Sydney Trains

Engineering System Integrity
Engineering Instruction
Electrical Distribution Unit

EI D 24-02

Test Before you Work on Aerial line poles and Structures

This Engineering Instruction includes urgent engineering information. Adherence to the information in this Instruction is **MANDATORY**.

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Audience:

- Traction Line workers
- Substation/Low Voltage Workers
- Electrical Engineers

Main Points:

- Before working on High Voltage Aerial, Line Poles and Structures use a non-contact tester to verify the pole does not have a voltage above 50 Volts.
- Where above 50 Volts inform ICON and protect people from contacting the pole until the hazard is mitigated.

Primary Affected Document: **PR D 78108 Pre-work Hazard Assessment and Controls for Work on Poles with Live Exposed Equipment**

Scope

Testing for hazardous leakage voltages before electrical workers contact High Voltage aerial line poles or structures.

Background

A small number of incidents have occurred involving line workers undertaking pole base maintenance receiving an electric shock whilst working on a wooden pole supporting high voltage aerial lines. No serious injuries have been reported, and investigation did not identify dangerous voltages present.

Note: The conductivity of timber poles and crossarms can be affected by moisture.

After investigation and consultation with other Electrical Network Operators, Sydney Trains is mandating testing before working on aerial line poles and structures supporting High Voltage.

All Poles/Structures (Steel, Wood, or Composite) supporting High Voltage Aerial Lines shall be electrically tested, in addition to any existing pre-work testing requirements before electrical workers contact or work on the pole/structure. The test shall be completed with an approved non-contact tester capable of detecting 50 Volt A.C. and above.

Where testing indicates the presence of greater than 50 volts A.C. additional testing shall be conducted using an approved low impedance voltmeter to determine the actual voltage that is present.

If the voltage measured with a low impedance meter is 50V A.C. or greater, persons must not come into uninsulated contact with the asset until the source of the voltage is investigated, identified, and mitigated.

Current approved Testers are listed in *SP D 79039 Electrical Tools and Test Equipment*

- Non-Contact Testers: Greenlee GT-13 or Hioki 3481-20
- For low impedance testing use a Fluke 113 digital multimeter and Fluke 80K-6 High Voltage Probe.

Wearing work gloves with neoprene and nitrile coating is a mitigation for extra low voltage, the Arc Safe Gloves in the Electrical PPE (Personal Protective Equipment) kit is an example of gloves that could mitigate the hazard.

Note: Neoprene and Nitrile coating does not provide low voltage insulation.

In accordance with D2013/80869 Electric Shock Protocol electric shocks from extra low voltage (i.e. no voltage was detected by an approved non-contact tester), do not require medical treatment, unless there are obvious signs or symptoms.

Action required

- Electrical Workers shall wear gloves with neoprene or nitrile coating when in contact with high voltage poles or structures.
- Electrical Workers shall not come into uninsulated contact with an aerial line pole or structure until deemed safe by testing as less than 50 Volts A.C.
- Electrical workers shall test Aerial Line Poles and Structures using an approved non-contact (proximity) type detector, which can detect an electric field from a source voltage of 50 Volts A.C. and greater.
- If the non-contact detector indicates a voltage is present (i.e., tester is illuminated), further investigation by an Electrical Engineer and Authorised Traction Operator shall occur. ICON shall be advised when an unsafe voltage is detected, and a defect notification shall be raised by ICON-EOC in SAP.
- Where a pole or structure is identified (by an illuminated non-contact tester) as greater than 50 Volts A.C. and is located **within the rail corridor** the pole or structure shall be barricaded, and an Authorised Officer Mains or Territory/Regional Electrical Engineer shall consider any additional relevant electrical safety controls. Until the source of the electrical hazard is mitigated to the satisfaction of an Authorised Officer Mains or Territory/Regional Electrical Engineer.
- Where a pole or structure is identified (by an illuminated non-contact tester) as greater than 50 Volts A.C. **outside** the rail corridor the pole or structure shall be barricaded, and a competent person shall stand by to ensure public safety until the source of the electrical hazard is mitigated to the satisfaction of an Authorised Officer Mains or Territory/Regional Electrical Engineer.

Contact

Your Electrical Team Manager, Territory/Regional Electrical Engineer, or Electrical Safety Investigators

Engineering System Integrity
Electrical Network Safety Rules

Engineering Procedure
Electrical Distribution Unit

One Method of Safe Working

PR D 78108

Pre-work Hazard Assessment and Controls for Work on Poles with Live Exposed Equipment

Version 1.3

Date in Force: 1 February 2022

Transport Sydney Trains

Approved by:	Associate Director Electrical Distribution Unit Engineering System Integrity	Authorised by:	Engineering Technical Publications Manager System Integrity

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Document control

Version	Date	Author/ Prin. Eng.	Summary of change
1.0	11 November 2015	Chris Leung	First issue as a Sydney Trains document, rebranded from previous RailCorp SMS-06-EN-0554 V1.2.
1.1	26 February 2016	Chris Leung	Updated checker responsibilities.
1.2	19 February 2019	Nick Loveday	Updated PR D 78108 "Approved by" to Associate Director Electrical Distribution Unit.
1.3	1 February 2022	ENSR Project Team	Reviewed as part of the ENSR Project.

Summary of changes from previous version

Summary of change	Section
Minor grammatical updates	All
Updated reference documents	8

Table of Contents

1 Purpose and scope

The purpose of this document is to outline the procedure to identify and mitigate the risks associated with working on poles or structures supporting live exposed High Voltage or Low Voltage electrical equipment, even when it is not intended to work near or on/within the live equipment.

This procedure applies to all workers when working more than one metre above the ground on Transport Asset Holding Entity of New South Wales (TAHE) poles or structures supporting live exposed electrical equipment, including working from an Elevating Work Platform (EWP).

“Structures” includes all freestanding structures such as poles and towers of timber, steel, concrete or other construction.

The Pole Hazard assessment required by this procedure is, in addition to a Safe Work Method Statement, prepared in accordance with *SMS-06-OP-3043 Preparing and using Safe Work Practices*.

NOTE

This procedure does not apply to work on poles or structures that support only Extra Low Voltage Equipment or 1500 Volt Overhead Wiring.

2 Definitions

Refer to the **Electrical Safety Definitions** page available on the **RailSafe** site.

3 Hazard assessment

PR D 78700 Working around Electrical Equipment Section 6.2 Risk assessment and planning requires that “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 PR D 78700 for details.

For a pole with multiple circuits, *PR D 78108 FM01 Pre-work Pole Hazard Assessment* shall be completed prior to work commencement if there is exposed electrical equipment on the pole, even if an Electrical Permit has been received for isolated equipment to be worked near or on/within the same pole.

A separate Pre-work Pole Hazard Assessment form shall be completed for each pole on which work is to be carried out except where:

- a number of poles are included in a single job, and
- the arrangement of conductors on the poles are identical, and
- the same work is to be performed on each pole.

4 Completion of Pre-work Pole Hazard Assessment form

4.1 General

The Pre-work Pole Hazard Assessment form may be downloaded from RailSafe or reproduced as required by photocopier (A4 size).

The Pre-work Pole Hazard Assessment form is to be completed by a member of the team doing the work. If the worker completing the form is not an Authorised Person, the form shall be countersigned as “checked” by an Authorised Person.

Where practicable, all members of the work team shall discuss and agree on the possible hazards associated with the work to be carried out. All workers assisting with the work on the pole shall read the completed Pre-work Pole Hazard Assessment form and acknowledge this by signature.

Most questions require “Yes” or “No” answers. In some cases, “N/A” (not applicable) is an acceptable response where the circumstance or situation does not exist for the pole or structure to be climbed up (e.g. The ‘Permit number’ will be “N/A” if the work does not require issuing an Electrical Permit).

4.2 Identification

4.2.1 General

The first section of the form provides for the identification of each circuit on the pole and for each to be nominated as “alive”, “dead” or "earthed".

In the case of communications cables write “Communications” or “Comms” on the line for “Voltage”. The “Owner/Operator” line may be left blank for communications cables if this information is unknown.

For all electricity distribution circuits on the pole, the voltage shall be correctly identified to ensure that the correct Safe Approach Distances are considered. If the voltage cannot readily be ascertained, the use of higher Safe Approach Distances shall be taken to be the highest voltage consistent with the arrangement and insulators used.

NOTE

Refer to *SP D 79049 Safe Approach Distances (SADs)* for applicable Safe Approach Distances.

4.2.2 Substation location poles

Special consideration should be given on locations with pole-mounted transformers fed from the main HV feeder via Air Break Switches (ABS) and HV fuses.

Practically there are three (3) 'circuits' to be considered when filling the Pre-work Pole Hazard Assessment form at such locations:

i. The HV circuit between the ABS and main HV feeder – this will remain energised if the ABS is opened and isolated to enable work to be carried out on the transformer.

ii. The HV aerial connection between the ABS and the HV terminal of the transformer via the HV fuses – this will be de-energised upon opening of the ABS.

iii. The Low Voltage (LV) outgoing circuit from the transformer secondary may still be live via a backfeed (refer to WARNING below). This may be isolated by opening the LV main switch. However, care shall be exercised to check and ensure that there is no backfeed from other possible LV sources.

WARNING

Where back-up supplies are provided, electro-mechanical interlocks usually prevent feedback from the alternative source. However, due to the presence at some locations of electronic changeover equipment or Uninterruptible Power Supplies (UPS), solar grid inverters or capacitors, great care shall be taken when isolating LV circuits to ensure no backfeed is possible to the Tx.

4.3 Relationship to the work

The second section of the form requires the consideration of the relative position of each circuit with respect to the work area and also to access to the work area.

4.3.1 Application of Safe Approach Distances

In relation to Safe Approach Distances, the worker completing the Pre-work Pole Hazard Assessment form, having established the Safe Approach Distances for each live circuit, shall then relate this distance to physical "landmarks" such as pole steps. They should determine that such physical landmarks to which they may contact with their body and/or the tools they hold during completion of the proposed work are outside the applicable Safe Approach Distance.

4.3.2 Raising or lowering conductors or conductive equipment

The need to raise or lower conductors or conductive equipment through or past live equipment shall be considered. This consideration shall include earthing sets.

"Can such equipment be raised or lowered safely whilst keeping the equipment outside the minimum Safe Approach Distance?"

5 Controls

Controls shall be put in place to mitigate the identified hazards.

5.1 Pole markers

Suitable pole markers are appropriate controls in some circumstances.

The use of pole markers is mandatory to warn people not to climb up, in the following two situations:

a. marking of poles that are outside but physically close to the electrically safe work area and hence not to be worked on, and

b. marking the upper limit of approach when working on the lower circuit erected on poles with the upper circuit live.

A suitable pole marker is shown in Figure 1. This is made of plasticised fabric and is secured around the pole by means of Velcro.

Figure 1: A suitable pole marker

Figure 2: Applying a pole marker at normal eye-viewing height

The pole marker can be easily applied on the pole at normal eye-viewing height (Figure 2), or up the pole via the use of an elevating work platform (Figure 3).

Figure 3: Applying the pole marker from EWP

If the poles are outside the railway corridor, the pole marker should be applied with sufficient clearance from ground so that it cannot be removed by an unauthorised person without the use of any climbing aid.

Care shall be exercised when applying the pole marker below the upper live circuit to ensure that the relevant minimum Safe Approach Distances from live conductors are not infringed. If the risk for applying the pole marker is higher than not applying it, e.g. at pole-mounted substation location poles, other means to warn people not to climb up shall be considered.

If erected up the pole, it can be easily removed via the use of an insulated stick from ground or via the use of an elevating work platform.

5.2 Inspection of permanent insulation

Where the work could inadvertently place workers and the tools they hold closer than 0.5m from live permanently insulated LV conductors, an initial inspection of the permanent insulation shall be conducted from the ground prior to the completion of the Pre-work Pole Hazard Assessment form.

A closer inspection shall be undertaken from the pole before coming closer than 0.5m from the live permanently insulated LV conductors.

Where the work could inadvertently place workers and the tools they hold closer than 1.2m from live permanently insulated conductors of a voltage greater than 1000 V but not exceeding 11kV, an initial inspection shall be conducted from the ground prior to the completion of the Pre-work Pole Hazard Assessment form.

This inspection shall confirm whether the conductors are of a type that includes an earthed metal screen and that the condition of the permanent insulation is satisfactory.

A closer inspection shall be undertaken from the pole before coming closer than 1.2m from the live permanently insulated high voltage conductors. If the conductors are of a type that does not include an earthed metal screen, they shall be treated as exposed conductors.

5.3 Installation of temporary insulation

Where it is necessary to install temporary insulation on LV conductors, and the insulation is not in place at the time the Pre-work Pole Hazard Assessment form is completed, an “R” shall be entered on the form indicating that it is required.

The completion of the Pre-work Pole Hazard Assessment form shall include consideration of the work of installing the temporary insulation. Once the temporary insulation has been installed, a “Y” shall be entered on the form next to the “R” indicating that the temporary insulation has been installed.

5.4 Exposed earths

Where work is to be undertaken on any pole/structure containing multiple earthing systems or more than one exposed earth, the hazard of transferred earth potential exists and appropriate controls shall be put in place prior to work commencement.

Some examples of exposed earths are HV feeder aerial earth down wires, lighting brackets, lighting control equipment boxes and support wires for communications cables. This is especially the case for joint-use poles or structures that contain installations belonging to another Electrical Network Operator, such as Ausgrid or telecommunications providers, e.g. Telstra or Optus, etc.

Appropriate control measures include the temporary covering up of all exposed earths with insulation material, or to effectively bond them together to create equipotential working conditions. Equipotential bonding is an option for TAHE assets ONLY.

WARNING

Do not bond any TAHE earths to another supply authority earth! These earthing systems must always be separate.

5.5 Additional controls required

SMS-01-SR-3000 Safety Management System Requirements requires that work around electrical equipment exposes persons to health and safety risks that must be:

- eliminated, so far as is reasonably practicable, or
- if it is not reasonably practicable to eliminate those risks, minimised so far as is reasonably practicable (SFAIRP)

Refer to SMS-01-SR-3000 for details. If additional controls are required to assure SFAIRP, then such controls shall be effectively implemented.

6 Can the work be done safely?

In consideration of the identified hazards related to the specified proposed work and given that the controls identified will be effectively implemented, the work team shall ask themselves,

“Can the work be done safely without infringing the Safe Approach Distances?”

WARNING

Work shall not proceed unless the answer to this question is “Yes”.

7 Completed forms

At the completion of the work, the Pre-work Pole Hazard Assessment form shall be forwarded to the relevant Electrical Engineer in the region concerned.

8 Audits

Site supervisors shall ensure that the Pre-work Pole Hazard Assessment forms are available and completed when required.

The relevant Electrical Engineer in the business unit concerned shall ensure that completed Pre-work Pole Hazard Assessment forms are reviewed and that regular audits are conducted to ensure compliance.

Business units shall undertake audits of each depot randomly at intervals of not more than 12 months.

9 Reference documents

PR D 78108 FM01 Pre-work Pole Hazard Assessment

PR D 78700 Working around Electrical Equipment

SMS-01-SR-3000 Safety Management System Requirements

SMS-06-OP-3043 Preparing and using Safe Work Practices

SP D 79049 Safe Approach Distances (SADs)