Engineering System Integrity
Electrical Network Safety Rules

Engineering Procedure
Electrical Distribution Unit

Electrical Distribution Network Management

PR D 78203

High Voltage Operating Procedure

Version 1.4
Date in Force: 28 January 2026

Transport Sydney Trains

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

Disclaimer

This document was prepared for use by persons in connection with works near or on/within the rail network electricity system operated by Sydney Trains. Sydney Trains makes no warranties, express or implied, that compliance with the contents of this document shall be sufficient to ensure safe systems or work or operation. It is the document user's sole responsibility to ensure that the copy of the document it is viewing is the current version of the document as in use by Sydney Trains. To the extent permitted by law, Sydney Trains excludes any and all liability for any loss or damage, however caused (including through negligence), which may be directly or indirectly suffered in connection with the use of this document.

Copyright

Document control

Version	Date	Author/ Prin. Eng.	Summary of change
1.0	29 July 2015	Chris Leung	First issue as a Sydney Trains document, rebranded from previous RailCorp SMS-06-EN-0562 V1.2
1.1	10 July 2018	Chris Leung	3 yearly review
1.2	19 February 2019	Nick Loveday	Updated PR D 78203 "Approved by" to Associate Director Electrical Distribution Unit
1.3	1 February 2022	ENSR Project Team	Reviewed as part of the ENSR Project. Incorporated EI D 21-02 Cable Identification and Spiking Process.
1.4	28 January 2026	Nick Loveday	Reviewed, no changes required.

Summary of changes from previous version

Summary of change	Section
No changes required.	All

Table of Contents

1 Purpose and Scope

This procedure describes the operating procedures that are applicable to Transport Asset Holding Entity of New South Wales (TAHE)'s High Voltage (HV) systems.

The HV system includes conductors and equipment with nominal voltages exceeding 1000 Volt alternating or 1500 Volt DC. The 1500 Volt DC system is not covered by this procedure.

2 Definitions

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

3 General Requirements

- The general requirements for electrical operating work are stipulated in *RL D 79800 Electrical Network Safety Rules*, and must also be complied with.
- The specification for *PR D 78201 Removal and Restoration of High Voltage Supply* must be followed where appropriate.
- Protective clothing worn by persons shall be appropriate for the purpose, fit correctly, cover the full body (including the arms and legs) and be in good condition sufficient for the arc potential energy as stated in the Equipment Local Instruction and/or SWMS. Refer to *D2013-80874 PPE for Electrical Work* for further details.
- Operating work must only be undertaken by specifically authorised persons as described in *PR D 78701 Personnel Certifications – Electrical*. Periodic re-assessment and/or refresher training shall be organised to ensure that these persons are still competent to operate specific switching devices, in line with *PR D 78202 Working High Voltage Instruction*.
- Where supplied, the manufacturer's approved operating tools must be used for undertaking the switching operation.

4 Isolation of High Voltage Equipment

HV equipment must be isolated from all sources that could make it live by providing at least one break in each source.

The TAHE HV system is generally configured to provide for isolation by a visible break. In some cases, enclosed switchgear providing an equivalent or higher level of security has been approved for use as an isolator. The Equipment Local Instructions will indicate where this is the case.

Where a Low Voltage (LV) supply can provide a back feed via a transformer, the supply via that transformer shall be isolated in accordance with *PR D 78401 Isolation and Energisation of Low Voltage Equipment*.

HV isolation must be provided by means of one or more of the following:

a. Opening air break switches or isolating links.
b. Removal of fuse links or jumpers.
c. Withdrawal of circuit breakers, switches or switch-fuses.
d. Operation of enclosed switchgear to place it in the isolated position.

WARNING

An open circuit breaker is not normally a sufficient isolating break. Unless otherwise indicated in the Local Instructions, the circuit breaker must be withdrawn or the associated air break switch or isolating links opened.

4.1 Locking and Danger Tags

The devices providing isolating breaks shall be secured in accordance with *PR D 78104 Securing Systems for Electrical Equipment*.

Isolations effected by the operation of the following equipment must be Danger Tagged by hanging a Special Lock and Danger Tag on the lowest pole step:

a. Isolating links and fuses operated using a portable insulated operating stick.
b. The removal of jumpers.

Where an air break switch provides the isolation, it must also be locked with a Special Lock (refer to PR D 78104 Section 4 Danger Tags and Special Locks).

When an isolating device can also be operated by remote control, the remote control must be made inoperative and the means of ensuring that it remains inoperative shall be Danger Tagged.

4.2 Changeover Contactors

Mechanically interlocked LV changeover contactors are used to prevent a back feed from one supply to the other. For this reason, they are not considered as a source of supply and do not need to be isolated. However, some mechanically interlocked changeover contactors utilised in substation auxiliary supply arrangements are provided with bypass links (normally removed) primarily to control the risk of loss of auxiliary supply due to failure of the changeover contactor. An inspection shall be carried out to confirm whether such a bypass arrangement exists. In such a case, this bypass circuit shall be considered as a source of supply and the bypass links isolated and Danger Tagged as part of the isolation of the HV equipment.

Generally, **electronic changeover contactors** do not provide the same level of protection against back feed as mechanical changeover contactors do, and shall be treated as sources of supply. Hence, each must be isolated as part of the isolation of the equipment providing one of the supplies.

Where **electronic changeover contactors are fitted with an auxiliary contactor** in the normal LV supply feeding the electronic changeover contactor, this arrangement prevents a back-feed. Such configurations may be treated in the same manner as a mechanical changeover contactor.

4.3 Operation of Isolating Devices

Operation of all isolating devices shall be carried out under the direction of the Electrical System Operator (ESO).

WARNING

An isolating device with a Danger Tag attached must not be operated.

The ESO shall follow the communications protocol described in *NGE 204 Network Operations* and *NPR 721 Spoken and written communication* when instructing the field operator which isolating device is to be operated and the operation to be undertaken. The field operator shall confirm either that these instructions match the written switching instructions that they have, or they must record the instructions in writing.

The field operator shall then ensure that the isolating device is the correct one, by checking the location and the label on the isolating device against the written instruction.

The field operator must also check that the isolating device is in the expected position prior to the operation. In the case of a switch, this shall be done by checking both the blade and handle positions.

The field operator shall then carry out the agreed operation as per the Equipment Local Instructions

After the required operation has been carried out, the field operator shall advise the ESO of the operation that has been carried out, following the communications protocol described in NGE 204 and NPR 721.

4.4 Air Break Switches

Except when approval is given by the ESO or in emergency conditions, air break switches associated and in series with circuit breakers, shall not be operated unless the associated circuit breaker has been opened.

WARNING

Whilst some of the switches are designed to make load or rated currents, they should not be closed onto any section of the electrical network which is suspected to be under fault.

The switching sequence of off-load air break switches that are not in a series configuration with a circuit breaker shall be carefully planned to ensure that they are not opened to break any load current or paralleling current that the air break switches are not rated to break. This sequence shall be discussed and agreed between the ESO and the field operator. Both parties should refer to the relevant network diagram, agree and record the steps before commencement of switching operation. An example of air break switches without a circuit breaker in series is in substations having a double busbar arrangement.

4.4.1 Isolating Links and Fuse Links

HV isolating links and fuse links shall be operated with a single unhesitating movement. When closing, care shall be taken to ensure that the link is closed completely and the safety latch, where fitted, is engaged.

In the case of removable fuse links, once opened, the removable part shall be removed and safely stored. If earths are to be applied at the location, this shall be done prior to applying the earths.

Links in series and associated with air break switches or circuit breakers shall only be opened after the associated air break switches or circuit breakers have been opened.

4.4.2 Enclosed Switchgear

Isolation by any of the following means shall be carried out in accordance with Local Instructions:

a. Withdrawing circuit breakers.

b. Withdrawing switches or switch-fuses.

c. The operation of switchgear to place it in the isolated position.

4.5 Removal of Jumpers

Where jumpers are to be removed in order to isolate a HV aerial line or cable, any free ends shall be positively secured so that they cannot come into contact with other conductors or earth.

Isolated conductors shall be separated from live exposed conductors by the minimum fixed clearance distances specified in Table 1.

Voltage	Clearance
Up to and including 33 000 Volt	320 mm
Above 33 000 Volt and up to and including 66 000 Volt	630 mm
Above 66 000 Volt and up to and including 132 000 Volt	1100 mm

Table 1: Minimum Fixed Clearances of Isolated Conductors from Live Exposed Conductors

4.6 Proving Dead of High Voltage Equipment

Each conductor of HV equipment that has been isolated for work shall be proved dead using the approved test voltmeter provided or otherwise as stipulated in the Equipment Local Instructions for enclosed switchgear. The proving dead shall be done immediately prior to applying earths and **at each point** where the earths are to be applied.

The test voltmeter shall be selected at the correct range for the voltage being tested. The test voltmeter shall be checked immediately prior to proving dead on known live HV equipment or, if that is not possible, by means of a self-check facility in the test voltmeter. The test voltmeter shall also be checked at the completion of proving dead to ensure that it was functional throughout the proving dead process.

Care shall be taken to ensure that the Safe Approach Distances, set out in *SP D 79049 Safe Approach Distances (SADs)* are maintained.

When HV equipment containing capacitors is being proved dead, sufficient time shall be allowed for the capacitors to discharge.

Proving dead is not required before applying earths to certain types of HV enclosed switchgear where an alternative procedure is stipulated in the Equipment Local Instructions.

In the case of HV pole mounted switch frame equipment, with an earthing switch on each side of a fuse, proving dead before earthing is not required provided the LV switch is open, Danger Tagged (refer to Section 4.1) and a visual check of the HV switch blades has been made to confirm them to be open.

5 High Voltage Cables

Isolated HV cables shall be proved dead at:

a. The supply point switchgear, and

b. Cable to the overhead line junctions, and

c. Cable to equipment junctions if there is provision for testing at this point.

Before cutting a HV cable, the cable shall be proved dead by spiking at the work site with an approved cable spiking device by a person trained in its use.

5.1 Spiking of Cables

1. Prior to spiking a cable, authorised Electrical workers shall:
    a. Positively identify the cable at the worksite by independent methods (e.g. survey layouts, cable protection methods, visual tracing, cable markings, etc.).
    b. Obtain an indication that the cable is de-energised.
    c. Call ICON Electrical advising they are planning to spike a cable.
    d. Advise the feeder number of the cable they are planning to spike.
2. ICON Electrical shall notify Other Network Operators of the intent to spike a cable.
3. Spike the cable at the worksite:
    a. By person trained in the use of an approved spiking device.
    b. An authorised electrical person at the worksite shall remain on the phone with ICON Electrical while the cable spiking takes place.
4. Personnel shall maintain Safe Approach Distances (SADs) from the cable and the spiking equipment and await confirmation from ICON Electrical.

After a minimum of 5 minutes,

5. ICON Electrical shall confirm with the nominated electrical representative if any alarms or equipment operations occur on the Sydney Trains Managed System or Other Network Operators as a result of the cable spiking.
6. If any alarms indicate in ICON Electrical or other Network Operators at the time of the cable spiking:
    a. Work is to cease immediately.
    b. Workers on site shall maintain SADs to the equipment until an investigation identifying the cause of the alarms has taken place.

Cables shall not be proved dead by spiking when performing:

a. Sheath, screen or serving repairs.

b. Insulation or joint repairs where the cable is not cut.

c. Work on non-concentric cables.

Under these circumstances, the cable shall be identified by two independent methods.

6 Earthing High Voltage Equipment

The general requirements for earthing are described in this section.

Where portable earthing sets are used for earthing purposes, reference should be made to *SP D 79047 Earthing of High Voltage Equipment Using Portable Earthing Equipment*, for more detailed requirements.

6.1 Locations where Earths shall be Applied

Isolated and proved dead HV equipment shall be short circuited and earthed at the following locations:

a. Safety earths shall be applied as close as practicable to the points of isolation on each side of a worksite. It is not necessary that the conductors be continuous between the point at which the safety earths are applied and the worksite. In the case of the 11kV system, where a number of sources of supply are connected on one or both sides of the worksite and in close proximity, the source of supply may be considered as being the worksite side of the “Tee” connection closest to the worksite.

b. Working earths shall be applied to all conductors, on which work is being carried out, on each side of the worksite. At least one set of working earths shall be near the work site and positioned to be readily checked. Where Safety Earths are in the work area, they can be considered also as working earths if they are connected to the equipment on which the work is being carried out. All earthed conductors at the worksite shall be connected to a common earth to ensure equipotential conditions.

c. Additional working earths shall be applied where there is a risk of dangerous voltages being induced in the conductors to be worked on from live aerial lines in the area.

d. In the case of a conductive pole or conductive structure that is not connected to an aerial earth wire, the conductors of an aerial line being worked on at that location shall be bonded to the pole or structure prior to any person bridging between the pole or structure and the conductors.

e. A bond shall be applied to bridge the two sides of a conductor that is broken or is to be broken, before bridging by hand. The bridging may be via another unbroken phase or aerial earth conductors.

f. An earth shall be attached to any aerial line conductor that is being lowered to or raised from the ground in the vicinity of other services.

g. When performing cable work, working earths shall be applied at the junctions of cable to equipment or aerial lines, where a section of aerial line exists between the worksite and the point of supply.

h. Prior to making or breaking bridges at a HV cable to HV aerial line junction, working earths and bonds shall be applied to ensure equipotential conditions at the work site.

i. Exposed busbars within substations need only have safety earths applied between the worksite and any source of supply. When the busbar is to be divided into sections, each section shall be short-circuited and earthed before being divided.

j. Busbars of enclosed switchgear shall be earthed at the points indicated in the Local Instructions.

k. If it is necessary to work on an aerial line at a time when there is an increased risk due to lightning, all conductors including aerial earth wires, shall be short-circuited together and earthed at each pole or structure being worked on.

l. Working earths shall be positioned such that there are no fuses between the working earths and the worksite.

6.2 Earthing Using Portable Earthing Equipment

Earthing using portable earthing equipment shall be carried out in accordance with SP D 79047.

6.3 Enclosed Switchgear

Earthing of enclosed switchgear shall be carried out in accordance with Equipment Local Instructions.

If a circuit breaker is used to effect earthing, it shall be made inoperative once the earths have been applied.

6.4 Earthing Switches – Outdoor Unenclosed

Immediately prior to closing an earthing switch, each conductor shall be proved dead, except for HV pole mounted switch frame equipment.

Earthing switches are to be operated with a single unhesitating movement. A visual check of the blade position shall be made for each phase to ensure the switch has operated correctly.

HV pole mounted switch frame equipment, with an earthing switch on each side of a fuse, need not be proved dead before earthing provided the LV switch is open and the HV switch blades are visually checked open.

7 Portable Insulated Operating Sticks

Approved portable insulated operating sticks per *SP D 79039 Electrical Tools and Test Equipment* shall be:

a. Labelled as suitable for the voltage.

b. Labelled as purchased or tested within the last 12 months.

c. Inspected for defects prior to use by the operator, as specified in *SP D 79041 Insulated Sticks, Tools and Equipment used for work near or on/within Exposed Electrical Equipment – Inspection, Testing, Care and Maintenance*.

d. Held below the hand guard or mark.

e. Stored correctly after use, as specified in SP D 79041.

8 Replacement of HV Fuses

Operation of HV equipment for fuse replacement shall be carried out under the direction of the ESO.

A Substation Access Permit shall be issued for all HV fuse replacement that requires isolation and the application of earths.

A Substation Access Permit is not required for fuse replacement in the following HV equipment:

a. Enclosed switchgear with withdrawable type fuses or switch-fuses that become disconnected equipment when fully withdrawn.

b. Fuses and fuse links that can be removed and replaced using approved portable insulated sticks.

Fuses are to be replaced in accordance with Local Instructions.

9 Reference documents

NGE 204 Network Operations

NPR 721 Spoken and written communication

PR D 78104 Securing Systems for Electrical Equipment

PR D 78201 Removal and Restoration of High Voltage Supply

PR D 78202 Working High Voltage Instruction

PR D 78401 Isolation and Energisation of Low Voltage Equipment

PR D 78701 Personnel Certifications – Electrical

RL D 79800 Electrical Network Safety Rules

SP D 79039 Electrical Tools and Test Equipment

SP D 79041 Insulated Sticks, Tools and Equipment used for work near or on/within Exposed Electrical Equipment – Inspection, Testing, Care and Maintenance

SP D 79047 Earthing of High Voltage Equipment Using Portable Earthing Equipment

SP D 79049 Safe Approach Distances (SADs)