



Office of the Chief Electrical Inspector

CODE OF PRACTICE *for*

SAFE ELECTRICAL WORK

LOW VOLTAGE ELECTRICAL INSTALLATIONS

**(Installations Operating at Voltages exceeding 32 Volt AC or 115 Volt DC and
not exceeding 1000 Volt AC or 1500 Volt DC)**

1997

This code of practice was prepared by

The Office of the Chief Electrical Inspector
PO Box 262 Market Street
MELBOURNE
Victoria 8007
Australia

Tel (03) 9203 9700
Fax (03) 9686 2197



The following interests were represented on the drafting Committee.

- ♣ Communications Electrical & Plumbing Union
- ♣ Electrical Industries Group
- ♣ EPIC Training
- ♣ Victoria WorkCover Authority
- ♣ Metal Trades Industry of Australia
- ♣ National Electrical Contractors Association
- ♣ Office of the Chief Electrical Inspector
- ♣ Victorian Electricity Distribution Companies

A code of practice does not have the same legal force as Regulations. Contravention of, or failure to comply with, Regulations made under State Electricity Commission Act 1958 is an offence. Failure to observe a provision of a code of practice is not in itself a breach of the Act. In situations where it is impracticable to comply with the literal provision of a code the electrical worker or employer must be able to show that an equivalent or higher level of safety results from the alternative action taken.

Note to User

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1. SCOPE & APPLICATION

This code of practice outlines principles and methods of safe work, organisation and performance on low voltage electrical equipment. It is designed to constitute a set of minimal recommended procedural and safety requirements for a safe working environment for all electrical workers, including self employed workers, authorised to perform work on electrical equipment and installations.

Where quality systems are in place, the minimum standards in this code should apply. This code may be used to supplement existing documented work practices.

This code is not intended to apply to work performed on electricity supply distribution systems of Electricity Distribution Companies.

This code of practice must be disregarded, where found in conflict with any statutory regulations.

2. INTRODUCTION

From time to time the electrical worker is called upon to undertake functions which include working on or near live exposed electrical equipment. This type of work must only be considered when other means are inappropriate and only when an adequate risk assessment process has been undertaken.

This document provides guidance on meeting the various Victorian Government Acts and Regulations including,

- The State Electricity Commission Wiring Regulations 1992 Regulation 11 states that;
“Any person handling electrical circuits or electrical equipment during the course of work must ensure that the circuits or equipment are entirely disconnected from supply or that other adequate precautions are taken to prevent electric shock or other injurious effects.”
- The State Electricity Commission Act 1958 Section 55(3) states that;
“Any person who carries out or engages in electrical wiring work without being licensed as an electrical mechanic in respect of that grade of electrical wiring work pursuant to the provisions of this section and the regulations shall be liable to a penalty of not more than 100 penalty units.”
- The Occupational Health & Safety Act 1985 (Vic) Section 21(1) in part states that;
The employer’s general duty to employees - to provide and maintain so far as is practicable a working environment that is safe and without risk to health (note: Section 21(3) states that ‘employees’ include independent contractors and their employees).
- The Occupational Health & Safety Act 1985 (Vic) Section 25 in part states that;
(1) *While at work, an employee must -*
 - (a) *take reasonable care for his or her own health and safety and for the health and safety of anyone else who may be affected by his or her acts or omissions at the workplace; and*
 - (b) *co-operate with his or her employer with respect to any action taken by the employer to comply with any requirement imposed by or under this Act.*(2) *An employee shall not -*
 - (a) *wilfully or recklessly interfere with or misuse anything provided in the interest of health safety or welfare in pursuance of any provision of this Act or the regulations;*
or
 - (b) *wilfully place at risk the health or safety of any person at the workplace.*



3. REFERENCED DOCUMENTS

AS 1270	Acoustics - Hearing Protectors
AS/NZS 1337	Eye Protectors for Industrial Applications
AS 1801	Industrial Safety Helmets
AS/NZS 1891.1	Industrial Safety Belts and Harnesses
AS 1892	Portable Ladders - Selection Safe Use and Care
AS/NZS 2210.1	Occupational Protective Footwear - Guide to Selection, Care & Use
AS/NZS 2210.2	Occupational Protective Footwear - Specification
AS 2225	Insulating Gloves for Electrical Purposes
AS 2626	Industrial Safety Belts and Harnesses - Selection, Use and Maintenance
AS 2676.1	Guide to the Installation, Maintenance, Testing and Replacement of Secondary Batteries in Buildings
AS 2865	Safe Working in Confined Spaces
AS/NZS 2978	Insulating Mats for Electrical Purposes
AS/NZS 3017	Electrical Installations - Testing Guidelines
AS/NZS 3108	Approval & Test Specification Particular Requirements for Isolating Transformers and Safety Isolating Transformers
AS 3190	Approval & Test Specification Residual Current Devices (Current-Operated Earth Leakage Devices)
AS 3439.1	Low-Voltage Switchgear and Controlgear Assemblies -Type-tested and Partially Type-tested Assemblies
AS/NZS 3760	In-Service Safety Inspection And Testing of Electrical Equipment
SAA HB13/MEEITC	Electrical Equipment for Hazardous Areas
O H & S ACT (VIC) 1985	Act No. 10190/1985
O H & S ACT (VIC) 1992	Asbestos Regulations
O H & S ACT (VIC) 1992	Plant Regulations 1995
O H & S ACT (VIC) 1992	Certification of Plant Users and Operators Regulations 1994
SEC ACT 1958	Act No. 6377/1958
SEC WIRING REGULATIONS 1992	Statutory Rule No. 259/1992

4. DEFINITIONS

For the purpose of this code of practice the following definitions apply, words or terms not specifically defined are to be interpreted as commonly understood.

Appropriate	Being suitable to, or proper for, the duty concerned.
Approved	Having an appropriate organisation's endorsement for a specified function.
Authorised	Has the permission of the appropriate authority for the duty concerned.
Close Proximity	Locations on installations, where deliberate, accidental or inadvertent contact with electrical equipment is possible, either direct or indirect through tools, long objects, drills, cutting blades, etc.
Competent	Means having acquired through training, qualification, or experience, or a combination of these, the knowledge and skills enabling that person to correctly perform the task required.
De-energised	Disconnected from all sources of supply but not necessarily isolated, earthed or out of commission.
Discharged	Removal of an electric charge by the application of a suitably earthed conductor.
Electrical Worker	Person or persons engaged in the installation, maintenance, repair and testing of electrical equipment.
Equipment (electrical)	Any appliance, wire, fitting, conduit or apparatus that uses, conveys or controls electricity which are live or can be made alive.
High Voltage	Exceeding 1000 V a.c. or 1500 V d.c.
Isolated	The state of equipment when disconnected from all sources of supply by breaks of a length appropriate to the voltage and the insulating medium.
Isolator	A device which for reasons of safety, provides in the open position, breaks appropriate to the voltage and the insulating medium.



Live (energised)	A term applied to an object when a difference of potential exists between conductors or would exist between it and earth under normal conditions of operation.
Low Voltage	Exceeding 32 V a.c or 115 V d.c. but not exceeding 1000 V a.c. or 1500 V d.c.
Must	Is to be understood as mandatory.
Safety Observer	A person specifically assigned the duty of observing and warning against unsafe approach to equipment and other potential hazards.
Should	Is to be understood as advisory, but not mandatory.

5. HAZARDS OF HIGH FAULT CURRENT LEVELS

HIGH FAULT CURRENTS - Electrical workers should be aware, when working on live electrical equipment, that fault current of up 20 times the rated current of the supply transformer can flow for short times during fault conditions. Arcs that are produced under these conditions have the energy to cause an explosion and/or melt metallic switchboard cubicles and cause severe burns to the skin and/or cause flash burns to the face and eyes. Circuit protection may not operate in such circumstances.

Furthermore, severe damage to the electrical switchboard equipment may occur resulting in expensive repairs and lost production time.

Note: Some switchboards may have been type tested in accordance with AS 3439.1, and may have lesser creepage and clearance distances, between live parts and live parts and earth, than normal.

Warning: Where fault currents exceed 2,000 amps special precautions must be used. Consideration should be given to the use of flame resistant and non-synthetic overalls as well as insulating gloves and full face shield.

6. PLANNING & RISK ASSESSMENT

General - An assessment should be made so work is planned to minimise the risk of inadvertent contact with live electrical equipment. Where isolation or the use of suitable insulating barriers is deemed impractical consideration must be given for using a safety observer when working on or in close proximity to live electrical equipment. All factors which reflect on safe working procedures should be considered, e.g. proximity to live electrical equipment, prospective fault levels, site conditions, weather conditions, work environment, noise, etc.

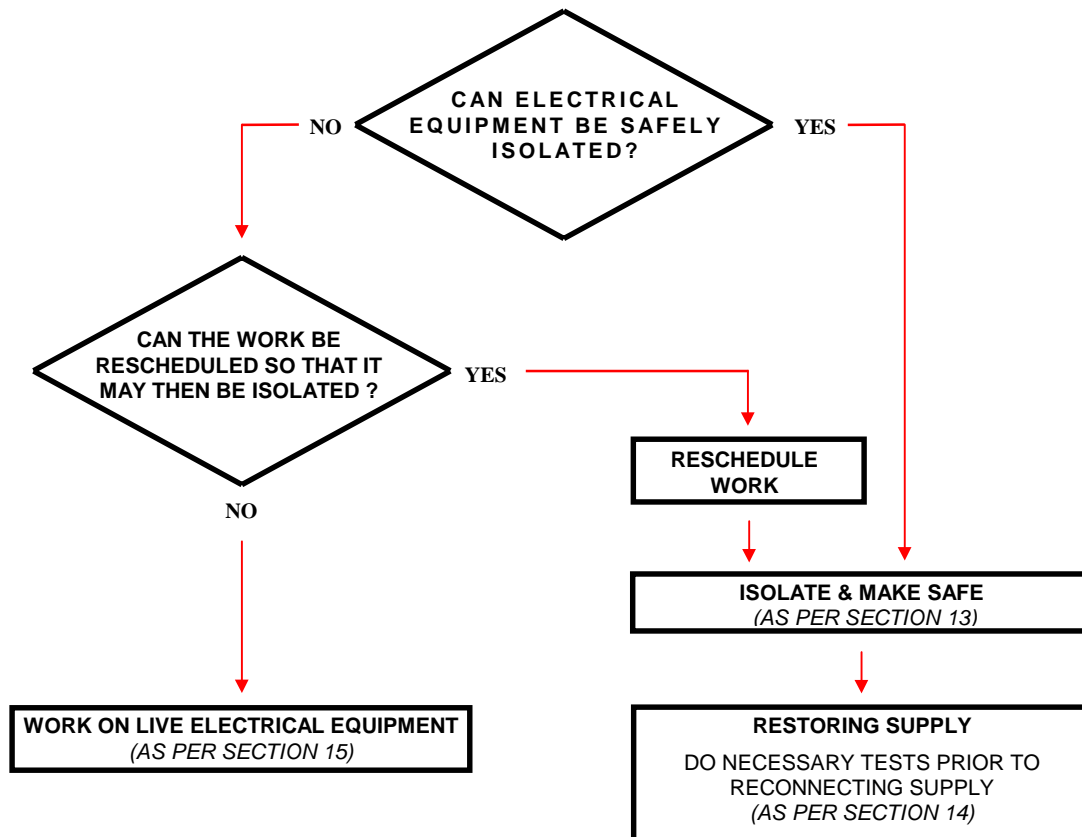
Consideration should also be given to the consequences of any inadvertent operation whilst working on live electrical equipment which may affect the safe operation of other equipment remote from the work site and affecting the safety of others, e.g. the operation of control devices, standby generators, non-electrical equipment, etc.

Any work being performed in the vicinity of electrical equipment must be organised in such a way as to eliminate any conceivable risk of any person, either performing work or accidentally entering work areas, to come in contact with live electrical equipment.

Electrical workers need to plan work in advance, particularly where other services are likely to be present, e.g. gas, telephone, data communications, water and other electrical circuits.



SAFE WORKING PROCEDURES



- 6.1. **Awareness** - Electrical workers must be capable of maintaining a physical and mental ability at all times when in close proximity to, or when working on, electrical equipment. Personnel, including supervisors, safety observers and those assisting electrical workers working on electrical equipment must understand the potential hazards involved in attempting work on electrical equipment if other workers are physically or mentally impaired, e.g. under the influence of alcohol or drugs or lack of rest.
- 6.2. **Identify** - Before electrical equipment is worked on, the switching, isolation, disconnection procedures and other necessary precautions must be identified by the person in charge of the work and, where practicable, verified by another experienced person.
- 6.3. **Areas of Reduced Mobility** - Particular care must be taken when working in these areas, due to movement restriction and the inability of being able to readily escape from the immediate area, e.g. behind switchboards, in roof spaces, under dwellings, up a ladder, on a scaffold or in a trench.
Note: AS 2865 - (Safe Working in Confined Spaces) identifies the hazards to persons entering and working in confined spaces and sets out the precautions to be taken to prevent occupational injuries and fatalities associated with such work environments.
- 6.4. **Trafficable Areas** - Persons working in close proximity to passing traffic, including vehicular and pedestrian, should install suitable screens, barriers and/or signage for personal safeguard and protection. Caution should be exercised when working in a passageway or narrow access area, e.g. where a door may be inadvertently closed and propel the electrical worker into a live electrical source.
- 6.5. **Illumination** - Adequate lighting is essential at all times. Illumination devices should be of the all insulated type and have no metallic or conductive exterior surfaces when used in close proximity to electrical equipment. Lamps should be protected against inadvertent breakage.



Illumination devices used in areas of reduced mobility should be operated at extra low voltage.

- 6.6. **Special Situations** - Refer to Section 18.

7. SAFETY OBSERVER (Work-Site Observance)

General - An assessment of all risks involved in undertaking work associated with either live (energised) or de-energised equipment must consider all factors which may have the potential to cause injury or damage. Should this potential exist, precautionary measures may include the use of an independent observer.

- 7.1. **Instructions & Skills** - Safety observers must be specifically instructed in their duties on each occasion. Any observer so employed must be appropriately skilled in all aspects of safety observation and be fully aware of the potential risks associated with the work. Unless local medical and rescue services are readily available, the observer should be fully conversant and skilled in first aid procedures. This should include appropriate safety rescue techniques for persons in contact with live electrical equipment.

Note: First aid procedures should be at least equivalent to Level-1 first aid training as provided by St Johns Ambulance, or similar organisations.

- 7.2. **Use of Observer** - Where it is established that an observer is deemed necessary for any work in close proximity to live electrical equipment, then work must not be undertaken without the presence of an observer.
- 7.3. **Duty** - Where a person, equipment or mobile plant may inadvertently contact live electrical equipment, such as bare or overhead wires, a safety observer must be posted. The safety observer's duty is to observe personnel working in a potentially hazardous situation and warn them when necessary to prevent inadvertent contact with live electrical equipment. Also to provide assistance in the case of an emergency. The observer must remain at the work site at all times whilst a potential hazard exists and no other duties should distract from this role.
- 7.4. **Safety Apparel** - The observer must be suitably attired with appropriate safety apparel relative to the situation. Refer to Section 12.
- 7.5. **Disabilities** - The observer must not have any known disabilities which would adversely affect their role and performance as an observer.

8. AUTHORISATION OF PERSONNEL

General - Personnel working on live electrical equipment must have appropriate training, be competent and familiar with the equipment and aware of all the potential risks involved. Personnel must ensure that relevant authorisation has been granted, for the duty to be performed, before proceeding with the work. Where practicable, authorisation should be in writing, i.e. from the owner or occupier of the premises, the employer, or the employer's authorised representative.



- 8.1. **Supervision of Trainees** - The employer of a trainee carrying out electrical wiring work must ensure that trainees are supervised by a competent person and,
- (a) that the trainee receives the directions, demonstrations and monitoring appropriate to the tasks assigned to the trainee and the competence of the trainee so that the trainee can perform the work in a manner that is safe and without risks to health; and
 - (b) that should an emergency involving the trainee arise, action to immediately rectify any dangerous situation can be taken; and
 - (c) that the trainee is always under direct supervision unless a lesser degree of supervision would not place the trainee or any other person at risk; and
 - (d) that the supervisor assumes final responsibility for the wiring work carried out by the trainee.

9. PERMITS

In work places that engage electrical workers, it is desirable to use a work permit system for undertaking electrical wiring work within that workplace.

A work permit system should be used for any work being performed in the vicinity of electrical equipment where potential hazards of injury to personnel or equipment damage exist. The work permit should set out relevant conditions of accessing electrical equipment, supervision of work, electrical and/or mechanical isolation of equipment, use of safety observers, use of safety equipment, conditions of restoring operational status, etc.

Note: Permit systems may require practices additional to the requirements detailed in this document.

10. TESTING EQUIPMENT

General - Test equipment including leads and probes must be appropriate and adequate for the tests being performed. The equipment must be suitable for use on the highest voltage and available fault current levels likely to be encountered in accordance with its operating instructions.

- 10.1. **Condition of Equipment** - Testing equipment must be in good condition and working order, clean and have no cracked or broken insulation and suitable for any voltages that could be found during fault conditions on the equipment being tested. Particular care must be taken as to the condition of the insulation on leads, probes and clips of test equipment.
- 10.2. **Accuracy of Equipment** - Instruments such as multi-meters, RCD performance testers, earth loop impedance testers, voltage testers, insulation resistance testers and similar instruments must be regularly tested for accuracy of operation against a relevant standard.
- 10.3. **Suitability of Equipment** - Testing equipment must pose no danger of electrocution to personnel or damage to the electrical equipment during testing. Test probes and other equipment must be designed and selected so that they cannot inadvertently short circuit between live conductors or live conductors and earth. The terminals of test equipment should be shrouded and all other test sockets on measuring instruments should be designed as to prevent inadvertent contact with any live test socket and/or conductor when equipment is in use. Where appropriate, test leads and testing devices need to be provided with suitable fuse protection. Testing equipment, where used in hazardous flammable areas, should be designed and clearly marked as being suitable for use in such locations.
- 10.4. **Proof of Operation** - Testing equipment used for detecting a live (energised) source should undergo trial operation to prove that it is functioning correctly immediately before and after the test has taken place.



11. TOOLS & EQUIPMENT

General - Correct tools should be chosen to suit a particular job. Properly designed and correctly insulated tools must be used. All hand tools used in close proximity to live electrical equipment and used in contact with live electrical equipment must be insulated to the highest potential voltage likely to be encountered. All tools and equipment must be in good order and regularly maintained.

11.1. Hand Tools

11.1.1. **Defective Tools** - Hand tools should be checked for wear, breakages and damage before use. Tools found to be defective must immediately be withdrawn from service and labelled '**DANGER - DO NOT USE**' if it is to be repaired, or otherwise directly made inoperable and safely disposed of, or destroyed.

11.1.2. **Exposed Conductive Parts** - The use of metallic measuring tapes, rulers and tools with exposed conductive parts should be avoided when working on or in the vicinity of live electrical equipment.

Note: If the use of hand tools with exposed conductive parts is unavoidable in the vicinity of live electrical equipment, extreme care must be exercised due to the risk of electrocution and/or arcing hazards.

11.2. Portable Electrical Tools

11.2.1. **Type** - Where practicable, tool and equipment insulation should be a minimum Class II type (double insulated) or equivalent.

11.2.2. **Protection** - All portable electrical tools, appliances and equipment should be supplied through a residual current device (RCD) providing personnel protection, Type II (30 mA) or Type I (10 mA) complying with AS 3190, or supplied through an isolating transformer complying with AS/NZS 3108. If portable RCDs are used they should be utilised as close as practicable to the point of supply, e.g. at the supply end of an extension lead and not at the appliance end.

11.2.3. **Risk of Short Circuit** - Caution must be exercised when using portable electrical equipment having exposed conductive parts due to the risk of short-circuiting between conductors or between conductors and earth.

11.2.4. **Tagging of Equipment** - Inspection and test procedures should be followed for the routine in-service and testing of electric tools, including flexible cords, cord extension sets, portable outlet devices, RCDs and portable isolation transformers, as described in AS/NZS 3760 (In-Service Safety Inspection and Testing of Electrical Equipment).

11.2.5. **Defective Equipment** - It is necessary to check equipment for wear, breakages and damage before use. Equipment found to be defective must immediately be withdrawn from service and labelled '**DANGER - DO NOT USE**' if it is to be repaired, or otherwise directly made inoperable and safely disposed of, or destroyed.



11.3. Ladders & Step Ladders

General - Portable ladders and step ladders should comply with the appropriate Australian Standard and be used in accordance with the manufacturer's instructions. Ladders should have a load rating of at least 120kg, be of correct size and length for the associated work and provided with anti slip feet where practicable. Only one person should work from a ladder at any one time. Persons should not over-reach when using a ladder.

11.3.1. **Positioning & Securing** - Ladders must be located and positioned to provide a safe and secure working medium. Extended ladders should be secured top and bottom, by securing at the ladder head, or held secure by other means, e.g. held securely at the base by an assistant.

11.3.2. **Use of Safety Belt/Harness** - Persons using ladders on poles or similar structures should, wherever practicable, be constrained by an appropriate safety belt or harness. Refer AS/NZS 1891.1 and AS 2626.

11.3.3. **Use of Electrically Conductive Equipment** - Metallic, wire-reinforced or otherwise conductive ladders, must not be used in close proximity to equipment where an electrical hazard may result from their use.

Note: Ladders which are damp or dirty may become conductive and create a potential hazard.

11.4. Elevating Work Platforms

General - All persons using elevating work platforms should be trained in their use and never enter or leave the platform whilst it is elevated. Persons working from elevating work platforms should not over-reach.

Note: Elevating work platforms include scissor lifts, boom lifts and cherry pickers.

11.4.1. **Positioning** - Elevating work platforms should only be used on a solid level surface. The surface area should be checked to make sure that there are no penetrations or obstructions that could cause violent movement or overturning of the platform.

11.4.2. **Use of Safety Belt/Harness** - Safety belts should be worn and suitably attached when working in boom lifts and cherry pickers. Refer AS/NZS 1891.1 and AS 2626.

11.4.3. **Use of Electrically Conductive Equipment** - Elevating work platforms, unless suitable for the purpose, must not be used in close proximity to equipment where an electrical hazard may result from their use.

Note: Elevating work platforms which are damp or dirty may become conductive and create a potential hazard.

11.5. Barriers & Insulating Mats

11.5.1. **Compliance** - Insulating covers and mats for electrical purposes must comply with and be tested in accordance with the requirements of AS/NZS 2978.

11.5.2. **Inspection** - Insulated covers and mats must be visually inspected for possible defects prior to each use.

11.5.3. **Material** - Insulated barriers must be of suitable material to effectively isolate electrical workers from adjacent live equipment.



12. SAFETY APPAREL

General - Electrical workers and their assistants must wear appropriate protective clothing when working on, or in close proximity to, live electrical equipment. Protective clothing worn by personnel must be of correct fit and in good condition.

12.1. **Safety Apparel** - Dependent on the type of work and the risks involved, the following safety apparel must be considered,

Eye Protection	Metal spectacle frames should not be worn, eye protection should comply with AS/NZS 1337.
Footwear	Shoes or boots complying with AS/NZS 2210.2 and selected and maintained to AS/NZS 2210.1.
Gloves	Gloves insulated to the highest potential voltage expected for the work being undertaken complying with AS 2225 . <i>(Note: Leather work gloves may be considered when performing de-energised electrical work).</i>
Noise Protection	Ear plugs or muffs to AS 1270.
Clothing	Should cover the full body (including arms and legs), be non-synthetic, of non-fusible material and flame resistant. Clothing made from conductive material or containing metal threads should not be worn.
Safety Belt/Harness	Safety belts and harnesses must be checked and inspected each time before use with particular attention being paid to buckles, rings, hooks, clips and webbing, complying with AS 2626.
Safety Helmets	Headwear complying with AS 1801.

Note: It is strongly recommended that bracelets, rings, neck chains, exposed metal zips, watches, metal spectacle frames, etc., are not worn whilst performing electrical work in the vicinity of live electrical equipment, however, where these are worn, they should be suitably insulated.

13. ISOLATING & MAKING SAFE (PREPARATION FOR WORKING ON DE-ENERGISED EQUIPMENT)

General - Electrical safety is primarily dependent upon appropriate job planning and correct testing procedures and techniques. No electrical equipment should be assumed to be de-energised after isolation. **Always test prior to touching.** Persons required to work in association with electrical equipment must be appropriately trained and competent in test procedures and in the use of testing equipment.

13.1. **Identify** - Clearly identify the electrical equipment to be worked on and the appropriate point of supply. Identification of equipment should include labelling that is both consistent and clear at the equipment to be worked on and all points of possible isolation, e.g. control isolator and main point of supply.

13.2. **Isolate** - The electrical equipment to be worked on must be isolated from all sources of supply either by opening switches, removing fuses or switching circuit breakers. Where isolation is effected at a removable or rack-out circuit breaker or combined fuse switch then it should be racked out or removed to provide a visible break for isolation verification.

Note: To safeguard against inadvertent reconnection by others, after being absent from the immediate work area, it is imperative that checks and tests be carried out to ensure that electrical equipment being worked on is still isolated.

13.3. **Test** - All electrical equipment, unless proven to be de-energised, must be treated as live. Any voltage tests must be conducted between all conductors and between all conductors and earth.

When voltage testers are used, they must be tested for correct operation immediately before use, and again after use to confirm that the instrument is still working.

Note: Consideration must be given to the possibility of circuit wiring or electrical equipment becoming live due to any operation of automatic control devices, e.g. thermostats, float switches, PLCs and other interface devices.

- 13.4. **Tag** - Where practicable, appropriate warning tags should be placed at all points of switching, isolation or disconnection. Such notices must be clearly understandable and, where appropriate, signed and dated by all personnel involved in the work or by the supervisor in charge of the work party. Tags should only be removed with the permission of all the signatories to the tags or if not possible by the signatory's immediate supervisor. Identification labels should also include warnings for any abnormal hazards, e.g. multiple points of supply, etc.

Note: Where a formal permit system is used, the designated sign-on and tagging procedure must be adhered to.

Sample Tags



- 13.5. **Lock Off** - All circuit breakers, switches and combined fuse switch units should be locked off where possible. Where fitted locking facilities are not available, temporary securing devices must be used. Securing devices must be able to withstand any disrupting environment, i.e. not becoming ineffective due to vibration.
- 13.6. **Bonding** - If practicable, where isolation of electrical equipment is made at a remote location, all conductors supplying the equipment should be bonded together and to the general mass of earth at the work-site. Bonding to earth may be effected by connecting conductors, which are adequate to carry the potential short circuit currents, to the electrical installation earthing system.

Note: Temporary bonding conductors must always be bonded together and attached to the general earth before any attempt is made to attach them to any de-energised component portion of the electrical installation. Removal of the bonding conductors must be carried out in reverse order. Suitable safety apparel should be used when attaching or removing temporary bonding conductors.



- 13.7. **Cutting Cables** - When carrying out work which involves cutting existing cables, the cable must be treated as live and the procedures for working on live electrical equipment contained in Clause 15 adhered to until positive tests proving the cable is de-energised can be made at the point where the cable is to be cut.
- 13.8. **Removing Out-of-Service Electrical Equipment** - When removal of out-of-service or decommissioned electrical equipment is required, the equipment must be isolated from supply and appropriate tests made to ensure the equipment is de-energised. Further tests must be made at any point a cable is required to be cut.

Warning: The use of a tester which detects an electric field surrounding a live conductor may not be suitable to test cables which are surrounded by a metallic screen.

14. RESTORATION OF SUPPLY TO ELECTRICAL EQUIPMENT

General - Before restoring supply after isolation, ensure all relevant personnel are notified and a visual inspection conducted to ensure that all tools, surplus material and wastes have been removed. After any alterations or additions to electrical equipment are made, those parts which have been altered or added must comply with relevant regulations. Before supply is re-energised, these alterations or additions must pass the appropriate tests, e.g. insulation resistance and earth continuity.

- 14.1. **Removal of Bonds** - Before supply to equipment is restored ensure that all personnel are clear and aware that power is to be restored, all safeguards including temporary bonds and short-circuiting devices have been removed, and it is safe to restore supply.

Note: Suitable safety apparel should be used when attaching or removing temporary bonding conductors.

- 14.2. **Operation of Other Equipment** - Precautions against the inadvertent operation of other equipment must be carefully considered when supply is restored.

- 14.3. **Restoration** - In general, all signatories to any tags or notices must agree that power can be restored and locks removed where used.

Note: Where a formal permit system is used, the designated sign-off procedure must be adhered to.

- 14.4. **Tests** - When power is restored, tests must be carried out to confirm that polarity is correct, actives are switched and, where applicable, phase sequences are correct before equipment is operated. Refer to AS/NZS 3017 and AS/NZS 3760 as appropriate.

15. WORKING ON LIVE ELECTRICAL EQUIPMENT

General - Rescheduling the work to a time when power can be isolated must be considered first. Working on live electrical equipment must only be considered as a last resort and when an adequate risk process has been undertaken. Suitable safety apparel must be worn and only tools and equipment appropriate for the work to be carried out must be used.

- 15.1. **Assessment** - An assessment of the associated risks prior to commencing any work on live electrical equipment must be made.

- 15.2. **Assistance** - Where in the judgment of the person doing the work that it cannot be carried out safely without assistance or a safety observer, then that person must be provided with that assistance, or the work delayed until isolation can be arranged.

- 15.3. **Competency** - Any persons undertaking work on live electrical equipment must be skilled and competent in the work to be carried out.

- 15.4. **Precautions** - The person responsible for authorising work to be carried out live must specify any particular precautions to be taken to eliminate hazards and to prevent injury. When work is to be carried out on or near live low voltage equipment, precautions must



be taken to prevent the likelihood of simultaneous contact with conductors or conducting objects at different potentials.

- 15.5. **Safety Apparel** - Electrical workers and their assistants must wear appropriate protective clothing suitable for the task when working on, or in close proximity to, live (energised) electrical equipment. Protective clothing worn by personnel must be of correct fit and in good condition. Refer to section 12 - Safety Apparel.
- 15.6. **Earthing** - When working on live electrical equipment having earthed metal, precautions must be taken to ensure earthing continuity is maintained to any component part of the equipment at all times. Bonding conductors may be required to be installed when removing electrical equipment from earthed metal, e.g. live component part separated from its connected earthing medium. Bonding conductors must be rated to withstand the 'let through' energy of the primary protection without failing.
- 15.7. **Neutral Connections** - Particular care should be taken when removing neutral connections as tests may have indicated a de-energised situation. However, when these connections are removed, a voltage may be present between conductors or between conductors and earth.
- 15.8. **Barriers & Insulation Mediums** - Only conductors at one potential should be worked on at any one time and insulated barriers should be utilised in the work area between conductors of different phases or voltage potentials. Insulating mats or barriers should be used between electrical workers and conductors and between electrical workers and earth including building structures such as concrete and steel which may be earthed.

16. FAULT FINDING

Isolating power as described in section 13 should always be the first choice, however, there may be instances when fault finding or obtaining test results is only possible whilst equipment is live, and other safety measures need to be taken.

- (a) The electrical worker must be competent in the work and familiar with the equipment involved and the requirements for working on live electrical equipment contained in section 15 must be adhered to.
- (b) Where testing for faults within plug-in electrical equipment, whilst live, an RCD or an isolating transformer should be used.

17. IN-SERVICE TESTING OF ELECTRICAL EQUIPMENT

The procedures specified in Australian Standards AS/NZS 3760 should be used for the in-service safety inspection and testing of equipment, other than fixed equipment, which is designed for connection by a supply flexible cord and plug, to low voltage supply.

The Standard also applies to the testing of cord extension sets, electrical portable outlet devices (power boards), cord connected portable residual current devices and portable isolation devices.

The electrical worker should be aware of the risk of electric shock or flash-over between conductors and conductors and earth whilst testing and take appropriate precautions.



18. SPECIAL SITUATIONS

- 18.1. **Capacitors** - When working on equipment that includes capacitors electrical workers should be aware that substantial energy and subsequent arcs can be produced that may cause burns to workers or ignite material.

Capacitors and associated circuitry must be proved to be fully discharged and de-energised by the use of a voltage tester prior to performing work on them and their associated circuit wiring. This may be achieved by waiting the requisite time as per the manufacturer's instructions and/or using appropriate safe discharging devices.

Always test to prove that these units are discharged, immediately prior to commencing work, as capacitors that do not have discharge devices attached may re-instate the full line voltage. When applying discharging devices, care should be taken against the harmful effects of arcing.

Note: Many older types of capacitors contain PCBs, a substance which has proven to be toxic and appropriate procedures must be used when handling this type of equipment. PCB capacitors should be disposed of in an environmentally responsible manner.

- 18.2. **Hazardous Flammable Locations** - Any work on live electrical equipment in areas classified as hazardous, other than intrinsically safe equipment, is not permitted due to the risk of causing explosion or ignition. Any electrical work within flammable or potentially flammable areas, e.g. petro-chemical installations, grain storage, flour mills and fine particle process areas, must be carried out using procedures applicable to the hazardous location.

Note: Appropriate non-sparking hand tools and equipment must be used when working in hazardous locations. Additional information is available from document SAA HB13/MEEITC (Electrical Equipment for Hazardous Areas).

- 18.3. **Batteries** - When working on batteries (or equipment that contain batteries), electrical workers should be aware that accidental short circuiting of battery terminals or connections may create substantial arcs that can cause burns or ignite hazardous gases or material and appropriate preventative precautions must be taken.

Refer to AS 2676.1, Guide to the Installation, Maintenance, Testing and Replacement of Secondary Batteries in Buildings, Part 1: Vented cells and Part 2: Sealed cells, which provides guidance on safe practices during battery installation and maintenance.

Note: Appropriate procedures must be used when handling batteries as their contents may be harmful.

- 18.4. **Asbestos** - Asbestos may have been installed at some electrical switchboards as a fireproofing material. Where there is a likelihood of the asbestos being disturbed by activities such as removal, drilling or cutting, appropriate precautions must be used.

Note: Removal of asbestos must be carried out in accordance with the Occupational Health & Safety (Asbestos) Regulations 1992.

- 18.5. **Cold Cathode Lighting Systems** - These systems of illumination, including outline lighting systems, may have open-circuit voltages up to 15,000 volts. No portion of the system should be touched whilst energised. Any work or replacement of component parts must not be performed unless the system is isolated from the electrical supply.

- 18.6. **Elevated Electrical Equipment & Overhead Conductors** - Extra caution must be used when working on live un-insulated overhead conductors or other live electrical equipment in elevated positions as even a slight shock can result in a fall which could prove fatal. Approved safety harnesses and other necessary safety apparel should be used where appropriate. Where a safety observer is deemed necessary the observer should be proficient in pole top rescue or other relevant rescue procedures.



Poles and structures must be tested and inspected to establish, as far as practicable, that they are safe for the work to be carried out without special precautions. Metal or wire reinforced ladders and scaffolds must not be used on live circuits and elevated platforms should be tested to ensure they are effectively insulated to the appropriate voltage.

- 18.7. **Alternative Power Supplies** - Care must be taken when alternative power supplies are connected to the installation. Isolation procedures should include steps to ensure isolation of automatic connection of alternative supply.

Note: Alternative systems may include inverter/UPS systems, standby generators, ring main systems, main power with separate auxiliary power supply for control, transformation up (backfeed from ELV controls), multiple control supplies, etc.

19. ELECTRICAL ACCIDENTS

- 19.1. **Medical Attention** - Any person receiving a severe electric shock should always seek medical attention promptly.

Note: The full effects of an electric shock may not be immediately obvious but symptoms of internal injuries may materialise at a later time.

- 19.2. **Reporting** - All electrical accidents must be immediately reported to the Supply Authority (Electrical Distribution Company) responsible for the distribution system in the area where the accident has occurred and to any other organisations as required by statutory regulation.

Note: The purpose of reporting an accident is to ensure proper investigation, ultimately to prevent future occurrences of similar potential incidents.

20. HIGH VOLTAGE INSTALLATIONS

No work must be done on or in close proximity to high voltage installations unless appropriate training has been undertaken and an appropriate safe work permit system used.

Note: Guidance for working on high voltage installations may be available from the Victorian Electricity Supply Industry's publication, "The Blue Book" & "Supplementary Electrical Safety Instructions to the Blue Book".



TYPICAL EXAMPLES OF LIVE ELECTRICAL WORK

1. Fault finding on;
 - motors and associated controls,
 - general light and power switchboards.
2. Working on Motor Control Centre (MCC) and/or Switchboard modules;
 - where the isolator does not isolate all low voltage power supplies in the module, or
 - where the line side of the isolating switch is not shrouded.
3. Installing cables in the vicinity of exposed live terminals of electrical equipment in;
 - cable zones with unshrouded terminals, in MCC's,
 - light and power switchboards.
4. Uninsulated live cables or busbars.
5. Resetting overload devices inside un-segregated or open type switchboards and/or removing fuses involving exposure to live conductors,

*Note: Resetting of overloads where there is no exposed live conductors, such as for externally mounted operator reset buttons on panels does not constitute live electrical work.
Removing shrouded fuse holders from shrouded fuse bases is not considered to be live electrical work provided that there are no other exposed live conductors in close proximity.*

CHECKLIST OF TYPICAL SAFETY PRECAUTIONS

- Cotton overalls
- Insulated tools
- Isolation
- Adequacy of working space, access and lighting
- Identification of isolator for source of supply and/or location of trip/isolating devices
- Insulated blankets
- Goggles
- Partial isolation - when incoming terminals are still alive
- Shrouding, barriers and warning notices
- Face shields
- Tested insulated gloves
- Insulated rescue stick
- Non conductive electrical safety mats
- Training specific to a particular task
- Avoiding installation of uninsulated conductive material that could make contact with any exposed live conductors
- Avoiding penetrations through panels containing live circuits - unless the rear of the panel can be sighted and the absence of live conductors is confirmed

OFFICE OF THE CHIEF ELECTRICAL INSPECTOR

The Office of the Chief Electrical Inspector (OCEI) is the regulatory body for electrical safety and appliance efficiency in Victoria.

The OCEI's major challenges include the achievement of sustained improvement in safety performance, reform of the regulatory environment, improved cost effectiveness and the delivery of high quality service to its customers.

Responsibilities of the Office

This office is an independent statutory office which :

- ensures the electrical safety of -
 - the electrical generation, transmission and distribution systems,
 - electrical installations,
 - electrical equipment.
- controls the electrical safety standards of electrical wiring work carried out by electrical workers.
- promotes awareness of energy efficiency through the energy efficiency labelling of major electrical appliances.
- protects underground and underwater structures such as gas, oil and water pipelines and telecommunication and electricity supply cables from corrosion caused by stray electrical currents.
- administers legislation, regulations and supporting processes which set standards, certify the initial compliance and monitor, audit and enforce the ongoing compliance with those standards in each of the above areas.
- maintains public awareness of electrical safety requirements through a strong media campaign.

The Code of Practice for Safe Electrical Work is aimed at addressing the unacceptable number of electrical workers being injured or killed working on live installations.