persons are placed in the charge of an *authorised recipient*.

The conditions under which *authorised person shall* sign onto an *electrical access permit* is that the *authorised recipient*:

- » understands the *electrical apparatus* covered and the limits of the *electrical access permit*, and
- » is satisfied with the precautions taken, and
- » is aware of the nearest adjacent *live electrical apparatus*.

The conditions under which an *instructed persons shall* sign onto an *electrical access permit* is that the *instructed person*:

- » understands instructions given on what approach is permitted to the *electrical apparatus*, and
- » understands instructions given on what activity is permitted to be taken in relation to the *electrical apparatus*, and
- » agrees to the continuous and close supervision by a nominated *authorised recipient*.

9.2.6 Recipient working alone

An *electrical access permit* may be issued to a single *authorised recipient*. The *recipient* may work alone provided there is no risk of infringing the *safe approach distances* and the *recipient* is working in accordance with *approved procedures*.

9.2.7 Issuer also a recipient

An issuer of an *electrical access permit shall* not be the initial *recipient in charge*, but may sign on to the *electrical access permit* form as an *authorised recipient*.

In accordance with *approved procedures*, the issuer may sign on as a subsequent *recipient in charge*.

9.2.8 Rejection of a recipient

A person *shall* recommend the exclusion from an *electrical access permit* of any other person who at any time is considered unsafe as a *recipient*. Such instances *shall* be reported promptly to the person in charge of the work.

9.2.9 Earthing/Short circuiting of electrical apparatus under electrical access permit

9.2.9.1 Absence of an earth

Electrical apparatus shall be earthed before the issue of an *electrical access permit*, wherever *practicable*.

Where an earth has not been applied to *electrical apparatus* prior to the issue of an *electrical access permit*, the *recipient in charge shall* arrange for discharging and/or *earthing* of the *electrical apparatus* before any *recipient* touches the *high voltage conductors*.

9.2.9.2 Recording of earths

All *earths* applied prior to and during the currency of an *electrical access permit* shall be recorded on the *electrical access permit*, or documented in accordance with *organisational procedures*.

The removal of all *earths* shall be verified prior to re-energising the apparatus.

9.2.9.3 Removal of earth when working under an access authority

During work under an *access authority*, the *recipient in charge* may authorise the removal of an earth for testing, reconductoring, or other purposes, only if such action is considered necessary and safe, and provided:

- » the *operating authority* that has operational control of the earth and the *operating authority* who applied the earth agree, and
- » in cases where the earth is listed on the *access authority*, the *operating authority* who issued the *access authority* is consulted, to confirm that the removal of the earth will not affect any other access authorities that have been issued, and
- » all persons likely to be affected by the removal of the earth are notified, and
- » consideration is given to induced voltages.

The earth removed shall be replaced in the same or other equally effective position, as soon as possible.

9.2.10 Temporary cessation of work or absence of recipients

Following a cessation of work or when *recipients* have been temporarily absent from the work site, upon return each *recipient* shall report to the *recipient in charge* to re-confirm the conditions of the *electrical access permit*.

9.2.11 Testing under an electrical access permit

Testing under an *electrical access permit* may be undertaken in accordance with *approved procedures* that include a risk assessment to ensure that:

- » all other work shall cease for the duration of the testing
- » no hazardous voltages and currents will be accessible as a result of the testing
- » *recipient/s* conducting the testing have the appropriate competency
- » consideration shall be given to any stored electrical charge
- » test voltages and current do not exceed the equipment rating or test equipment rating
- » consideration shall be given to maintain earth between the *recipient/s* and the sources of supply
- » consideration shall be given to the hazards of connecting and disconnecting test equipment

- » adequate precautions are taken for the safety of all persons during the performance of the test, and
- » the provisions of section 8.3 are met.

9.2.12 Working on multi-circuit overhead lines

Where more than one *high voltage* circuit is carried on a pole or line structure, and work is to be performed on circuits under an *electrical access permit* while others remain *live*, each *recipient* of the work party who approaches near any circuits *shall* correctly identify the circuit/s under *electrical access permit* and all other circuits.

If there is any doubt the *recipient shall seek* clarification from the *recipient in charge*.

9.2.13 Change of electrical access permit conditions

The conditions specified and the precautions listed on the *electrical access permit shall not* be changed unless mutually agreed upon by both the *operating authority* and the *recipient in charge*, and then only when a check has been made with the appropriate *operating authority* regarding the requirements of other *electrical access permits*, and all *recipients* working under the *electrical access permit* have been notified of the change.

9.2.14 Cancellation of an electrical access permit

9.2.14.1 Recipients signing off an electrical access permit

It *shall* be the duty of each *recipient* of an *electrical access permit* to sign off before the *electrical access permit* is relinquished.

9.2.14.2 Responsibilities of the recipient in charge when relinquishing an electrical access permit for cancellation.

When an *electrical access permit* is to be relinquished for cancellation, the *recipient in charge shall*:

- » ensure that all *recipients* signed on the *electrical access permit* have ceased work covered by the *electrical access permit* and have signed off
- » ensure that all *recipients* and equipment are clear and will remain clear of the *electrical apparatus*
- » sign off the *electrical access permit* as the *recipient in charge* to indicate that the *electrical access permit* can be cancelled
- » advise the *operating authority* of any condition of the *electrical apparatus* which could affect its operation.

Having the *recipient in charge* as the cancelling operator is undesirable and *should* be avoided.

Appropriate *approved procedures* shall be established to cover instances where this is unavoidable.

9.2.14.3 Absence of a recipient at relinquishment

The practice of signing off an *electrical access permit* on behalf of another person is undesirable and *should* be avoided.

Appropriate *organisational procedures* should be implemented with instruction for signing off *recipients* where the *recipients* could not sign off in person.

9.3 Testing HV and DC traction electrical apparatus

9.3.1 General

The *sanction for testing* or an alternative *approved* authorisation for testing, *shall* be used if the testing of *high voltage electrical apparatus* has the potential to produce currents and voltages hazardous to the human body.

The alternative *approved procedure* shall satisfy the requirements of this section 9.3 to achieve the same or better safety outcomes.

9.3.2 Planning for testing of high voltage electrical apparatus

Only an *authorised applicant* shall make application for a *sanction for testing*.

Before making an application for *sanction for testing*, the *authorised applicant* shall establish that the proposed work has been properly planned and can be carried out safely.

The *electrical apparatus* to be tested and its location *shall* be accurately defined, and the task to be undertaken adequately described.

Testing *shall* be undertaken in accordance with *approved procedures* and adequate precautions *shall* be taken to avoid exposure to hazardous voltages and currents.

Only one *sanction for testing* shall be on issue on the same *electrical apparatus* at any time. However, where the testing requires work at remote locations as well as at the nominated main location, a complementary *sanction for testing* covering the same *electrical apparatus* shall be issued at each remote location.

Where a complementary *sanction for testing* is required, it *shall* be nominated on the original application and issued only in accordance with this section 9.3.

Where the test is to be undertaken on *electrical apparatus* with more than one control authority involvement, then protocols *shall* be established for processing the application and test requirements.

9.3.3 Sanction for testing procedure

9.3.3.1 A *sanction for testing* shall be cancelled prior to the issue of an *electrical access permit* on the same *electrical apparatus*.

9.3.3.2 The *sanction for testing* shall be issued to the *tester in charge* by an *authorised electrical operator*.

A complementary *sanction for testing* shall be issued only after, and relinquished only before, the *sanction for testing* at the nominated main location.

Such issues and cancellations *shall* take place only with the approval of the *tester in charge*.

9.3.3.3 A tester responsible at remote location is an *authorised tester* at a remote location to whom an *authorised electrical operator* has issued a complementary *sanction for testing*.

9.3.3.4 *Sanctions for testing* and complementary *sanctions for testing* shall be issued and cancelled only by an *authorised electrical operator*.

9.3.3.5 The appropriate provisions of sections 7, 8 and 9 *shall* also apply to *sanctions for testing* and complementary *sanctions for testing*.

9.3.3.6 *Sanctions for testing* and complementary *sanctions for testing* may be issued or relinquished by telephone or radio, subject to the statements between the *authorised electrical operator* and the *tester in charge* or tester responsible at the remote location.

9.3.3.7 In the case of a *sanction for testing* or a complementary *sanction for testing* issued by telephone or radio, the *tester in charge* or the tester responsible at remote location, as appropriate, *shall* assume the responsibilities of the *authorised electrical operator* in applying these provision.

9.3.4 Persons permitted to sign on sanctions for testing

Persons permitted to sign onto a *sanction for testing* shall be *authorised testers*, *authorised electrical operators*, *authorised recipients* or *instructed persons approved* to work under that specific *sanction for testing*.

In the case of *authorised electrical operators*, *authorised recipients* or *instructed persons*, it *shall* be the responsibility of the *tester in charge*, or the tester responsible at the remote location to ensure that such persons are placed in the charge of an *authorised tester* (who may be the *tester in charge*).

The conditions under which an *authorised tester shall sign onto a sanction for testing* are that the *authorised tester*:

- » understands the *electrical apparatus covered* and the limits of the *sanction for testing*, and
- » is satisfied with the precautions taken, and
- » is aware of the nearest adjacent *live electrical apparatus*.

The conditions under which an *authorised electrical operator or authorised recipient shall sign on to a sanction for testing* are that the *authorised electrical operator or recipient*:

- » understands instructions given on what approach is permitted to the *electrical apparatus*, and
- » understands instructions given on what activity is permitted to be taken in relation to the *electrical apparatus*, and
- » is aware of the nearest adjacent *live electrical apparatus*, and
- » agrees to the general supervision by a nominated *authorised tester*.

The conditions under which an *instructed person shall sign on to a sanction for testing* are that the person:

- » understands instructions given on what approach is permitted to the *electrical apparatus*, and

- » understands instructions given on what activity is permitted to be taken in relation to the *electrical apparatus*, and is made aware of the nearest adjacent *live electrical apparatus*, and
- » agrees to the continuous and close supervision by a nominated *authorised tester*.

9.3.5 Responsibilities of tester in charge

9.3.5.1 The *tester in charge shall ensure* that members of the work party who will be making contact with *electrical apparatus* under test and any of the test connections or approaching within the prescribed *safe approach distances* during the currency of the *sanction for testing*, sign onto the *sanction for testing* or a complementary *sanction for testing*.

9.3.5.2 The *tester in charge shall ensure* that the members of the work party are suitably experienced and trained for the work required of them, and that adequate precautions are taken for the safety of all persons.

9.3.6 Complementary sanctions for testing

The tester responsible at remote location *shall assume* the same responsibilities as specified for the *tester in charge* and *shall function* under direction of the latter.

9.4 Out of commission electrical apparatus

9.4.1 Declaring electrical apparatus out of commission

An *out of commission* written declaration shall include a statement of the condition of the *electrical apparatus* including all relevant auxiliary equipment. This includes control circuits and compressed air supplies.

Where the physical removal of a portion of each of the *conductors* is *impracticable*, the racking out of a removable type *circuit breaker* shall be accepted as the 'physical disconnection of the *conductors*'.

Safety measures shall be introduced that will prevent/impede the restoration of the removable type *circuit breaker* using normal operating and *isolating procedures*. Such measures shall be implemented in accordance with *approved procedures*.

9.4.2 Access to out of commission electrical apparatus

Electrical apparatus that is declared *out of commission* may be approached and worked upon without the issue of an *electrical access permit*, or *sanction for testing*.

Although the *electrical apparatus* is not electrically *connected*, consideration shall be given to the possibility of inadvertent *energisation* from adjacent *electrical apparatus*, induction, lightning, static charges or other means with appropriate controls applied.

9.5 Suspension of an access authority

Not used by the traction industries.

9.6 Live work high voltage

Section 9.6 is not applicable to the operation, washing or testing of *live high voltage electrical apparatus*. Refer to *approved procedures*.

9.6.1 General

Live work shall only be undertaken after first considering performing the work under *isolated* and *earthed/short circuited* conditions.

Before *live work* is undertaken, a hazard identification and risk assessment shall confirm that the work can be performed safely.

All *live work* shall be conducted in accordance with *approved procedures* and *approved live work* minimum approach distances.

When developing *approved procedures*, determining *live work* minimum approach distances and performing the tasks, the following *shall* be considered:

- a. AS 5804 (High voltage *live working*) and related standards and guidelines as may be appropriate
 - b. electrical and ergonomic distances necessary to prevent flashover
 - c. possibility of inadvertent movement
 - d. minimising the duration of work at the *live work* minimum approach distances
 - e. work techniques that provide maximum practical distance from *live conductors*
 - f. limiting overvoltage conditions by operational or site controls
 - g. work crew on site risk assessment
 - h. control of inadvertent movement by the use of insulating *barriers*, *insulated plant* and *appliances* and controlled body movements, and
 - i. environmental conditions.
- c. the risk assessment *shall* consider as a minimum:
 - » the condition of the *electrical apparatus*
 - » proximity of other *electrical apparatus*
 - » proximity of *earthed* equipment and structures
 - » protection and control settings, and
 - » appointment of a *safety observer*
 - d. persons performing *live work shall* use appropriate rated and tested equipment and wear appropriate apparel, and
 - e. the work *shall* be performed in accordance with *approved procedures*.

9.6.2 Minimum requirements

The *procedures* for undertaking *live work shall* include:

- a. persons performing *live work* and appointed safety observers shall be *authorised live HV workers*, and
- b. persons when specifically instructed and supervised by an *authorised live HV worker* as part of *live HV worker* training, and

9.6.3 Live work

9.6.3.1 Insulating stick work

An *authorised live high voltage worker* may access *live high voltage conductors* using *insulating sticks* and at the special *safe approach distances* as determined through reference to section 9.6.1.

9.6.3.2 Glove and barrier work

An *authorised live high voltage worker* may make *insulated* contact with *live high voltage conductors* up to 33 kV when fully *insulated* from earth and other phases using *approved* and tested *personal protective equipment* and insulating devices.

9.6.3.3 Live working on traction conductors DC

DC *live work* may be carried out only on *traction voltage conductors* of the electric traction system, and in accordance with *approved procedures*.

Approved procedures/processes shall determine if the work can be performed safely *live*. It is the responsibility of each person on site required to work *live* to be satisfied that the work can be performed safely.

The *procedures* for undertaking *live work shall* include:

- a. persons performing *live work shall* be authorised DC *live* workers, and
- b. safety observers shall be authorised DC *live* workers or *authorised safety observers* for DC *live work*
- c. persons when specifically instructed and supervised by an authorised DC *live* worker as part of DC *live* worker training
- d. the risk assessment *shall* consider as a minimum:
 - » the condition of the *electrical apparatus*
 - » proximity of other *electrical apparatus*
 - » proximity of *earthed* equipment and structures
 - » protection and control settings
 - » appointment of a safety observer

- e. persons performing *live work shall* use appropriate rated and tested equipment and wear appropriate apparel, and
- f. the work *shall* be performed in accordance with *approved procedures*.

9.6.3.4 Staff permitted to do traction DC live work

Traction DC *live work shall* only be undertaken by persons who have been trained and assessed as *competent* in traction DC *live work* techniques.

The person *shall* be authorised by the company to undertake DC *live work*.

9.7 Preparing high voltage and DC traction electrical apparatus for access

9.7.1 Isolation and earthing/short circuiting

High voltage and DC traction *electrical apparatus* should not be regarded as being safe for the issue of an *electrical access permit* until it has been *isolated*, tested and *earthed/short circuited*.

Whenever *practicable*, all *isolation* points should be tagged.

Consideration *shall* be given to the *isolation* of sources of supply from *low voltage* or secondary circuits.

Approved procedures shall ensure the integrity of the isolation is maintained during currency of the electrical access permit.

Isolation for access shall either be visible, or an approved means used to confirm that the electrical apparatus is de-energised.

Note: such isolation may not eliminate the effects of electrical or magnetic induction.

Earth/short circuits shall be applied as described in section 8.2.

If earthing/short circuiting is impracticable, other appropriate precautions shall be taken. The authorised electrical operator shall advise the recipient in charge, and record the absence of an earth on the electrical access permit.

9.7.2 Barriers and signs

9.7.2.1 General

Appropriate barriers shall be used where necessary to indicate areas containing live electrical apparatus and the degree of hazard.

Appropriate signs shall be used where necessary:

- » *to identify electrical apparatus covered by an access authority*
- » *to identify adjacent live electrical apparatus and related hazard.*

Barriers shall not be altered or crossed except in accordance with approved procedures.

In particular instances where identification is positive, such as on some high voltage overhead lines and underground cables, and providing appropriate safeguards have been taken, approved procedures may dispense with the use of barriers and/or signs.

9.7.2.2 Hazards that are likely to be life threatening

Situations where there is an immediate and probable risk of contact with live electrical apparatus shall be defined by the use of danger barriers and/or signs. (Refer to 9.7.2.4)

This includes:

- a. *areas where safe approach distances cannot be maintained*
- b. *areas in which high voltage testing is in progress.*

9.7.2.3 Hazards that are not likely to be life threatening

For the purpose of general identification of those areas where warning is necessary, warning barriers and/or signs (refer to 9.7.2.4) shall be used.

One such example is between work areas and adjacent areas containing *live high voltage* or DC traction *electrical apparatus* that does not present an electrical hazard to normal pedestrian movement.

9.7.2.4 Descriptions of barriers and signs

Live (alive) sign

Approved danger sign with the word LIVE (ALIVE) printed in white on a red background, or otherwise conforming to AS 1319.

Danger barrier and/or sign

A *barrier* and/or sign of suitable material coloured red or alternatively red and white to indicate the presence of danger, or otherwise conforming to AS 1319.

Under access permit sign

A sign of appropriate dimensions with the words UNDER ACCESS PERMIT or similar, printed in white on a green background, or otherwise conforming to AS 1319.

Under sanction for testing sign

A danger sign of appropriate dimensions with the words UNDER SANCTION FOR TESTING printed in red on a white background, or otherwise conforming to AS 1319.

Warning barrier and/or sign

A *barrier* and/or sign of suitable material coloured yellow or alternatively yellow and black to indicate the need for a warning, or otherwise conforming to AS 1319.

9.7.2.5 Barriers and/or signs for electrical access permits

Prior to the issue of an *electrical access permit*, *barriers* and/or signs shall be erected:

- a. to make it clearly evident which *electrical apparatus* is under *electrical access permit*, and which is not
- b. to guard against mistaken or inadvertent contact with other *electrical apparatus*.

The above *shall* be achieved with the use of appropriate signs and *barriers* including *live* signs and under access permit signs. In positioning signs and *barriers*, consideration *shall* be given to all approaches to the work area.

Additional *barriers* and signs may be erected after the issue of the *electrical access permit*, by agreement between the *authorised electrical operator* and the *recipient in charge*.

9.7.2.6 Barriers and/or signs for sanction for testing

Prior to the issue of a *sanction for testing*, *barriers* and/or signs *shall* be erected:

- a. to make it clearly evident which *electrical apparatus* is under *sanction for testing*, and which is not
- b. to guard against mistaken or inadvertent contact with other *electrical apparatus*, or equipment under test.

The above *shall* be achieved with the use of appropriate signs and *barriers* including danger barriers, *live* signs and under *sanction for testing* signs. In positioning signs and *barriers*, consideration *shall* be given to all approaches to the work area.

Additional *barriers* and signs may be erected after the issue of the *sanction for testing* by the *tester in charge*.

9.7.3 Use of a statement of condition of apparatus/plant – (SCAP)

9.7.3.1 General

A *SCAP* is a statement outlining the condition of apparatus/plant. It *shall* be used between operating authorities to confirm plant conditions and *isolations*, to support an *access authority* or other operational requirements.

This statement covers only the state of the *electrical apparatus* or plant specified, and does not by itself authorise work on the *electrical apparatus* or plant.

The issue, cancellation, acceptance and relinquishment of *SCAP* must be authorised or co-ordinated by the electric traction control officer.

9.7.3.2 Use of the SCAP

The conditions of *isolation shall* remain unchanged until the statement is cancelled.

Any *earths* listed on the statement may be removed as requested by the *recipient* in accordance with section 8.3.

The *SCAP shall*, where *practicable*, detail all relevant precautions taken for the safety of the work party/ies. Where the precautions are detailed, they *shall* not be changed during the currency of the *SCAP*.

Where it is not *practicable* to detail all such precautions, a general statement of the condition of the *electrical apparatus* (e.g. *isolated* and *earthed*) is acceptable provided that:

- a. it is acceptable to the operating authorities
- b. it is acceptable to all *recipients* on the associated *electrical access permit* or *sanction for testing*

- c. the *authorised electrical operator* issuing the *electrical access permit*, or *sanction for testing*, can satisfy the *recipients* of the precautions taken through demonstration or references to drawings, etc.

The *operating authority* accepting a SCAP may inspect and verify the security and adequacy of the precautions, taken by the issuing *operating authority*.

Where a general statement is used and any *isolation* point is to be changed (whilst still maintaining general condition of *isolation*), prior agreement *shall* be obtained from all affected operating authorities.

The receiving *operating authority shall* consult with *recipients* of affected access authorities before agreeing to any change.

9.7.4 High voltage and DC traction metal clad switchgear and associated electrical apparatus

9.7.4.1 For the purpose of issuing an *electrical access permit*, a *circuit breaker* or a voltage transformer may be regarded as *isolated* and at earth potential, when it is racked out and appropriate precautions taken to prevent re-energisation. (See also 9.1)

9.7.4.2 For work on busbar circuits, where the physical separation of circuits within a chamber is not visibly evident, additional precautions *shall* be taken for the safety of the working party.

9.7.4.3 The proposed means of access within metal clad chambers *shall* be described to the *authorised electrical operator* by the *recipient in charge*. Both must agree on the extent of access and that such access is safe.

9.7.4.4 When access is required within spout bushings, the contacts *shall* be confirmed as *de-energised* by an *approved* test. The circuit *shall* also be *earthed* elsewhere or other precautions taken to ensure that the spout contacts cannot become *live* by induction or other means.

9.7.4.5 When it is not *practicable* to earth metal-clad circuits, a risk assessment *shall* be conducted to determine the special precautions including discharging to ensure that the *conductors* can be regarded as being at earth potential.

9.8 Working on insulated power or supervisory cables

9.8.1 Onsite identification of insulated cables (including out-of-commission or abandoned cables)

Where it is necessary for a *cab*le to be *de-energised* to enable access to the *cab*le, the *de-energised* state *should* be confirmed on site by positive identification or visually tracing it from one end, or by the use of a spiking device.

9.8.2 Spiking of cables

A spiking device may be used to confirm that a *cab*le is *de-energised*.

When a *cab*le is to be spiked by a power operated spiking device, the following measures *shall* be taken.

- » Where practical, the electrical condition of the remote ends of the *cab*le *shall* be confirmed as *isolated* and *earthed/short circuited*.
- » Where necessary, the person in charge of the work *shall* personally select the *cab*le to be spiked after careful reference to the appropriate records and use of *cab*le tracers.
- » An *approved cab*le spiking device *shall* be used by a person trained in its use and in accordance with *approved procedures*.

Prior to spiking the *operating authority shall* be advised. The *operating authority shall* prevent the energising or re-energising of any *cab*le in the *vicinity* of the proposed works, until advised that spiking has been completed.

9.8.3 Working under induced voltage conditions

Whenever work is to be carried out on a *cab*le core, sheath, armouring, oil line etc. of a fully *insulated cab*le system, careful assessment *shall* first be given to the voltage that may appear on the *conductor* via induction or other means, and appropriate *earthing* practices and *approved work procedures* adopted.

10. Placing high voltage and DC traction electrical apparatus in service

Principle

High voltage and DC traction electrical apparatus shall not be placed into service until it has been cleared for service.

10.1 Clearance for service

An operating authority shall not consider electrical apparatus being available for service until it has been handed over from the constructing or maintaining authority by written notification or by approved procedures.

10.2 Connections to new or out of commission electrical apparatus

Before any electrical connection is made, whereby new *electrical apparatus* or any *electrical apparatus* previously *out of commission* can be *energised* by direct switching or *live work procedures*:

- » the *operating authority* shall be notified of the intention to make such connection
- » all persons associated with the work, and any others likely to be affected, shall be informed that no further work is permitted on the *electrical apparatus*, unless:
 - › they are recipients of an *access authority*
 - › *live work procedures* are used, and
 - › to enable the connection to be made an appropriate *access authority* or *live work procedure* shall be used.

11.

Low voltage network assets

Principle

Safe working procedures shall be established for work on or near low voltage network assets.

11.1 General

11.1.1 Persons required to work on or *near low voltage network assets shall* be appropriately trained and authorised.

11.1.2 Work on or *near low voltage network assets shall* be undertaken in accordance with *approved procedures*.

11.1.3 Before commencing work on or *near any low voltage network assets they shall* firstly be identified as the assets associated with the work to be undertaken.

11.2 Work on or near live low voltage conductors

When work is to be carried out on or *near live low voltage network assets, approved precautions shall* be taken to prevent simultaneous contact with *conductors* or conducting objects at different potentials.

11.3 Work on or near de-energised low voltage exposed conductors

11.3.1 Except for protection, control systems, *sub/tie station* service supplies, auxiliary circuits and *low voltage* services, an *access authority* shall be issued to work on or *near* the *exposed conductors*. For this purpose, an *electrical access permit* or other *approved access authority* may be used.

11.3.2 The *conductors* shall be *isolated* where *practicable*.

11.3.3 *Exposed conductors* shall be proved *de-energised* in accordance with *approved procedures*. This shall include testing of all *conductors* by an *approved voltage test*.

11.3.4 Control measures shall be taken to:

- a. prevent inadvertent contact with other *live exposed conductors* or objects at different potentials
- b. minimise the risks from hazardous induced voltages or unknown supplies.

11.3.5 Control measures may include the use of:

- a. blocking and locking of switches
- b. signs and tags placed at all points of *isolation* that shall be removed only with the permission of a person identified in *approved procedures*
- c. *earths* and/or *short circuits*
- d. bonds
- e. work planning to minimise the risk of inadvertent contact with *live conductors* in the *vicinity* of the work
- f. insulating and other types of *barriers*.

12.

**Work by persons
not under the
control of the asset
owner/operator**

Principle

The asset owner/operator shall have procedures to facilitate a safe system of access, by persons not under the control of the asset owner/operator.

Electrical safety procedures

12.1 General

An electrical asset owner/operator *shall* have *procedures* to facilitate a safe system of access by persons, not under the control of the asset owner/operator, to work *near* or within *safe approach distance* or, when appropriate, in the *vicinity of electrical apparatus*.

For the purposes of this clause, persons not under the control of the electrical asset owner/operator are persons or organisations that have no contractual obligation to the electrical asset owner/operator, and are not performing work for the asset owner/operator for the particular task.

The electrical asset owner/operator *shall* ensure appropriate instruction is provided on the electrical hazards.

The electrical asset owner/operator *shall* instruct the person controlling the work, not under the control of the asset owner/operator, that they are responsible for having a safe system of work in place to avoid the risk from electrical hazards, and will ensure all persons are aware of the safe system of work.

12.2 Permit to work adjacent to electrical assets

Where the safe system of access referred to in clause 12.1 is used, it *shall* include the use of the permit to work adjacent to *network assets*.

When a *permit to work adjacent to network assets* is required, the asset owner/operator *shall* require a *written* application to be submitted.

The application *shall* include sufficient information to enable the asset owner/operator to determine appropriate control measures to enable safe access.

The *procedure* for the *permit to work adjacent to network assets* *shall* include:

- a. an *approved* issuer, and
- b. nominated person in charge of the work, and
- c. control measures (precautions) undertaken by the asset owner, and
- d. instructions given to the nominated person in charge of the work, and
- e. a process for the issue and cancellation.

12.3 Work on abandoned underground cables

For work by persons, not under the control of the asset owner/operator, on abandoned underground *cables*, the use of a safe system of access *shall* be considered by the electrical asset owner/operator.

12.4 Electrical safety rules for vegetation management work near overhead powerlines by non-electrical workers

Vegetation management clearing work in this section means the pruning, cutting, trimming or felling of a tree. It is assisting to prune, cut, trim or fell a tree where any part of the tree is or may come within, or the work requires any person, tool, equipment or *vehicle* to come within, the minimum safe distance prescribed in the *Electricity Safety Act 1998* (the Act) for persons who are not employed, engaged or under control of the electrical asset owner.

No person *shall* perform tree clearing work in the *vicinity* of *live electrical apparatus*, unless the person:

- a. has completed a training course *approved* by ESV, and

- b. has a standard of qualifications, proficiency and experience that enable the person to safely perform the work, and
- c. has been endorsed in writing by the *organisation* (e.g. the employer) to perform the work, and
- d. has documented a hazard identification and risk assessment, and
- e. has implemented a risk management process to control hazards associated with the work, and
- f. complies with Electrical Safety Rules for vegetation management work *near* overhead powerlines by non-electrical workers, as published or amended from time to time by Energy Safe Victoria.

Appendix A— Information to be contained in forms

This appendix provides information that shall be included and other information that could be considered by organisations in the formal communications associated with procedures referenced within these rules. Unless stated otherwise the information may be communicated verbally or by written or electronic means.

Application for an access authority

An application for an *access authority* shall contain sufficient information to determine:

- » the type of *access authority* to be issued
- » *electrical apparatus* to be covered
- » the precautions to be taken.

Examples of information which could be included are:

- » work to be done
- » details of special requirements by work party, e.g. hazard control measures, cross-referencing of *electrical access permits*
- » instructions to be observed
- » a unique identifying number
- » the date, and endorsement of the applicant
- » time and date for anticipated start and finish of *access authority*
- » the work location.

Application for authority to work in the vicinity of electrical apparatus

An application for an authority to work in the *vicinity of electrical apparatus* shall contain sufficient information to determine:

- » work to be done, including details of *mobile plant*
- » the work location and work area and access routes.

Examples of information which could be included are:

- » details of special requirements by work party e.g. cross referencing to related *access authority/ies* and instructions to be observed
- » unique identification number
- » date and endorsement of applicant
- » time and date for start and finish.

Personal authorisations

Authorised persons shall be issued a written statement of their authority.

The statement *shall* contain:

- » the type of authority
- » any limitations or extensions on the type of authority
- » the signature of authorising officer
- » the date of issue.

The statement could also contain:

- » the duration or authorisation review date
- » the date of reviews and competency test
- » signed statement of acknowledgment by the *authorised person*
- » the knowledge and skill required for the authority, and
- » a description and scope of duties the person is authorised to perform.

Authority to work in the vicinity of electrical apparatus

The details *shall* contain:

- » form number, and
- » location of work, and
- » description of work, day, date, and
- » estimated day and date of completion, and
- » instructions to be observed by the work party, and
- » receipt, relinquishment, and canceling, and
- » signatures, time, date of issue.

Clearance to place electrical apparatus into service (may also be overhead line clearance, and underground cable clearance)

The details *shall* contain:

- » a description of the *electrical apparatus* being cleared, and
- » expected commissioning date, and
- » authority to place into service with signature and date from the construction authority, and
- » statement that all construction persons are clear and will treat the apparatus as *live* and provision for construction persons to sign statement, and

- » statement that all commissioning tests have been completed by the testing authority and provision for the testing authority to sign and date the statement, and
- » statement that the apparatus has been accepted by the *operating authority* and provision for the *operating authority* to sign and date the statement.

The details could contain:

- » drawing references
- » description of works
- » statement of when works ready for general inspection.

Electrical access permit and sanction for testing

The details *shall* contain:

- » unique identification number, location, application number, cancellation due time and date, and
- » location or station, and
- » sections for *electrical apparatus* covered, and
- » condition of *electrical apparatus* (for *sanction for testing*) and precautions taken, and
- » section for issue, title, time, date, issued by, and
- » sections for receipt, relinquishment of test party, and

- » section for condition of on relinquishment of *sanction for testing*, and
- » section for cancellation, signed, title, time, date.

The details could contain:

- » for telephone or radio issue additional sections for witnesses.

Statement of condition of apparatus/plant (SCAP)

The details *shall* contain:

- » statement of certification of conditions of *electrical apparatus*, and
- » sections for signatures of acceptance, relinquishment and cancellation, and
- » record of *electrical access permits* issued, and
- » statement which states: this statement covers only the state of the *electrical apparatus* specified here on and does not by itself authorise work on the *electrical apparatus*.

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