Work on Low Voltage Installations

Document no.	Work description
SMS-06-SW-0276	Working on Low Voltage (LV) electrical installations

Scope

This SWI describes the procedures to be complied with by RailCorp for all Qualified Persons, including electrical contractors, who work on Low Voltage (LV) electrical installations.

Electrical installation means any fixed appliances, wires, fittings, apparatus or other electrical equipment used for (or for purposes incidental to) the conveyance, control and use of electricity in a particular place, but does not include any of the following:

- subject to any regulation made under subsection (4) of the Electricity (Consumer Safety) Act — any electrical equipment used, or intended for use, in the generation, transmission or distribution of electricity that is:
  - (i) owned or used by an electricity supply authority, or
  - (ii) located in a place that is owned or occupied by such an authority,
- any electrical article connected to, and extending or situated beyond, any electrical outlet socket,
- any electrical equipment in or about a mine,
- any electrical equipment operating at not more than 50 volts alternating current or 120 volts ripple-free direct current
- any other electrical equipment, or class of electrical equipment, prescribed by regulations made under the Electricity (Consumer Safety) Act.

Work on LV electrical equipment which forms part of the RailCorp electrical distribution network is outside the scope of this SWI. Such work is to be performed in accordance with SMS-06-EN-0575 Work on the Low Voltage Distribution System.

Review date

15/09/012

References

- Electricity (Consumer Safety) Act 2004
- Electricity (Consumer Safety) Regulation 2006
- Occupational Health and Safety Act 2000
- Occupational Health and Safety Regulation 2001
- WorkCover Code of Practice 'Low Voltage Electrical Work' 2007
- AS/NZS 3000:2007 Electrical Installations (known as the Australian/New Zealand Wiring Rules)
- AS/NZS 4836:2001 Safe working on low voltage electrical installations
- SMS-11-GD-0244 Personnel Certifications – Electrical Authorisations
- SMS-06-PR-0173 Plant and Equipment Lock Out-Out/Tag-out and Isolation
- SMS-06-EN-0575 Work on the Low Voltage Distribution System
- SMS-06-EN-0574 Isolation and Energisation of Low Voltage Equipment
- ISSC 32 "Guide for Network Operators to Provide Information to the Construction Industry for the Use of Cable Covers" September 2006

Responsible supervisor *Insert name in BLOCK letters*	PPE and precautions	Competencies or qualifications	Licences or permits required
	As determined by Risk Assessment	Qualified Person SMS-11 GD-0244 Personnel Certifications Electrical Authorisations	Qualified Supervisor Certificate (Electrician) or Contractor Licence (Electrical - Q) issued by the Office of Fair Trading. Refer to Personnel Certifications –Electrical Authorisations

Tools and equipment required

As determined by the task to be performed and Risk Assessment

IF CONTROL MEASURES ARE NOT SUITABLE AND MAJOR CHANGES ARE NEEDED, CONDUCT A RISK ASSESSMENT AND DEVELOP NEW CONTROLS ACCORDING TO SMS-06-PR-0401 WORKPLACE RISK MANAGEMENT.

General

All work on LV installations is to be carried out by a Qualified Person (Qualified Electrician), or by a person closely and continuously supervised by a Qualified Person.

The OHS Regulation 2001 prohibits work on an electrical installation while the circuits and apparatus of the part of the installation being worked on are energised. The allowable exception is where it is necessary to work live in the interests of safety and to remove supply would create a greater risk of harm than if the circuits and apparatus were de-energised before work commences.

Where live work is justified, the requirements set out in "Work on or near live LV installations" in this SWI are to be complied with at all times.

In addition to the above requirements, Under no circumstances is work to be performed live which involves:

- the connection between the main neutral and the earthing system being removed, or
- a neutral conductor which is carrying load current becoming discontinuous.

If work involves the earth conductor for a portion of the installation becoming discontinuous, supply is to be removed from that portion of the installation.

If the work involves breaking the MEN link of the installation and the installation includes an uninterruptible power supply (UPS) that will remain in service during the work, particular care must be taken to ensure that there is still a MEN connection for the output circuit of the UPS. If this can not be provided then the UPS must be taken out of service for the duration of the work.

When supply is removed for the work, each conductor is to be proved dead prior to work commencing and the procedures set out in the Plant and Equipment Lock Out-Out/Tag-out and Isolation procedure followed. Where a LV conductor cannot be proved dead, it is to be treated as being live even though it might have been isolated.

When performing work on conductors avoid (as far as possible) bridging hand to hand across:

- insulators
- phase conductors
- phase conductor and neutral
- phase conductor and earth/earthed equipment or structure.

Warning

Electrical workers often risk contacting live parts when:

- altering or adding to switchboards
- cutting into cables, conduits and other wiring enclosures
- making connections in junction boxes which contain numerous circuits
- touching parts of installations not isolated by a main switch, e.g. consumer's mains
- touching neutrals without proving dead (as neutrals may become live due to possible cross connections)
- dual supplies are connected to appliances, e.g. hot water service, emergency lighting.
- circuits are not isolated by control switches, e.g. switch wires.
- supply could be readily reconnected by others.

Always make sure all circuits being worked on (or which may be contacted during work) are isolated, proved dead and protected in accordance with the Plant and Equipment Lock Out-Out/Tag-out and Isolation procedure.

General cont	**Compliance with Regulation**	All LV electrical installations are to be installed, tested and maintained in accordance with the requirements of the Electricity (Consumer Safety) Regulation 2006.
	Applicable documents	All LV electrical installations are to comply with the technical requirements of AS/NZS 3000:2007 Electrical Installations (known as the Australian/New Zealand Wiring Rules) and any specific requirements of the network distributor. In addition to the requirements of this safe work instruction, the NSW WorkCover Code of Practice 'Low Voltage Electrical Work' 2007 provides practical guidance for protecting the health and safety of persons working on or near LV installations or systems.

General cont	**Qualified Person's responsibilities**	The Qualified Person (Qualified Electrician) supervising any electrical work is to: • give directions that are adequate to enable the work to be carried out correctly, and • require the person to advise on progress of the work • be present when the work is being carried out and be available for advice, and to give directions relating to how the work is to be carried out • personally make sure that the work is correctly carried out • Be responsible for the electrical safety of the persons being supervised • warn persons being supervised of any electrical hazards • warn persons being supervised before equipment is energised • check that any necessary isolation is still secured in accordance with the procedures set out in the Plant and Equipment Lock Out-Out/Tag-out and Isolation procedure prior to work commencing at each shift
	Testing and fault finding	Where it is necessary to leave supply on to facilitate testing or fault finding a risk assessment is to be conducted and safe systems of work to conduct the testing developed and implemented. The system of work is to include, but not be limited to:- • The provision of suitable protection from inadvertant contact • The use of Personal Protective Equipment where necessary • Provision of test equipment suitable to the electrical installation and the location of the test points

Work on isolated LV Installations	**Removal of supply**	All work near exposed LV equipment is to be carried out in accordance with SMS instruction SMS-06-GD-0268 Working Around Electrical Equipment. Prior to removing supply, the Qualified Person carrying out the switching to remove supply is to make sure that all affected parties have been advised of the commencement and duration times of the proposed interruption to supply. The requirements of SMS-06-PR-0173 Plant and Equipment Lock-out/Tag-out and Isolation are to be applied to the planning of the isolation. Any local requirements for isolation and lockout are to be determined and included in the isolation plan. Particular attention must be given to ensuring that all possible sources of contact (including apparatus adjacent to the area where the work is being performed) are identified and isolated.
	Possibility of back feeds or alternative supplies	The isolation plan is to consider the presence of alternative supplies. It is essential to check the possibility of backfeed or feeding from other energy sources such as back-up power supplies, Uninterruptible Power Supplies (UPS) and capacitors. Where the circuit configuration warrants, the possibility of induced voltages being present must also be considered.
		***Warning*** *Pay special attention to illumination control circuits, changeover contactors and transfer switches etc. Make sure that they are isolated, if necessary*

Warning
*Signalling supplies are **not** to be interrupted without the prior knowledge and agreement of the Electrical System Operator or a responsible person for areas not covered by the Electrical System Operator.*

Work on isolated LV Installations cont	**Method of isolation**	LV installations or apparatus are to be isolated from all sources by providing at least one break in each active conductor through which the equipment could be made live from these sources. Breaks are to be provided by: • opening a circuit breaker, or • removing fuses, or • opening isolating switches, or • disconnecting conductors. Devices operating in a control circuit (such as an emergency stop or limit switch) are not to be used as the sole means of providing isolation for plant or equipment. The devices providing isolating breaks are to be protected in accordance with the Plant and Equipment Lock Out-Out/Tag-out and Isolation procedure. When an isolating device can also be operated by remote control, the remote control is to be rendered inoperative, and the means of ensuring that it remains inoperative protected in accordance with the Plant and Equipment Lock Out-Out/Tag-out and Isolation procedure.  ***Warning*** *Isolation of an installation or apparatus is **not** to be achieved by a remote control alone.*
	Isolation by the breaking of connections	When isolation of LV equipment is achieved by the breaking of connections, the active conductors are to be disconnected first, followed by the neutral conductor and the earth conductor last. Disconnected conductors are to be secured in a position which will prevent possible contact with any live terminals or apparatus. The reverse of the disconnection procedure is to be followed for reconnection on restoration of supply.
	Securing the Isolation	The requirements of the Plant and Equipment Lock Out-Out/Tag-out and Isolation procedure are to be followed for all Low Voltage isolations.
	Proving dead	LV installations that have been isolated are to be proved dead by a voltage-testing device to confirm that the equipment is dead. The tester is to be checked immediately prior to proving dead, and at the completion of the test to make sure that it has not failed during the test. This checking is to be done on a known live source using safe systems of work or by means of a self-check facility of the tester.
	Energising LV installations	Before LV equipment is energised, the Qualified Person restoring supply is to: • make sure that the installation or equipment is inspected, tested if required and is safe to be energised • Check that there are no Isolation Locks or Danger Tags attached to the isolation points to be operated • if connections have been disturbed then tests are to include (as required by the work performed): - insulation resistance - phase rotation - phase check - earth conductor integrity - correct connection and continuity of the neutral When appropriate, notify the affected parties that supply is about to be restored.  ***Warning*** *Signalling supplies are **not** to be restored without the prior knowledge and agreement of the Electrical System Operator or a responsible person for areas not covered by the Electrical System Operator*

Work on or near live LV installations	**Legislation**	Clause 207 of the OHS Regulation 2001 requires that: • An employer is to make sure that any electrical work on an electrical installation at a place of work is carried out using a safe system of work. • An employer is to make sure that such work is not carried out while the circuits and equipment of the part of the installation that is being worked on are energised. • A safe system of work is to be in place to make sure that the circuits and equipment of the part of the installation being worked on are de-energised prior to work commencement, and will remain so until work completion. • Measures are to be adopted to eliminate or control the risk of the person carrying out the work from inadvertently contacting any part of the installation that remains energised. • Electrical work on an electrical installation may be carried out while the circuits and apparatus of the part of the installation that is being worked on are energised if it is necessary to do so in the interests of safety and the risk of harm would be greater if the circuits and equipment were de-energised, subject to compliance with the particular requirements listed.
	Safety precautions for live work	When work is carried out live, take care to prevent: • inadvertent contact with live parts • short circuits. Connections are **not** to be either made or broken under load. Portable ladders with metal or metal reinforced styles are to not be used for work on or near live low voltage equipment.

Work on or near live LV installations cont	**Requirements for work on or near exposed energised LV**	When performing work on or near exposed energised low voltage installations or apparatus there is a risk of injury from: • electric shock • burns from radiant energy • burns from hot gas / plasma • burns from air pressure wave / blast. Take the following precautions to manage this risk: • Before commencing work on exposed energised low voltage conductors, a written assessment of the associated risks shall be made in consultation with the persons proposing to do the work. • The work has been authorised by the relevant electrical discipline manager (Level 5 or above). • The work is carried out in accordance with a Safe Work Method Statement for the work. • The persons doing the work are to be appropriately qualified, trained and instructed in safe working practices for the particular task, including the proper use of test equipment, tools, accessories and personal protective equipment. • The only exception to this is a person undergoing training who may be permitted to undertake work on live LV electrical equipment provided that person has: - been assessed to be competent to perform similar work under dead conditions, and - the work will be carried out under the continuous and close supervision of another person who is certified to be competent to carry out the same work under energised conditions. • Appropriate test equipment, tools and accessories, provided to the persons doing the work, are properly used and are well maintained. These are to be inspected or checked to be in sound serviceable conditions prior to use. • Appropriate clothing and personal protective equipment (PPE) are provided to the persons doing the work, are properly worn and used. Necessary PPE is listed in this document under the heading *Personal Protective Equipment* • The LV Rescue Kit is to be available and ready for immediate use at the work sites as described in SMS-06-SW-0271 – Rescue from Live Low Voltage (Including rescue kit care). • The isolation point of the relevant electrical supply has been clearly identified and is able to be reached and operated quickly without any need to negotiate or remove obstacles. • The work area is clear of obstructions if a quick entry and exit is required. • Unauthorised persons are prevented from entering the work area by the use of signage, barriers, or both. • The work is undertaken in the presence of a safety observer who is also competent to perform the particular task being undertaken and is also competent in LV electrical rescue and cardio-pulmonary resuscitation. • Precautions shall be taken, or procedures put in place, to prevent the possibility of simultaneous contact with conductors at different voltages. All work on exposed aerial energised conductors is to be done from a stable work platform approved for that use.

Work on or near live LV installations cont	**Personal Protective Equipment**	Persons working on or near energised exposed low voltage electrical installations and apparatus should be aware that a fault current may be many times the rated current for short times during fault conditions. If a fault current occurs, severe burns and flash burns to the face, eyes or other parts of the body are likely. Live low voltage work is to be carried out only if the worker is wearing the appropriate PPE required by RailCorp unless the risk assessment indicates otherwise. The PPE required for the work is to be listed in the Safe Work Method Statement. Appropriate PPE may include but is not limited to: • flame-retardant clothing including long trousers, and a long sleeve shirt buttoned close to the neck and at the wrist • insulating gloves • flame-resistant gloves • suitable footwear • safety belts and harness • eye and face protection • hearing protection. Insulating gloves are to be air tested by the person wearing them prior to use. Inflate them, then roll them from the cuff to force air into the fingers, listening closely for the sound of any air escaping, and monitor for any noticeable pressure drop.
	Insulation	Care is to be taken to check that the insulation of permanently insulated conductors is in good condition and that there are no exposed connections on the conductor within the work area. In addition to the initial inspection, conducted as part of the Risk Assessment, ongoing attention is to be given to this issue during the course of the work. Approved insulating covers and lengths of split insulating hose are provided to temporarily cover conductors. Line Managers are to make sure that insulating covers are available, are in good condition and are used in the correct manner. The insulating gear is to be checked in good order prior to commencing work.
	Application and removal of temporary insulation covers on LV conductors	The following procedure applies to the application and removal of temporary LV insulation covers: • before application, inspect the insulated covers to make sure the integrity of their insulation properties. If there is any doubt about the insulation properties, put aside for testing and use other insulated covers in good condition • When installing cable covers sufficient ties, buttons, or other means should be used to ensure that the cable covers will not move, open or otherwise allow unintentional contact to be made with electrical mains or apparatus based on the period of the work and location of the work site. (Risk based approach). • the person applying or removing the insulation covers is to wear insulated gloves on both hands • insulated covers are to be applied on one conductor at any time • make sure no part of the body comes within a minimum distance of 0.5m from any conductor, except for hands wearing insulation gloves. On completion of the work, remove only one insulated cover at any one time.

Working on Live Low Voltage Aerial Lines	Only Authorised Overhead Traction Workers or a Qualified Persons accredited as an Overhead Worker in accordance with SMS-11-GD-0244 Personnel Certifications – Electrical Authorisations may work on aerial lines that form part of a LV installation.

Additional controls