

Work on Low Voltage Installations

DOCUMENT NO.	D2013/80873
WORK DESCRIPTION	Working on Low Voltage (LV) electrical installations
RISK ASSESSMENT REF.	See Hazards, below
SCOPE:	<p>This SWI is applicable to all workers, employees or contractors, who carry out work on Low Voltage electrical installations that form part of Transport for NSW/ TAHE rail assets or such assets maintained by Sydney Trains.</p> <p>A Low Voltage Asset is defined in Railsafe as all the low voltage electric wiring, accessories, fittings, consuming devices, control and protective gear and other equipment associated with the wiring situated in, on, or beyond any building, structure or premises to which electricity is supplied or is to be supplied through any one or more low voltage mains or submains from a substation or distribution aerial line. This includes substation general lighting and power but excludes equipment used for the transmission or distribution of electricity.</p> <p>Work on LV electrical equipment which forms part of the Low Voltage Distribution System is outside the scope of this SWI, refer PR D 78402 Work on the Low Voltage Distribution System. SP D 79046 Description and Labelling of the Low Voltage Distribution System provides guidance to the boundary between the Low Voltage Distribution System and a Low Voltage electrical installation.</p>
AUTHORISATIONS:	<p>A Person Conducting a Business or Undertaking (PCBU – refer WHS Act section 5), e.g. a Pty Ltd company, working on a LV installation must:</p> <ul style="list-style-type: none"> • be registered with the Australian Securities and Investment Commission (ASIC), and • provide a current certificate of currency for Public and Product Liability insurance to the value of \$10M, and • provide a current certificate of currency of Workers Compensation, and • hold a NSW Office of Fair Trading (OFT) Qualified Supervisor Certificate (Electrician), or Contractor Licence (Electrical - Q). <p>Persons planning work around electrical equipment shall ensure that the work is assessed and planned to enable the highest practicable level of risk control to be applied. (Refer to <i>PR 78700 Working around Electrical Equipment</i>)</p> <p>Persons performing risk assessments must hold either:</p> <ul style="list-style-type: none"> • OFT Qualified Supervisor Certificate (Electrician), or • OFT Contractor Licence (Electrical - Q). <p>Only Authorised Person (Low Voltage) AES19 are permitted to work on assets forming part of the Low Voltage Distribution System. Such examples being Distribution Supply Main Switchboards or low voltage supplies to signalling equipment. Refer PR D 79055 Electrical Competency Specific Certifications, published on RAILSAFE</p> <p>Workers performing electrical work on LV installations, such as connecting/disconnecting electrical supply, installing, removing, adding, testing, replacing, repairing, altering or maintaining electrical equipment, must hold:</p> <ul style="list-style-type: none"> • a OFT Qualified Supervisor Certificate (Electrician), or • a OFT Contractor Licence (Electrical - Q), or • be under the direct/constant supervision of a worker holding either of the abovementioned OFT certificates. <p>Authorised Persons supervising others should conform to the guidelines set out in RL D 79805 Personnel Competency, Pre-Work Briefings and Supervision.</p> <p>Supervision of Electrical Apprentices shall adhere to the OFT requirements: Supervision Practice Standard (SPS) for licenced electricians supervising apprentices.</p> <p>Sydney Trains Line Managers shall ensure that either the Sydney Trains staff or the external company engaged to perform work on LV installations meet the particular requirements indicated above.</p>

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HAZARDS:	<p>WARNING</p> <p>Electrical workers often risk contacting live parts when:</p> <ul style="list-style-type: none"> • altering or adding to switchboards or installations • 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 a possible intermix of circuits or the neutral conductor becoming discontinuous) • working on equipment with dual supplies connected, e.g. emergency lighting, UPS systems or installations containing solar/ Photo Voltaic systems • working on circuits not isolated by control switches, e.g. switch wires • undertaking testing of the electrical installation which remains live during the test, or • supply could be readily reconnected by others. <p>WARNING</p> <ul style="list-style-type: none"> • Contact with electricity – severe electric shock, injury or death may result if a conducting path is formed allowing electric current to pass through the body. • An electric shock may also cause you to fall. • Opening a circuit carrying current or forming a short-circuit on a live conductor may expose you to an arc-flash or explosion – burns, loss of hearing, loss of eyesight, major injury or fatality are possible consequences.
SAFETY CONTROLS:	<p>Treat all conductors as LIVE until proven dead.</p> <p>Avoid simultaneous contact with more than one conductor at any time as the conductors may be at different potentials.</p> <p>Where an exposed low voltage conductor cannot be proved dead, it shall be treated as being live even though it may have been isolated.</p> <p>TEST BEFORE YOU TOUCH When supply is removed for the work, each exposed conductor must be proved dead prior to work commencing.</p> <hr/> <p>NOTE Before you break or disconnect an insulated conductor/termination you must:</p> <ul style="list-style-type: none"> • test to confirm the insulated conductor/termination is not live, and • after you break the insulated conductor/termination you must test to verify the exposed conductor is still not live. <hr/> <p>All work on or near exposed LV equipment shall be planned and carried out in accordance with PR D 78700 Working around Electrical Equipment.</p> <p>Where appropriate, a Low Voltage Access Permit (refer to PR D 78503 Low Voltage Access Permits) must be issued before any work commences.</p> <p>The power isolation point shall be DANGER Tagged and should be secured either directly with a Special Lock or appropriate lock out/ tag out system (refer to PR D 78104 Securing Systems for Electrical Equipment) and PR D 78401 Isolation and Energisation of Low Voltage Equipment</p> <p>When supply is to be removed, the equipment shall be:</p> <ul style="list-style-type: none"> • Isolated, and • DANGER Tagged, and • Proved dead <p>Appropriate testing equipment, tools and accessories shall be properly used. These must be inspected or checked to be in sound serviceable conditions prior to use.</p> <p>When working on poles or structures supporting live exposed LV equipment, even when it is not intended to work on or near the live equipment, the requirements of instruction PR D 78108 Pre-Work Hazard Assessment and Controls for Work on Poles with Live Exposed Equipment shall be fulfilled.</p> <p>Supply shall be removed before work is to be performed which involves:</p> <ul style="list-style-type: none"> • the connection between the main neutral and the earthing system being removed, or • a neutral conductor which is carrying load current becoming discontinuous. <p>If work involves the earth conductor for a portion of the installation becoming discontinuous, supply shall be removed from that portion of the installation.</p>

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	<p>Where possible, non-bridging work techniques should be adopted. It is a good work practice to avoid simultaneous contact with conductors and/or equipment that could, if the power is not isolated, be at different potentials. That is, avoiding bridging 'hand to hand':</p> <ul style="list-style-type: none"> • across insulators, or • between phase conductors • between phase conductor(s) and neutral, or • between phase conductor(s) and earth or an earthed metallic structure. <p>After a supply is isolated for the work, each exposed conductor is to be proved dead prior to work commencing and the procedures set out in PR D 78401 Isolation and Energisation of Low Voltage Equipment and PR D 78104 Securing Systems for Electrical Equipment are to be followed.</p> <p>Work involving breaking of the NEL/MEN connection</p> <p>If the work involves breaking the Neutral Earth Link (NEL) or Multiple Earth Neutral Link (MEN as referred to in AS/NZS3000) and the installation includes an uninterruptible power supply (UPS) that will remain in service during the work or the installation will be supplied from an alternate source, for example: a back up supply via an automatic transfer switch arrangement or generator, particular care must be taken to ensure a NEL/MEN connection remains in service. If this cannot be proven, then the alternate supply or UPS must be taken out of service for the duration of the work.</p> <p>Testing and fault finding</p> <p>Where it is necessary to leave supply on to facilitate testing or fault finding, a risk assessment shall 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:</p> <ul style="list-style-type: none"> • the provision of suitable protection from inadvertent contact • the use of appropriate Personal Protective Equipment where necessary • Suitable and appropriately rated tools and test equipment <p>PPE Appropriate PPE for the task shall be worn, refer D2013/80874 PPE for Electrical Work. LV insulating gloves shall be worn where there is a risk of inadvertent contact with exposed live conductors. At other times, where practicable, leather riggers gloves should be worn to provide limited protection against electric shock and against minor injuries such as cuts and splinters.</p>
<p>Work ON or NEAR LIVE LV installations</p>	<p>WARNING</p> <p>Under NO circumstances may work performed live which involves:</p> <ul style="list-style-type: none"> • the connection between the main neutral and the earthing system being removed, or • a neutral conductor which is carrying load current becoming discontinuous, or • the main earth conductor or earth conductor of a live final subcircuit becoming discontinuous <p>The WHS Regulation prohibits work on an electrical installation while the circuits and apparatus of the part of the installation being worked on are energised. Work may be carried out live ONLY in the following circumstances:</p> <ul style="list-style-type: none"> • it is necessary in the interests of health and safety that the electrical work is carried out on the equipment while the equipment is live, or • it is necessary that the electrical equipment to be worked on is live in order for the work to be carried out properly, or • it is necessary for the purposes of testing to determine whether or not the equipment is live, or • there is no reasonable alternative means of carrying out the work. <p>In the specific instance(s) when work ON or NEAR live exposed electrical equipment work is justified, the requirements set out in the following instructions shall be complied with:</p> <ul style="list-style-type: none"> • PR D 78403 Work on Live Low Voltage Equipment, and • D2013/80870 Rescue from Live Low Voltage Equipment (Including Rescue Kit Care)
<p>SHUT DOWN PROCEDURES:</p>	<p>Prior to removing supply, the worker carrying out the isolation shall ensure that all affected parties have been advised of the commencement, and duration times of the proposed interruption to supply.</p> <p>Any local requirements for isolation and lockout are to be determined and included in the isolation plan.</p> <p>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.</p> <p>Signalling and communication supplies must not be interrupted without the prior knowledge and agreement of ICON Electrical or a responsible person for areas not covered by ICON Electrical.</p>

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Work on ISOLATED LV installations

Possibility of back feeds or alternative supplies

The required electrical isolation must consider the presence of alternative supplies. It is essential to check the possibility of back-feed or feeding from other energy sources such as back-up power supplies, Uninterruptible Power Supplies (UPS) Solar/PV systems and any other stored energy devices. 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.

Method of isolation

LV installations or apparatus are to be isolated from all sources of supply by providing at least one break in each active conductor through which the equipment could be made live.

Breaks are to be provided by:

- opening a circuit breaker, or
- removing fuses, or
- opening isolating switches, or
- disconnecting conductors.

Where possible, the isolated equipment to be worked on shall be checked to ensure correct isolation. Ideally the equipment to be worked on should be monitored as supply is being removed, so that upon operation of the identified isolator the equipment to be worked on becomes de-energised.

Devices providing isolating breaks shall be protected in accordance with [PR D 78104 Securing Systems for Electrical Equipment](#), and [PR D 78401 Isolation and Energisation of Low Voltage Equipment](#)

Devices operating in a control circuit (such as an emergency stop or limit switch) shall not to be used as the sole means of providing isolation for plant or equipment.

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.

WARNING

Isolation of an installation or apparatus shall not to be achieved by a remote control alone. Refer to procedures and local instructions.

Isolation by the breaking connections

When isolation of LV equipment is achieved by breaking connections, the active conductors shall be disconnected first, followed by the neutral conductor and the earth conductor last. Disconnected conductors shall be secured in a position which will prevent possible contact with any live terminals or apparatus.

The reverse of the disconnection procedure shall be followed for reconnection on restoration of supply.

Securing the Isolation

The requirements of the *PR D 78104 Securing Systems for Electrical Equipment* and [PR D 78401 Isolation and Energisation of Low Voltage Equipment](#) are to be followed for all Low Voltage isolations.

Proving Dead

Each exposed conductor, LV electrical equipment or installation that has been isolated, shall be proved dead by a voltage-testing device (where practicable, a contact-type voltage detector shall be used in preference to a non-contact type voltage detector) to verify that the equipment is dead.

WARNING

The tester shall 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 shall be done on a known live source using safe systems of work or by means of a self-check facility of the tester.

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	<p>The worker shall use an LV proximity detector to test a LV cable, and label the proved dead cable before cutting if:</p> <ul style="list-style-type: none"> the cable was previously live, or both ends of the cable are not local to the work site and not obviously disconnected. <p>Non-contact LV Proximity Detectors</p> <p>Non-contact LV proximity detectors have limited application and shall not be used:</p> <ul style="list-style-type: none"> On DC electrical equipment or installations. On extra low voltage equipment, outside of the operating range of the non-contact LV detector. In close proximity to another live circuit or electrical equipment. The non-contact LV detector works on induction principles and can give a false "live" due to proximity of other conductors. On neutral conductors – if there is any doubt about the identification of a neutral conductor and there is potential for it to be carrying current – test with a clamp type ammeter before disconnecting. On conductors secured directly to an earthed cable tray or troughing where the metallic tray or trough may effect the cables electrical field <hr/> <p>WARNING</p> <p>If there is any doubt on the "live" indication due to induction from nearby live LV circuit or equipment, a contact-type detector must be used to prove dead. The contact-type detector must also be proved to be working immediately before and after the test.</p> <p>Proximity testers that detect an electric field surrounding an energised conductor are not suitable for testing cables surrounded by a metallic screen, cables carrying direct current and in similar circumstances. (AS/NZS 4836 clause 3.2.5)</p>
<p>Energising LV installations</p>	<p>WARNING</p> <p>Before restoring supply, notify all persons near the equipment that supply is about to be restored.</p> <p>Before restoring supply to signalling and communication equipment you must inform and obtain agreement from ICON Electrical or a responsible person for areas not covered by ICON Electrical.</p> <p>Before LV equipment is energised, the person restoring supply must:</p> <ul style="list-style-type: none"> Ensure any associated Electrical Permit is signed off and cancelled Ensure the installation or equipment is inspected, tested if required and confirm it is safe to be energised Check 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): <ul style="list-style-type: none"> insulation resistance, phase rotation, phase check, polarity test and voltage check, earth conductor continuity, and correct connection and continuity of the neutral.
<p>Compliance with regulations / standards</p>	<p>All work on LV electrical installations, the LV installation or parts of an LV electrical installation shall be installed, tested and maintained in accordance with the requirements of the Gas and Electricity (Consumer Safety) Act 2017.</p> <p>All work on electrical installations, the installation or parts of an electrical installation shall comply with applicable TfNSW rail asset engineering standards, the Service and Installation Rules of NSW and Australian Standards (AS), such as <i>AS/NZS 3000</i> and <i>AS/NZS 3012</i>.</p> <p>Where the above documents conflict, the order of precedence shall be:</p> <ul style="list-style-type: none"> a TfNSW engineering standard, the NSW Service and Installation Rules, and an Australian standard.

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	<p>AS/NZS 3000 sets out requirements for the “design, construction and verification of electrical installations, including the selection and installation of electrical equipment forming part of such electrical installations”. (AS/NZS 3000:2018 clause 1.1)</p> <p>The following electrical installations, or parts of electrical installations, shall not be energised unless the Local Distribution Network Service Provider (LDNSP), i.e. Sydney Trains first authorises it:</p> <ul style="list-style-type: none"> • an approved form SP D 79059 FM01 Application for Connection has been received prior to the connection of an additional load • any new electrical installation that has not previously been energised • any alteration of, or addition to, an electrical installation that will require a change to the network connection or metering arrangements. • An electrical installation, or part of an electrical installation, shall not be energised unless it's safe operation and compliance with AS/NZS 3000 has been established by a safety and compliance test. • A Certificate of Compliance for Electrical Work (CCEW) is submitted to the LDNSP within 7 days following energisation
<p>EMERGENCY PROCEDURES:</p>	<p>Incidents and injuries must be reported as soon as possible and within 48 hours of occurring, refer Safety Hazard, Injury and Incident Reporting</p> <p>In the event of an incident requiring immediate medical assistance call emergency services for assistance on 000.</p> <p>Report the incident to ICON on 1800 060 015 or 9379 4911, the Safety Incident Hotline on 1800 772 779 and to your Line Manager.</p> <p>In the event a person receives an electric shock always follow the Electric Shock Protocol D2013/80869</p> <p>In the event a person is incapacitated apply the Rescue from Live LV Equipment Procedure D2013/80870</p> <p>Unsafe conditions (assets) should be reported to the Territory Engineer, and logged in SHEM.</p> <p>Major defects associated with the installation as listed in AS/NZS 3017 are to be isolated immediately and made safe</p>
<p>FURTHER INFORMATION:</p>	<p>For further information please refer</p> <p>PR D 78700 Working around Electrical Equipment.</p> <p>PR D 79055 Electrical Competency Specific Certifications</p> <p>PR D 78503 Low Voltage Access Permits</p> <p>PR D 78104 Securing Systems for Electrical Equipment.</p> <p>PR D 78401 Isolation and Energisation of Low Voltage Equipment</p>