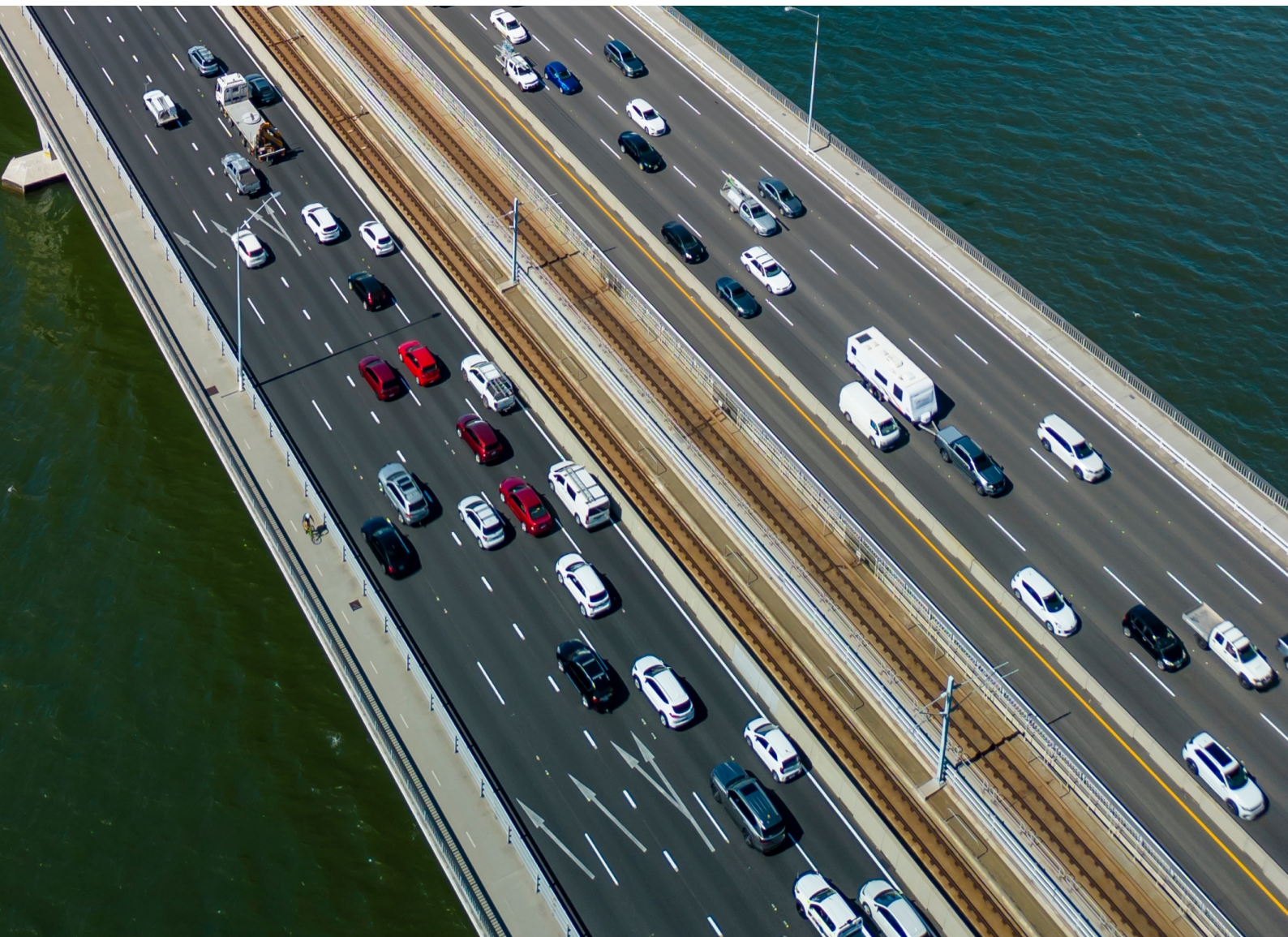


Safety – It's No Accident



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Manager's Guide to Low Voltage Switch Board Safety

Be aware. Be alert.



Leading Knowledge - Sharing Information

Board Safety has been developed by Cement Concrete & Aggregates Australia (CCAA) to provide managers and supervisors with a basic understanding of the requirements for successfully managing the risks associated with working on electrical switchboards in an occupational environment. This document is a guide only and further information should be sought from the referenced Australian Standards and relevant regulatory legislation.

This document covers low voltage work only and further guidance should be sought on requirements for work requiring access to high voltage installations.

Definitions

- Extra Low Voltage: <50V a.c.
 <120V ripple free d.c.
- Low Voltage: >50V & <1000V a.c.
 >120V & <1500V d.c.
- High Voltage: >1000V a.c.
 >1500V d.c.

Plant

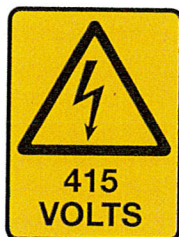
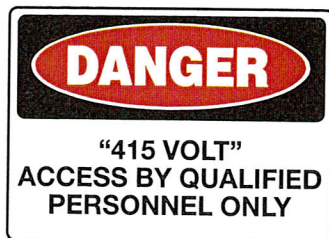
An integral part of managing switchboard safety is ensuring that switchboards are constructed to the required safety standards. Following is a general guide on switchboard design guidelines. Further information can be found in the relevant Australian Standards, Codes of Practice and Building Codes. For a list of relevant documents see the references section of this document.

Switchboard Design

All electrical cabinets and switchboards should comply with the Building Code of Australia, AS3007/AS3000/AS3439 (as applicable) and to the following minimal provisions;

- At least 600mm of clearance shall be provided in front of switchboards with doors fully open to allow clear access and egress. This area should be clear of debris and be free draining to prevent build up of moisture;
- The switchboard must be connected to the incoming supply by a direct method (e.g. wired to terminals) and not by socket outlets or connecting devices;
- The switchboard cabinet should be of robust construction with a minimum IP33 rating. The switchboards should be fit for purpose with the preference being IP54 indoors and IP66 outdoors due to the nature of the work environment.
- The switchboard internals should be arranged for maximum safety. The opening of a module door shall not reveal live terminals, contacts or live parts unless they are protected to IP2X.
- The switchboard should have a protective cover or lid that is;
 - secured at all times using tool specific locks and/or a specific site electrical master key;
 - attached in a way that will not damage cables or equipment on the switchboard; and
 - with means to retain the door in the open position when it is required to be kept open for the purpose of electrical work on the switchboard.
- Doors in excess of 600mm in height shall be fitted with stiffening channel.
- The switchboard should have an isolating switch which is installed to the outside of the access door/lid that removes all power above ELV from all electrical compartments containing live contact points (i.e. bus bars, contact points etc) unless fitted with protection barriers to avoid inadvertent touch incidents. This isolating switch must be able to be locked or secured in the open position.

- Switchboard cabinets or panels where live connections are exposed behind doors or covers to be labelled with a warning symbol and sign stating "Danger – Qualified Personnel Only" and a sign stating the highest voltage contained in the cabinet and the point of isolation of the switchboard.



- Plant electrical single line distribution diagrams and schematic wiring diagrams should be available to electrical workers for all electrical installations. These diagrams should be updated as modifications to plant occurs and be periodically reviewed.
- Switchboards should be clearly labelled if secondary supplies are present. Such labels should include the source of supply (fed from) and voltage.
- A full risk assessment must be undertaken taking into consideration the prospective ARC Blast consequences when designing switchboard assemblies. To provide increased protection to personnel and equipment, consideration should be given to fitting an ARC detection protection system.
- Provisions for external panel resetting of overload and electrical protective devices should be provided.

People

Training

Only qualified electricians may work on switchboards where there is any risk of coming into contact with energised conductors at low voltage levels, either deliberately or inadvertently.

A full risk assessment must be undertaken taking into consideration the prospective ARC Blast consequences when accessing switchboards for fault finding. **Specific PPE may be required to perform these tasks.**

Non-qualified persons may only access switchboard cabinets where the switchboard design prevents access to live conductors.

The practice of unauthorised personnel resetting switches or overloads should not be permitted. Tripping of switches is generally an indicator of a fault or problem with the equipment or electrical circuit that should be attended to by a qualified electrician. Overload trips should only be reset by authorised personnel after an investigation into the cause of the overload trip. The procedures to follow in the resetting of electrical systems should be included in the removal and restoration of power procedures for the operation.

Prior to undertaking any work, all electrical workers should undertake a site induction. The induction should include electrical safety requirements, isolation guidelines and emergency response procedures.

Whenever electrical work is undertaken a qualified first aider should be available for first response. In addition all persons carrying out work on low voltage equipment should be trained in the principles of low voltage rescue kits and undertake regular CPR refresher training.

Authorised Persons

The following section identifies authorisation requirements for entry to extra low and low voltage electrical switchboards. Categorisation of all switchboards should be undertaken by a qualified electrician prior to entry.

Extra Low Voltage <50V a.c. <120V ripple free d.c.

Enclosure Category: An ELV enclosure *that has no exposed voltage contact points*. The person accessing is likely to operate switches only.

Authorised Person Category: A site manager or his delegate (i.e. a line manager or a ticketed "connect & re-connect" operator) as minimum.

Enclosure Category: An ELV enclosure *that has exposed voltage contact points*.

Authorised Person Category: Either a qualified auto electrician/plant technician /electrician as minimum.

Low Voltage >50V & <1000V a.c. >120V & <1500V d.c.

Enclosure Category: An LV enclosure *that has no exposed voltage contact points*. The person accessing is likely to operate switches only.

Authorised Person Category: A site manager or his delegate (i.e. a line manager or a ticketed "connect & re-connect" operator) as minimum.

Enclosure Category: An LV enclosure *that has exposed energised voltage contact points*.

Authorised Person Category: A qualified electrician who is accompanied by an equally qualified electrician or a trained observer who are both competent in electrical rescue as per the Job Safety Assessment (JSA).

Process

JSA/SWMS

Prior to any job requiring personnel to perform electrical work and/or work that encroaches on an electrical installation/aerial conductor a Job Safety Analysis (JSA) or Risk Assessment (RA) must be completed. A Safe Work Method Statement (SWMS) must be available for all tasks and should be referenced in the JSA or RA for common tasks.

Each job should be analysed by breaking down each step performed (tasks) in a sequence to allow identification, assessment and control of associated hazards. All controls should be selected in line with the hierarchy of controls.

The JSA/SWMS should identify the hazards and risks associated with the location of the task, plant and substances required to perform the task, sequence of steps required and the competency and behaviour of personnel performing the task

Isolation

Isolation procedures should be developed for all work on electrical equipment. Work on energised equipment is prohibited except for testing and fault finding and then only when absolutely necessary. Testing of live circuits requires conformance with relevant regulatory requirements.

Isolation procedures for electrical work should:

- Be prepared and endorsed by a certificated person;
- Be checked and endorsed by a second person, certificated to check the steps for such an instruction
- Contain the identification of the apparatus to be worked on or tested;
- Contain the description of work or test to be carried out;
- Identify the points of isolation; and
- Detail the placement of working earths if required.
- Provide details of restoration of power procedures.

Isolating of electrical switchboards should follow basic isolation principles. Isolation methods should include precautions to ensure that the supply remains isolated by locking of and/or tagging. Testing of all de-energised conductors should be undertaken before commencing work. Non contact electrical instruments should be used for proving the isolation. Additional tests must be done using electrical meters with a minimum CATIII rating.

Wherever work is carried out on de-energised conductors where contact with adjacent energised conductors can occur then these conductors must also be isolated or a barrier placed to ensure that contact with the live conductors can not occur. This should be identified by and controlled through a JSA or RA.



Even if it is believed that the supply has been isolated, it must be assumed that all conductors and electrical components are energised until they are proven de-energised.

Test Before YOU Touch



In accordance with the statutory risk requirements of the relevant OHS regulation, the practice of working on an energised low voltage installation cannot usually be justified. It is the responsibility of the employer and the controller of the premises to ensure that this is not done other than in situations where it is necessary in the interest of safety and the risk of harm would be greater if that part of the installations circuits or apparatus were to be de-energised.

Testing

Remember that the location of faults should always be attempted first with the supply safely de-energised. If not possible then:

- Testing of energised equipment should only be carried out with devices rated as category III or IV as defined by Australian Standard 61010.1;
- Safety barriers and notices should be placed to prevent others from entering the work area; and
- JSA/RA and/or SWMS relevant to each activity should be maintained identifying PPE requirements, procedures for switching circuits or equipment on and off during the fault finding or testing process.
- Extreme care must be taken when switching to place circuits back into operation. In particular Arc Blast Hazards in large high current switchboards.

Work Permit

All electrical work requires a work permit system to be utilised. The work permit should detail all controls that are to be put in place as well as defining responsibility for implementing and monitoring controls.

Emergency Response

Documented emergency response procedures should be in place and communicated to all involved persons for electric shock incidents.

Low voltage electrical rescue kits including electrical shock survival must be available for all low voltage rescue work.

A trained first aider should be present whenever electrical work is being carried out.

All electric shock incidents should be treated as serious and medical treatment should be sought no matter how minor the incident appears. Serious symptoms may occur many hours after the incident. Electrical shock victims should be subject to a 12point ECG and blood enzyme test to minimise the risk of these symptoms occurring without medical intervention.

Manager Checklist

Item	Requirement	Yes/No/N/A
Process - Documentation	Isolation Plan	
Process - Documentation	JSA/RA/SWMS	
Process - Documentation	Live Access Work Permit	
Process - Documentation	Documented Emergency Procedures	
Plant	Low Voltage Rescue Kit	
Process	Isolation carried out according to plan	
Process	Area cordoned off	
Plant	Category III and IV Testing Equipment	
People	Qualified Electrician	
Plant	Up to Date Single Line and Schematic Diagrams	
People	Observer/Bystander	
People	Qualified First Aider	
People	Training in Low Voltage Rescue	

Glossary

CPR	Cardiopulmonary resuscitation
ECG	Electrocardiogram
ELV	Extra Low Voltage (<50V a.c. <120V ripple free d.c.)
JSA	Job Safety Assessment
LV	Low Voltage (>50V a.c. & <1000V a.c. >120V & <1500V d.c)
PPE	Personal Protection Equipment
RA	Risk Assessment
SWMS	Safe Work Method Statement

References

1. AS 3000/2007 / Admt 1 2009 Electrical Installations
2. AS 3007/2004 Parts 1-5 Series Electrical installations - Surface mines and associated processing plant
3. AS 3439/2002-2009 Parts 1-5 Series Low Voltage Switchgear and Control Gear Assemblies.

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Be aware. Be alert.

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