Sydney Trains

Engineering System Integrity
Engineering Advice
Electrical Distribution Unit

EA D 24-05

Work above Pole Top Substations

This Engineering Advice is produced for information and guidance. Adherence to the information in this Advice is recommended but not mandatory.

Date in Force: 1 October 2024

Date of Review: 1 October 2025

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Audience:

- Authorised Persons - Mains
- Authorised Persons - Substations

Main Points:

- Working above Pole Top Substations

Reference Document: PR D 78500 Electrical Permits

Document Control

Version	Date	Summary of Change
1.0	1/10/24	1st issue

Scope

The intention of this document is to provide guidance on the requirements for work above pole top substations.

Background

When a High Voltage Aerial Line is isolated, the downstream assets are also de-energised. This includes distribution substations and Low Voltage (LV) distribution networks.
During HV isolations certain LV configurations may form a back feed via the distribution Substations. These are usually isolated as part of the WHVI with any exposed hazards noted in the special instructions.

Note: Backup Low Voltage supplies equipped with mechanical changeover contactors, as well as Low Voltage generating systems like solar arrays with anti-back feed or anti-islanding features, are specifically designed to prevent back feed into the distribution network.

Another form of voltage potential is from breaks in conductors due to remote earth locations, hence the requirement to ensure touch potentials mitigated by ensuring breaks are bridged by:

a. local earthing or bonds or
b. avoidance by observing line voltage Safe Approach Distances (SAD).

Action required

1. Aerial Line work may be carried out above pole top substations under an Electrical Permit to Work only, using an EWP.
2. Pole Top Substation HV fuses cannot be visually confirmed for electrical continuity, therefore the SAD shall be maintained to the substation equipment including the fuses.
3. Work shall not be conducted above energised High Voltage equipment.

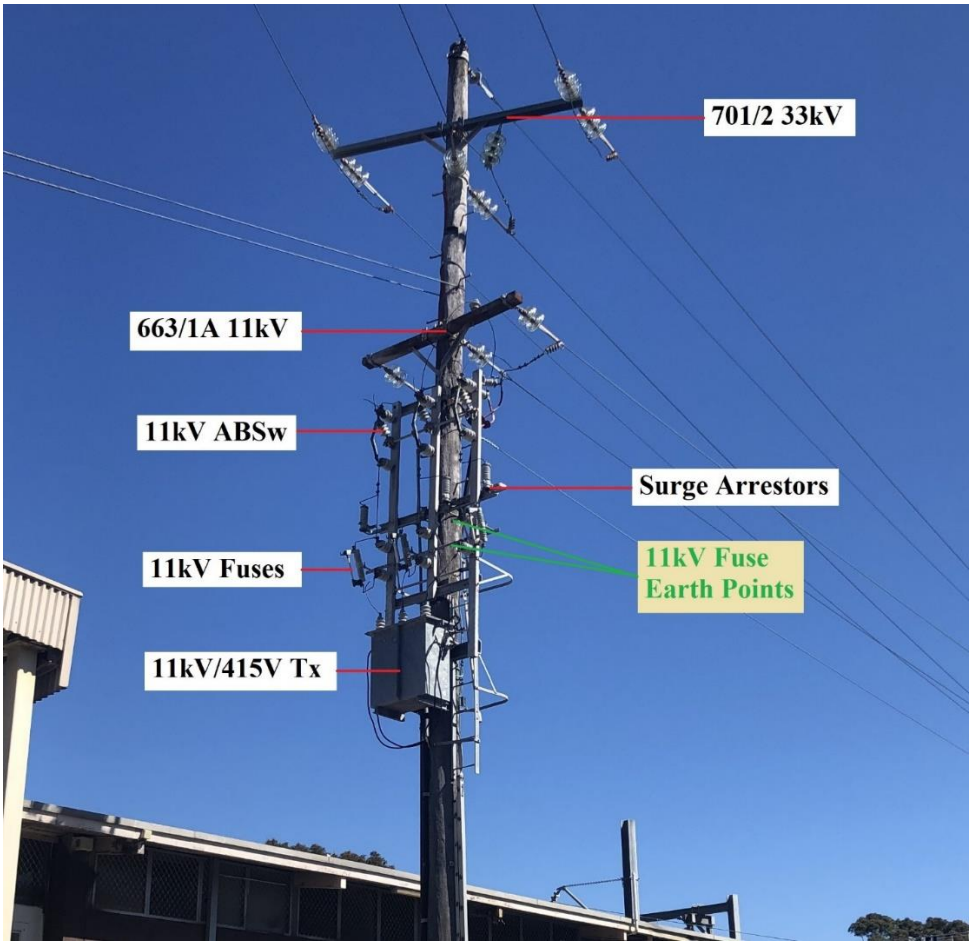

Figure 1 - Typical Pole Top Substation construction

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OFFICIAL

Engineering System Integrity
Electrical Network Safety Rules

Engineering Procedure
Electrical Distribution Unit

Working Near or On/Within

PR D 78500

Electrical Permits

Version 1.2
Date in Force: 1 February 2022

Transport Sydney Trains

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Document control

Version	Date	Author/ Prin. Eng.	Summary of change
1.0	4 November 2015	Chris Leung	First issue as a Sydney Trains document, rebranded from previous RailCorp SMS-06-EN-0577 V1.2. Added the "ABANDONED Electrical Permit to Work" requirements in Table 4 – Permit Variants.
1.1	19 February 2019	Nick Loveday	Updated PR D 78102 "Approved by" to Associate Director Electrical Distribution Unit, and document reference numbers.
1.2	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	All

Table of Contents

1 Purpose and scope

This procedure describes the types of Sydney Trains Electrical Permits appropriate to various circumstances.

2 Definitions

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

3 Responsibility

Authorised Persons planning or coordinating the electrical isolation are responsible for determining the correct type of Electrical Permit to be issued in accordance with this procedure.

4 Principles

An Electrical Permit is the primary safety document used in relation to work near or on/within electrical equipment, where the work requires the equipment to be isolated and made safe to allow the work to proceed.

The permit system ensures that work can be carried out in a safe manner through the application of three fundamental principles:

The Permit acts as a ‘token’ to control.

Timing on the basis of two fundamental principles:

1. Persons shall not commence the work for which the Permit is required until the Permit is received (the Permit will not be issued until it is electrically safe to commence the work).
2. The safe condition shall remain until the Permit is cancelled and returned (the workers doing the work shall stay clear of the equipment after they have signed off the Permit).

Work area as a third fundamental principle:

3. Persons shall work only in the areas that they have been shown are electrically safe.

4.1 An Electrical Permit:

At a minimum, an Electrical Permit will:

a. Document the area shown to the Permit Holder, by the Authorised Person instructing the Permit Holder, as being electrically safe to work in.

b. Record the names of all the workers in the work party. Each worker acknowledging by their signature that the Permit Holder has instructed them in relation to the Permit, and

c. At the completion of work, records shall confirm that all workers of the work party acknowledge by their signature that they have been instructed that the equipment is no longer safe to approach.

The Permit Holder must instruct all workers who signed onto the permit that the equipment is no longer safe and must ensure they are clear of exposed equipment prior to supply being restored.

In addition, certain other safety and administrative measures are documented on the Permit. These are fully described in the instructions specific to the various types of Permit.

5 Types of Permit

There are four basic types of Electrical Permit in use:

1. Electrical Permit to Work
2. Substation Access Permit
3. Low Voltage Access Permit
4. Operating Agreement.

6 Types of variant permits

6.1 Test High Voltage or 1500 Volt Equipment or 1500 Volt OHW under construction

When testing or constructing high voltage or 1500 volt equipment, variants of the Electrical Permit to Work and the Substation Access Permit are used:

a. Test Electrical Permit to Work

The Test Electrical Permit to Work is a variant of the Electrical Permit to Work that permits the application of test equipment and removal of earths and/or portable rail connections from high voltage and/or 1500 Volt DC equipment.

b. Wiring Under Construction Electrical Permit to Work

The Wiring Under Construction Electrical Permit to Work commonly referred to as a construction permit, is a variant of the Electrical Permit to Work. The 'construction permit' is used to indicate that 1500 volt overhead wiring or a HV aerial line under construction is not live.

c. Test Substation Access Permit

The Test Substation Access Permit is a variant of the Substation Access Permit that permits the application of test equipment and the removal of earths from high voltage equipment.

d. Extraordinary Substation Access Permit

The Extraordinary Substation Access Permit is a variant of the Substation Access Permit that allows repeated isolation and restoration of supply for the testing, inspection or adjustment of equipment.

e. Abandoned Cables

The Abandoned Electrical Permit to Work is a variant of the Electrical Permit to Work used to indicate that electrical cable is designated abandoned, proved dead, and visually and continuously traced from end to end.

6.2 Forms

A Test Electrical Permit to Work and a Wiring Under Construction Electrical Permit to Work, are made out on the same form (*PR D 78501 FM05 Electrical Permit to Work*) as an Electrical Permit to Work form and shall be completed in accordance with the relevant sections of *PR D 78501 Electrical Permit to Work*.

A Test Substation Access Permit and an Extraordinary Substation Access Permit, are made out on the same form (*PR D 78502 FM01 Substation Access Permit two Personnel Registers* and *PR D 78502 FM03 Substation Access Permit six Personnel Registers*) as a Substation Access Permit form, and shall be completed in accordance with the relevant sections of *PR D 78502 Substation Access Permit*.

7 Specific procedures relevant for each Electrical Permit type

Table 1: Procedures applying to specific Electrical Permits

Ref. No.	Procedure title	Permit
PR D 78501	Electrical Permit to Work	• PR D 78501 FM05 Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 Electrical Permit to Work 26 Personnel Registers • PR D 78501 FM05 TEST Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 TEST Electrical Permit to Work 26 Personnel Registers
PR D 78502	Substation Access Permit	• PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers • PR D 78502 FM01 TEST Substation Access Permit two Personnel Registers • PR D 78502 FM03 TEST Substation Access Permit six Personnel Registers • PR D 78502 FM01 EXTRAORDINARY Substation Access Permit two Personnel Registers • PR D 78502 FM03 EXTRAORDINARY Substation Access Permit six Personnel Registers
PR D 78503	Low Voltage Access Permit	• PR D 78503 FM01 Low Voltage Access Permit
PR D 78504	Operating Agreements	• PR D 78504 FM01 Operating Agreement

7.1 Electrical Permit Application Guide

Table 2: Permits Required for Normal Work

Outside a Substation		
No.	**Work Type**	**Permit**
1	For work that requires the OHW to be isolated for the cutting or removal of rails.	• PR D 78501 FM05 Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 Electrical Permit to Work 26 Personnel Registers
2	For work being performed on 1500 Volt negative connections to a Substation or Section Hut, outside the Substation or Section Hut.	• PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers
3	For work near or on/within Transport Asset Holding Entity of New South Wales (TAHE) 1500 Volt equipment outside a Substation building or switchyard and covered by an Authority only.	• PR D 78501 FM05 Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 Electrical Permit to Work 26 Personnel Registers
4	For work being performed outside a Substation near or on/within 1500 Volt equipment which cannot be covered by an Authority as the 1500 Volt equipment is not part of an Electrical Section or Subsection.	• PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers with earthing or rail connecting as mandatory on the equipment.
5	For work near or on/within TAHE High Voltage equipment outside Substation buildings or switchyards and covered by a WHVI only.	• PR D 78501 FM05 Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 Electrical Permit to Work 26 Personnel Registers
6	For work not under a WHVI i.e. when the feeder is not isolated via a WHVI, near or on/within TAHE pole mounted high voltage equipment including: • Transformers • Surge arrestors • Switchgear • Associated pole mounted substation equipment.	• PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers

Outside a Substation		
No.	**Work Type**	**Permit**
7	For work being performed outside a Substation building or switchyard near or on/within 1500 Volt links/switches which: • are, or could be used as, points of isolation for Authority's, AND • cannot be isolated to allow work on the switch under an Authority alone.	• PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers and • PR D 78501 FM05 Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 Electrical Permit to Work 26 Personnel Registers
8	For work being performed near or on/within isolating links, switch pairs and/or three position switches under the following conditions: • The isolating link, switch pair and/or three position switch is the point of isolation for an Authority. • The Electrical System Operator gives permission for the 1500 Volt isolation under the Authority to be extended within the Substation to the feeder DCCB to allow the overhaul of the isolating and/or rail connecting switch.	• PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers and • PR D 78501 FM05 Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 Electrical Permit to Work 26 Personnel Registers
9	For work being performed outside a Substation building or switchyard near or on/within low voltage equipment.	• PR D 78503 FM01 Low Voltage Access Permit

Inside a Substation		
No.	**Work Type**	**Permit**
10	For work being performed inside a Substation building or switchyard near or on/within Substation low voltage equipment.	• PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers
11	For work being performed inside a Substation building or switchyard near or on/within Substation high voltage equipment and where the earths required for this work are located inside a Substation building or switchyard and consequently, a WHVI is not required.	• PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers
12	For work being performed inside a Substation building or switchyard near or on/within 1500 Volt equipment which has been isolated without an Authority.	• PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers
13	For work being performed inside a Substation building or switchyard near or on/within 1500 Volt equipment isolated and rail connected under an Authority.	• PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers and • PR D 78501 FM05 Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 Electrical Permit to Work 26 Personnel Registers
14	For work being performed inside a Substation building or switchyard near or on/within Substation high voltage equipment and where earths required for this work are located outside a Substation building or switchyard and consequently, a WHVI is required.	• PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers and • PR D 78501 FM05 Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 Electrical Permit to Work 26 Personnel Registers

Inside a Substation		
No.	**Work Type**	**Permit**
15	For work being performed inside a Substation building or switchyard on high voltage cable equipment isolated and earthed under a WHVI.	• PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers and • PR D 78501 FM05 Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 Electrical Permit to Work 26 Personnel Registers
16	For work being performed inside a Substation switchyard near or on/within a high voltage line air break switch under the following conditions: • The line air break switch to be worked on is the point of isolation for a WHVI. • The Electrical System Operator gives permission for the high voltage isolation under the WHVI to be extended within the Substation to allow the overhaul of the line air break switch.	• PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers and • PR D 78501 FM05 Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 Electrical Permit to Work 26 Personnel Registers
17	For work under a WHVI near or on/within TAHE pole mounted high voltage equipment including: • Transformers • Surge arrestors • Switchgear • Associated pole mounted substation equipment.	• PR D 78501 FM05 Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 Electrical Permit to Work 26 Personnel Registers • PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers

Other		
No.	**Work Type**	**Permit**
18	For excavation work in the vicinity of 1500 Volt and High Voltage Distribution cables.	• PR D 78501 FM05 Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 Electrical Permit to Work 26 Personnel Registers
19	For work being undertaken by another Network Operator under the following conditions: • The work is being performed on that Network Operator's equipment. • Isolation and rail connecting of TAHE 1500V equipment outside Substation switchyards under an Authority is required to allow the work to be performed and/or Isolation and earthing of TAHE High Voltage aerial lines or cables and/or Isolation and proved dead (Note: LV aerial lines are only earthed if specifically requested by the Electrical Network Operator) of TAHE Low Voltage aerial lines or cables. • The work is being performed under the Network Operator's permit system	• PR D 78504 FM01 Operating Agreement

Table 3: Permits for defining an electrically safe work area

Location	Permit
Defining an area which does not contain live exposed electrical equipment within substations	• PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers
Defining an area which does not contain live exposed: • High Voltage aerial lines or cables, • 1500 Volt DC overhead wiring or cables, or • Low Voltage aerial lines or cables outside substations.	• PR D 78501 FM05 Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 Electrical Permit to Work 26 Personnel Registers or • PR D 78503 FM01 Low Voltage Access Permit
Defining an area which does not contain live exposed low voltage equipment outside substations	• PR D 78503 FM01 Low Voltage Access Permit
Defining an area which is near or on/within another Network Operator's live exposed electrical equipment that is required to be isolated and earthed prior to Sydney Trains work commencing near or on/within of the other Network Operators' electrical equipment.	• Other Network Operator's Operating Agreement

Table 4: Permit Variants (e.g. testing, construction, etc.)

Activity	Permit
Testing high voltage or 1500 Volt (positive) equipment outside substations where the equipment under test is energised from the test equipment at a potential exceeding extra low voltage or where the test requires that earths or rail connections be removed.	• PR D 78501 FM05 TEST Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 TEST Electrical Permit to Work 26 Personnel Registers
Testing high voltage equipment within substations where the equipment under test is energised from the test equipment and the test requires that earths be removed.	• PR D 78502 FM01 TEST Substation Access Permit two Personnel Registers • PR D 78502 FM03 TEST Substation Access Permit six Personnel Registers
Testing, inspection or adjustment of high voltage or 1500 Volt equipment within substations, requiring repeated isolation and restoration of supply and earths may be removed.	• PR D 78502 FM01 Substation Access Permit two Personnel Registers • PR D 78502 FM03 Substation Access Permit six Personnel Registers or • PR D 78502 FM01 EXTRAORDINARY Substation Access Permit two Personnel Registers • PR D 78502 FM03 EXTRAORDINARY Substation Access Permit six Personnel Registers
Testing of high voltage and/or 1500 Volt equipment extending outside substations, such as an aerial line or cable, where the test is carried out from within a substation and there is a WHVI current for the equipment.	• PR D 78501 FM05 TEST Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 TEST Electrical Permit to Work 26 Personnel Registers • PR D 78502 FM01 TEST Substation Access Permit two Personnel Registers • PR D 78502 FM03 TEST Substation Access Permit six Personnel Registers

Activity	Permit
Testing of 1500 Volt equipment within a substation which cannot be isolated from the 1500 Volt overhead wiring.	• PR D 78501 FM05 TEST Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 TEST Electrical Permit to Work 26 Personnel Registers • PR D 78502 FM01 TEST Substation Access Permit two Personnel Registers • PR D 78502 FM03 TEST Substation Access Permit six Personnel Registers
The 'construction permit' is used to indicate that 1500 Volt overhead wiring or a HV aerial line under construction is not live.	• PR D 78501 FM05 WIRING UNDER CONSTRUCTION Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 WIRING UNDER CONSTRUCTION Electrical Permit to Work 26 Personnel Registers
The 'ABANDONED permit' is used to indicate that electrical cable is designated abandoned, proved dead, and visually and continuously traced from end to end.	• PR D 78501 FM05 ABANDONED Electrical Permit to Work six Personnel Registers • PR D 78501 FM06 ABANDONED Electrical Permit to Work 26 Personnel Registers

8 Retention period of cancelled Electrical Permits

1. The minimum retention period for a cancelled and returned Electrical Permit is 3 months.
2. If any specific Electrical Permit is the subject of incident investigation, the retention period depends on the severity of the incident as follows:
   a. In the event of an incident causing death, serious injury, extensive damage to property or major disruption to the train network, it shall be retained as required for State Archives.
   b. In the event where there is only minor injury, minor damage to property or minor disruption to the rail network. The permit shall be retained for a minimum of 7 years after the last action.

   NOTE

   Where there is a minor involved i.e. persons under age of 18 the permit must be retained until the worker involved turns 25, whichever is the longer.

   c. For minor incidents requiring investigation, it should be retained for a minimum of 2 years.

In determining the retention period, other factors as described below, should be considered as well:

i. Whether they may be used as evidence for re-certification of competency in the issue and/or holding of Electrical Permits.
ii. For audit purposes.

9 Reference documents

PR D 78501 Electrical Permit to Work

PR D 78501 FM05 Electrical Permit to Work six Personnel Registers

PR D 78501 FM06 Electrical Permit to Work 26 Personnel Registers

PR D 78502 Substation Access Permit

PR D 78502 FM01 Substation Access Permit two Personnel Registers

PR D 78502 FM03 Substation Access Permit six Personnel Registers

PR D 78503 Low Voltage Access Permit

PR D 78503 FM01 Low Voltage Access Permit

PR D 78504 Operating Agreements

PR D 78504 FM01 Operating Agreement