Sydney Trains

Engineering System Integrity
Engineering Instruction
Electrical Distribution Unit

EI D 23-05 V2.0

1500 V Switching in Maintenance Centres

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

Date in Force: 18 December 2023

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Audience:

- ICON Isolations Planning team
- Electrical Authorised Persons
- Fleet Maintenance staff in Electric Vehicle Maintenance Centres.
- Electrical Maintenance Teams
- ESI Electrical
- AMD Electrical

Main Points:

- Clarification of **Removal and Restoration of 1500 Volt Supply** in Maintenance Centres
- Confirmation of Rail Bonding arrangement.

Primary Affected Document: **PR D 78301 Removal and Restoration of 1500 Volt Supply**

Scope

This document clarifies the electricity network rules for the **Removal and Restoration of 1500 Volt Supply in Electric Vehicle Maintenance Centres.**

Background

Network Configuration

1500 V isolations within Electric Vehicle Maintenance Centres (EVMC) are implemented by Sydney Trains Network Maintenance, in accordance with the interface agreement with Fleet Maintenance and the Electricity Network Safety Rules (ENSR).

Common Rail Connection

The TAHE Heavy Rail electrified network uses an electrical common rail as maintained in accordance with PRS40026 and PRS40027. When the OHW is connected to rail it therefore has a common electrical reference point.

However when isolated with remote OHW rail connection points hazardous electrical potentials may arise across sectioned OHW, therefore steps shall be implemented to ensure that all OHW within a permit area shall be electrically continuous.

Retractable OHW that isolates and connects to earth

In this case for “touch potentials” and “electrical permits” the High Bay Road, Rails/Building/OHW (in-running & retracted) are considered as connected to rail via the Rail/Earth switch, building structure and bond on an alternate rail.

When working clear of a shed road with an earthing arrangement, ensure the track beneath the worksite remains at rail potential by confirming the location of the Rail Insulating joint as well as the rail bonding arrangement.

Action required

1. 1500 V switches fitted with Annett Key or Supplementary Lock Systems must be either in the open or closed position.
2. Electric Vehicle Maintenance Centre staff are reminded to operate 1500 V switches fitted with Annett Key or Supplementary Lock Systems per D2013/80655.
3. Electrical authorised personnel are reminded to isolate equipment within EVMC in accordance with *PR-D-78301 Removal and Restoration of 1500 Volt Supply*.
4. For work across a 1500 V switch that is fitted with an Annett Key or Supplementary Lock Systems, to remove the hazard of localised voltage potentials across the switch by:
   a. Securing the switch in the Closed Position – In agreeance with the yard controller.
   b. Rail connections applied in the vicinity either side of the switch.

      Note: The termination side Rail connection may be the Switch To-Rail connection lead.

   c. 1500V bridges across the switch – When Authorised per EI D 23-07.
5. EVMC shed bonding arrangements to be connected to rail that cannot be isolated from the common traction rail return system.
6. Confirmation that the High Bay Earthing systems is electrically connected to an intact Rail bonding arrangement shall be carried as part of the bond inspection TMP. If the earthing arrangement or Rail Bonding is found to disconnected ICON Electrical and the Yard Controller must be notified.
7. AMD to develop a programme to replace the switch gates on existing Termination roads that have a single point of supply with 3 position switches to 2 position (Closed/To-Rail), likewise future termination switches per designs EL0282734 or EL0282735.
8. Rail Fleet associated work utilising the Fleet Maintenance Annett Key or Supplementary Lock Systems for access do not require an Electrical Permit to work.

Contact

EDU team via email: RailElectricalSafety@transport,gov.nsw.au

OFFICIAL

Engineering System Integrity
Electrical Network Safety Rules

Engineering Procedure
Electrical Distribution Unit

Electrical Distribution Network Management

PR D 78301

Removal and Restoration of 1500 Volt Supply

Version 1.0
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	1 February 2022	ENSR Project Team	First issue as Sydney Trains document. Rebranded from SMS-06-EN-0566 V1.4. Reviewed as part of the ENSR Project.

Document history (previously SMS-06-EN-0566)

Version	Date	Author/ Prin. Eng.	Summary of change
1.4	28 February 2019	-	-

Table of Contents

1 Purpose and scope

To describe procedures for the co-ordination and management of removal and restoration of supply for work near or on/within Transport Asset Holding Entity of New South Wales (TAHE) 1500 Volt equipment.

2 Definitions

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

3 General

All work near or on/within exposed 1500 Volt equipment must be carried out in accordance with *PR D 78700 Working around Electrical Equipment*.

No 1500 Volt equipment is to be taken out of service without the prior approval of the Electrical System Operator (ESO), except where a life threatening situation exists.

WARNING

The 1500 Volt equipment must not be returned to service until all necessary inspections, tests, measurements or trials have been carried out.

4 Removal and Restoration of supply for work near or on/within 1500 Volt Overhead Wiring which is to be Rail Connected

As stated in *D2021/6078 Electrical Switching Incidents from Human Error*,
"When switching you shall work in accordance with the Electrical Network Safety Rules; *PR D 78203 High Voltage Operating Procedure*, *PR D 78305 1500 Volt Operating Procedures* or *PR D 78401 Isolation and Energisation of Low Voltage Equipment:*

- Operation of High Voltage, 1500V and some Low Voltage isolating devices shall be carried out under the direction of the Electrical System Operator (ESO).

  NOTE

  With the exception of Electrical Vehicle Maintenance Centres (EVMCs).

- The Authorised Person shall confirm either that these instructions match the written switching instructions that they have, or they shall record the instructions in writing and repeat the written instructions back to ICON.
- **The Authorised Person 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 Authorised Person shall check that the isolating device is in the expected position prior to the operation
- The Authorised Person shall then carry out the agreed operation.
- After the required operation has been carried out, the Authorised Person shall advise the Electrical System Operator of the operation that has been carried out.".

4.1 Authority for Removal of Supply from 1500 Volt Sections

An Authority and an Electrical Permit to Work must be issued for all work outside a substation that requires isolation and rails connection of a section/subsection of the 1500 Volt overhead wiring system except:

- At locations such as at Electric Vehicle Maintenance Centres where special instructions allow specific roads to be isolated and rail connected for work on vehicle roofs only without an Authority. These instructions are held at the Maintenance Centres. This applies specifically to maintenance of Rolling Stock and is part of Sydney Trains the Interface Agreement.
- 1500 Volt equipment under construction may not need an Authority.

4.2 Removal of Supply – Outside Substations

a. An Authority must be issued in accordance with the procedure detailed in *PR D 78302 1500 Volt Authority*.

   For work at Electric Vehicle Maintenance Centres refer to Section 6 of this document.

b. Prior to work commencing, the Authorised Person (Mains) in Charge of the Authority must contact the ESO and advise their name, the number of the Authority held and the staff arrangements for switching.

   The ESO must give clearance to proceed with the work only to the Authorised Person (Mains) in Charge of the Authority.

c. The ESO must complete tasks (i) to (iv) listed below:

   i. Obtain from the Operations Control Officer clearance to remove supply in accordance with the Authority and the assurance that no electric trains with raised pantographs will be allowed to enter, leave or cross the sections/subsections concerned.

   ii. Arrange for the switching operations listed on the Authority to be carried out.

NOTE

It is acceptable for switching operations that do not result in supply being removed from any section/subsection of the OHW, to be carried out prior to obtaining clearance from the Operations Control Officer to remove supply on the Authority.

   iii. Where other Network Operators' services need to be isolated:

      o request the other Network Operator to remove supply from its services

      o obtain confirmation from the Authorised Person (Mains) in Charge of the Authority that the required Operating Agreement has been received.

   iv. On completion of the switching operations, inform the Authorised Person (Mains) in Charge of the Authority that:

      o supply has been removed in accordance with the Authority

      o clearance is given to proceed with the proving dead, rail-connecting (refer to *PR D 78305 1500 Volt Operating Procedures*) and issuing of relevant Electrical Permits to Work and/or Operating Agreements.

4.2.1 Isolation requiring removal of bridges

Where equipment is isolated by the removal of bridges, jumpers or permanent connections and this removal requires both sides to be isolated and proved dead. A separate Authority and Electrical Permit to Work is required for each of the following stages:

- The work of removing the bridges, jumpers or permanent connections.
- The work for which the bridges, jumpers or permanent connections are being removed.
- The restoration of bridges, jumpers or permanent connections.

4.3 Restoration of Supply – Outside Substations

a. The Authorised Person (Mains) in Charge of the Authority must:

   i. Cancel the Authority in accordance with PR D 78302.

   ii. Sign off all other Network Operators' Operating Agreements if received.

b. The ESO must:

   i. Accept clearance to restore supply only from the Authorised Person (Mains) in Charge of the Authority.

   ii. Arrange for the relevant rail connecting switches to be opened.

   iii. Arrange for the relevant Danger Tags to be removed and the necessary switching operations to restore supply to be carried out.

   iv. Advise other Network Operators that their Operating Agreements have been signed off and that their supply may be restored as far as TAHE is concerned.

   v. On restoration of TAHE's supply, advise the Authorised Person (Mains) in Charge of the Authority and the Operations Control Officer that supply has been restored to normal so far as that Authority is concerned.

WARNING

The overhead wiring must not be returned to service until all necessary inspections, tests, measurements or trials have been carried out.

5 Removal and Restoration of supply for work near or on/within 1500 Volt Equipment Within Substations

5.1 General

When supply is to be removed for work near or on/within 1500 Volt equipment within substations, the following shall be completed before any work commences:

a. the equipment must be isolated and proved dead

b. the Electrically Safe Work Area shall be defined, work area and temporary warning signs applied where required

c. a Substation Access Permit must be issued.

For this work it is not necessary to rail connect or earth this equipment.

However, for work on rectifiers and associated equipment, earths must be applied to the primary side of the rectifier transformer.

Where high voltage or low voltage equipment in the Substation also has to be isolated and proved dead for the work, it must be included on the Substation Access Permit.

Where a section of overhead wiring has to be rail connected for the work, an Electrical Permit to Work shall referenced as part of the switching for the substation access permit.

5.2 Removal of Supply – Within Substations

The Authorised Person (Substations) issuing the Substation Access Permit must arrange for the removal of supply with the ESO.

5.3 Restoration of Supply – Within Substations

Danger Tags must not be removed and supply to 1500 Volt equipment within substations must not be restored until all associated Substation Access Permits have been cancelled.

The Authorised Person (Substations) cancelling the Substation Access Permit must arrange for the restoration of supply with the ESO.

WARNING

The equipment must not be returned to service until all necessary tests have been carried out.

6 Removal and Restoration of Supply for Engineering Work in Electric Vehicle Maintenance Centres

6.1 Form to be issued

At Electric Vehicle Maintenance Centres, for engineering work other than maintenance of rolling stock, the form *PR D 78301 FM01 Notification for the Removal of 1500 Volt Supply in EVMCs* must be issued as well as an Authority.

PR D 78301 FM01 must be issued by an Authorised Person (Mains) a minimum of 24 hours in advance of the planned work to:

- the Officer in Charge of the Maintenance Centre
- the appropriate signaller(s).

6.2 Roads provided with Isolating Switches Only

6.2.1 General

For engineering work other than that on vehicle roofs to be carried out on roads provided with isolating switches only:

- The work must be advertised in a Special Train Notice and/or Telegram.
- The form PR D 78301 FM01 form must be issued.
- Where the removal of 1500 Volt supply will affect both the main line and any road within the Electric Vehicle Maintenance Centre, two Authority forms may be issued – one Authority for the main line, and one Authority for any road within the Electric Vehicle Maintenance Centre. Alternatively, both areas may be included on the same Authority. This also applies where Engineering Work extends into Storage Roads or Servicing Roads provided with Combined Isolating and Rail Connecting Switches.

6.2.2 Responsibilities of the Authorised Person

The Authorised Person must:

- Issue completed copies of the form PR D 78301 FM01 as required.
- Issue additional copies of the form PR D 78301 FM01 to the officer in charge of the Electric Vehicle Maintenance Centre for distribution to the employees in charge of any ground frame within the Electric Vehicle Maintenance Centre, if required.
- Obtain acknowledgement of receipt from the officer in charge of the Electric Vehicle Maintenance Centre, by that person signing in the space provided on the original copy of the form PR D 78301 FM01.
- Issue a copy of the completed form PR D 78301 FM01 to Signaller No.1, if required. In some circumstances, the issuing of an additional copy may be applicable where another signal box is involved. In such a case a copy of the completed form is also issued to Signaller No. 2.
- Obtain acknowledgement of receipt from the signaller(s), by that person signing in the space provided on the copy of the form PR D 78301 FM01.

- On the day of the work, contact the running supervisor and advise of the intention to remove the 1500 Volt supply from the nominated 1500 Volt sections/subsections within the Electric Vehicle Maintenance Centre.

NOTE

Isolation of the 1500 Volt supply must not commence until authorised by the ESO.

6.3 Roads Provided with Combined Isolating and Rail Connecting Switches

6.3.1 General

When Engineering Work is to be carried out on Roads provided with Combined Isolating and Rail Connecting Switches normally secured with a Token Board Release Key or the maintenance centre's supplementary locking system:

- The form PR D 78301 FM01 must be issued, however a copy of the form will not be issued to the signaller(s).
- The procedures for the operation of the Token Board Release Key or supplementary locking system, as used by the Electric Vehicle Maintenance Centre, must be complied with.
- The work will not be advertised in a Special Train Notice and/or Telegram.

NOTE

When Engineering Work is to be carried out on Roads provided with Combined Isolating and Rail Connecting Switches in conjunction with Engineering Work on roads provided with isolating switches only, the requirements of Section 6.2 of this document apply.

6.4 Restoring Supply to 1500 Volt Sections

Where PR D 78301 FM01 has been issued for work at an Electric Vehicle Maintenance Centre, the Authorised Person in Charge of the Authority must arrange for the form to be cancelled by completion of the "Restoration of 1500 Volt Supply" section of the form as soon as practicable after supply has been restored.

The Authorised Person holding the Authority shall:

- Cancel all Electrical Permits and the Authority in accordance with PR D 78302.
- Restore supply in accordance with Section 4.3.
- After the 1500 Volt supply has been restored, withdraw all PR D 78301 FM01 forms issued in relation to the cancelled authority. The form PR D 78301 FM01 form issued to the signaller(s) may be withdrawn by telephone. If this process is used, the details must be recorded on the original copy of the form PR D 78301 FM01.

NOTE

The withdrawal of the copies of the PR D 78301 FM01 form is an assurance that the 1500 Volt supply has been restored to the isolated sections/subsections listed on the form.

7 Removal of 1500 Volt Supply Under Emergency Conditions

7.1 General

Under emergency conditions, supply may be removed without an Authority being issued where there is danger to life, a sustained fault, or a train operation irregularity.

In such circumstances the ESO must arrange for all necessary switching operations to be carried out and record each switching operation completed.

In cases where there is danger to persons from live equipment due to damaged overhead wiring or other reasons, or where such danger is reported or suspected to exist, supply must initially also be removed from adjacent overhead wiring sections to prevent energising the section in which the danger exists by pantographs bridging the sections.

If Electrical Permits will be required for emergency work, an Authority must be issued in accordance with PR D 78302 Section 5 Issue of Authorities Under Emergency Conditions as soon as it is practicable.

As soon as practicable, steps must be taken to determine that the isolated and adjacent overhead wiring sections are not being bridged by individual pantographs or two electrically connected pantographs and to restore supply to unaffected sections once an appropriate clearance has been obtained from the Train Controller.

7.2 Rescue Power Outage

Where there is an immediate threat to human life, the following arrangements, termed a Rescue Power Outage (RPO), may be used, in lieu of isolation and rail connection in order to:

- Protect casualties from further injury.
- Allow rescuers to come near or touch the 1500 Volt overhead wiring for the purpose of effecting a rescue.

For the purposes of the RPO, isolation of the overhead wiring is not necessary provided that there are a minimum of **two** open circuit breakers or switches between the section(s) at the incident site and any source of supply.

NOTE

Where a manual switch is used, a second break is required only if the opened switch has not been secured with a special lock and danger tagged, refer to PR D 78305.

For the purpose of the RPO, rail connection is not necessary provided that there is a “buffer section” of de-energised overhead wiring (OHW) between the section(s) at the incident site and any live section. This means both at either end and beside the section(s) involved in the incident.

The necessary switching operations will be carried out or arranged by the ESO. After the necessary switching operations have been completed, the ESO will allocate and issue to the Train Controller an RPO number. The Train Controller will communicate the RPO number to the organisation, carrying out the rescue, such as Police Rescue or Fire Brigade.

Notwithstanding the above, the section(s) at the incident site should be isolated and rail connected as soon as possible. Upon isolating and rail connecting the section of OHW associated with the incident, the additional de-energised subsections can then be energised.

When the RPO has been put in place, supply must not be restored until the organisation carrying out the rescue has advised that the RPO can be cancelled.

Should rescue operations be in place no recovery, remedial or maintenance work may be carried out until a full isolation and rail connection is completed and Electrical Permits issued. Should rescue operations be continuing at the time the Electrical Permits are issued, rescue personnel may continue to carry out life-saving rescue operations under the RPO. If an Authority (refer to PR D 78302 Section 5 Issue of Authorities Under Emergency Conditions) is issued while the RPO is current, the ESO must make a notation on the Authority quoting the number of the RPO. Supply must not be restored on the Authority until notification has been received that the RPO has been cancelled.

8 Bridging Isolation Points by Trains

Special care must be taken when electric rail vehicles are stranded at air gaps or section insulators.

On electric rail vehicles there is a possibility that the two pantographs of the 4 car set may be electrically connected and one pantograph may energise the other of the set.

WARNING

In addition, pantographs can connect on both sides a section isolator or air gap causing a dead section to become live.

An Electrical Permit must not be issued for work on a section/subsection of overhead wiring above a pantograph of electric rail vehicles set if there is live overhead wiring above the other pantograph, regardless of that pantograph being lowered and/or isolated.

9 Reference documents

PR D 78301 FM01 Notification for the Removal of 1500 Volt Supply in EVMCs

PR D 78302 1500 Volt Authority

PR D 78305 1500 Volt Operating Procedures

PR D 78700 Working around Electrical Equipment