

Engineering Instruction Electrical Distribution Unit	EI D 18-14 V2.0
Approved by: Nadine Youssef, Associate Director Electrical Distribution Unit, Sydney Trains	Date in Force: 14 August 2019 Date Expires: 14 August 2020
Authorised by: Jonathon McKinnon, Engineering Technical Publications Manager, Sydney Trains	
This Engineering Instruction includes urgent engineering information. Adherence to the information in this Instruction is <b>MANDATORY</b> .	
<b>Removing 1500VDC Supply in Electric Vehicle Maintenance Centres</b>	
Audience: <ul style="list-style-type: none"> <li>• GM Fleet Maintenance</li> <li>• GM SEQR Maintenance</li> <li>• Fleet Maintenance Asset Managers</li> <li>• Fleet Managers at HMC, FMC, MMC</li> <li>• Network Maintenance Division</li> </ul>	Main points: <ul style="list-style-type: none"> <li>• Isolation of OHW for high roads/pits</li> <li>• Switches used to isolate OHW within maintenance centres</li> </ul>
<b>Primary affected document: SMS-06-EN-0566 Removal and Restoration of 1500 Volt Supply</b>	

## Scope

This instruction concerns modifications to the safety controls at Maintenance Centres, where 1500V isolation switches and the Fortress key system are used to control physical access to areas where hazardous voltages may be present – including high roads and pits.

## Background

Isolation switches are used to isolate sections of the overhead wire as part of routine maintenance of the network. Notably at substations and throughout the rail corridor where the general principle is to isolate the section of the OHW, prove it is not energised ("prove dead"), then connect the OHW to the rail. Proving it is dead provides confirmation it is safe to approach the OHW or equipment connected to it.

An exception was made previously at Maintenance Centres where, as part of routine rolling stock maintenance, the step "prove dead" is not performed. Instead administrative controls (interlocked keys) and a manual action (looking up at the switch) are relied upon. Recent observations at two centres show these controls are ineffective and not performed reliably.

Other similar applications are known elsewhere in the rail industry where automated sensors are used to sense the presence of hazardous voltages on the OHW, notably at Sydney Trains' substations and Yarra Trams.

### Disclaimer

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Prepared using: TP ESI 004 V1.3

The Work Health and Safety Act 2011 clause 21 requires Sydney Trains to ensure, so far as is reasonably practicable, that those things installed in the workplace are without risks to health and safety of any person. Where new or modified access controls or isolation switches are installed at maintenance centres there is an obligation to provide assurance the electrical safety hazards have been reduced SFAIRP.

Furthermore the high use of the switches at Electrical Vehicle Maintenance Centres has resulted in situations where the jaws have spread and lost contact with the knife, hence a lack of rail connection of the Overhead Wiring.

## Action Required

- a) An upgrading plan for the existing Annette and Fortress key system is to be developed so that the practice of proving the OHW dead may be implemented at the Maintenance Centres.

This shall include a voltage sensor electrically interlocked with the Fortress key(s) controlling physical access to the gates on high roads or pits.

Technical requirements for implementation are provided in specification SP E 70008.

From a practical perspective at the Maintenance Centres, this will:

- Simplify the administrative controls.
- Allow the switch to be operated from a convenient location (not necessarily at the switch).
- Eliminate the need for the manual (visual) check of the switch position.

With respect to safety management, this will:

- Implement a “best practice” already established elsewhere.
- Implement the requirements of AS2067-2008 clauses 6.4.3 and 6.4.5 for the devices required to isolate and rail connect the overhead wiring and prevent the inadvertent operation.
- Strengthen the claim that the electrical hazard has been reduced as reasonably practicable as required by the Work Health and Safety Act 2011.

- b) Existing 1500V switch arrangements utilised through the use of the Annett Key Token or the Supplementary Lock Systems are to be maintained as per the 1500V switch Technical Maintenance Plans with an additional task as follows:

- i) Carry out a 12 monthly overhead wiring rail connection electrical continuity test. This test may be carried out using a Line to Rail (LR) Tester.

## Contact

E. [RailElectricalSafety@transport.nsw.gov.au](mailto:RailElectricalSafety@transport.nsw.gov.au)

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## 1. Purpose and scope

To describe procedures for the co-ordination and management of removal and restoration of supply for work on or near RailCorp's 1500 volt equipment.

## 2. General

All work near exposed 1500 volt equipment must be carried out in accordance with SMS-06-GD-0268 Working around Electrical Equipment.

No 1500 volt equipment is to be taken out of service without the prior approval of the Electrical System Operator, 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.*

## 3. Removal and Restoration of Supply for Work on or Near 1500 Volt Overhead Wiring which is to be Rail Connected

### 3.1. Authority for Removal of Supply from 1500 volt Sections

An "Authority for Removal of Supply from 1500 Volt Sections" form PR D 78302 FM 01, hereafter called an Authority and an Electrical Permit to Work must be issued for all work that requires a section / subsection of the 1500 volt overhead wiring system to be isolated, proved dead and rail connected.

The exception is 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.

### 3.2. Other Network Operator's services

Where another Network Operator's services also have to be isolated and earthed for the work, an Operating Agreement must be received from the Network Operator concerned, for the work near its services. This must be received by the Person in Charge of the Authority, refer clause 6 of SMS-06-EN-0567. The Electrical Operating Centre will be responsible for all arrangements for the isolation of another Network Operator's services.

### 3.3. Procedure for Removing Supply

- (i) An Authority must be issued in accordance with the procedure detailed in SMS-06-EN-0567 1500 Volt Authority.
- (ii) For work at Electric Vehicle Maintenance Centres see also Section 5.
- (iii) Prior to work commencing, the Authorised Person (Mains) in Charge of the Authority must contact the Electrical System Operator and advise their name, the number of the Authority held and the staff arrangements for switching.

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

- (iv) The Electrical System Operator must complete tasks a) to d) listed below.
  - a) 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.
  - b) 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.*

- c) Where other Network Operators' services need to be isolated:
- request the other Network Operator to remove supply from its services, and
  - obtain confirmation from the Authorised Person (Mains) in Charge of the Authority that the required Operating Agreement has been received.
- d) On completion of the switching operations, inform the Authorised Person (Mains) in Charge of the Authority that:
- supply has been removed in accordance with the Authority, and
  - clearance is given to proceed with the proving dead, rail-connecting (refer PR D 78305 1500 Volt Operating Procedures) and issuing of relevant Electrical Permits to Work and/or Operating Agreements.

### 3.4. 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, and
- 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 PR D 78305 1500 Volt Operating Procedures.)

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 Electrical System Operator (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 permits issued. Should rescue operations be continuing at the time the permits are issued, rescue personnel may continue to carry out life-saving rescue operations under the RPO. If an Authority (refer SMS-06-EN-0567 1500 Volt Authority, section 4) 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.

## 3.5. Procedure for Restoring Supply

- (i) The Authorised Person (Mains) in Charge of the Authority must:
  - a) Cancel the Authority in accordance with SMS-06-EN-0567 1500 Volt Authority.
  - b) Sign off all other Network Operators' Operating Agreements if received.
- (ii) The Electrical System Operator must:
  - a) Accept clearance to restore supply only from the Authorised Person (Mains) in Charge of the Authority.
  - b) Arrange for the relevant rail connecting switches to be opened.
  - c) Arrange for the relevant Danger Tags to be removed and the necessary switching operations to restore supply to be carried out.
  - d) Advise other Network Operators that their Operating Agreements have been signed off and that their supply may be restored as far as RailCorp is concerned.
  - e) On restoration of RailCorp'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.*

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## 4. Removal and Restoration of Supply for Work on or Near 1500 Volt Equipment Within Substations

### 4.1. General

When supply is to be removed for work on or near 1500 volt equipment within substations, the equipment must be isolated, proved dead, work area and access markers set where required and a Substation Access Permit issued before any work commences. 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 has to be isolated and proved dead for the work, these details must be included on the Substation Access Permit.

Where a section of overhead wiring has to be rail connected for the work, an Authority and Electrical Permit to Work are both required.

### 4.2. Procedure for Removal of Supply

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

### 4.3. Procedure for Restoration of Supply

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 Electrical System Operator.



#### **Warning**

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

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## 5. Removal and Restoration of Supply for Engineering Work in Electric Vehicle Maintenance Centres

### 5.1. Form to be issued

At Electric Vehicle Maintenance Centres, for engineering work other than that on vehicle roofs, a PR D 78301 FM 01 Notification for the Removal of 1500 Volt Supply for Engineering Work in EVMCs form must be issued as well as an Authority.

The PR D 78301 FM 01 form 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, and
- the appropriate signaller(s).

### 5.2. Roads Provided with Isolating Switches Only

#### 5.2.1. General

When Engineering Work is to be carried out on roads provided with isolating switches only:

- The work must be advertised in a Special Train Notice and/or Telegram.
- A PR D 78301 FM 01 Notification for the Removal of 1500 Volt Supply for Engineering Work in EVMCs 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.

## 5.2.2. Responsibilities of the Authorised Person

The Authorised Person must:

- Issue completed copies of the PR D 78301 FM 01 form as required.
- Issue additional copies of the PR D 78301 FM 01 form 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 PR D 78301 FM 01 form.
- Issue a copy of the completed PR D 78301 FM 01 form 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 PR D 78301 FM 01 form.
- 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 Electrical System Operator.*

## 5.3. Roads Provided with Combined Isolating and Rail Connecting Switches

### 5.3.1. 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:

- An PR D 78301 FM 01 Notification for the Removal of 1500 Volt Supply for Engineering Work in EVMCs form 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 5.2 apply.*

### 5.3.2. Responsibilities of the Authorised Person

The Authorised Person's responsibilities are as detailed in Section 5.2.2.



## 5.4. Restoring Supply to 1500 Volt Sections

Where a "Notification for the Removal of 1500 Volt Supply for Engineering Work in EVMCs" Form PR D 78301 FM 01 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 Permits and the Authority in accordance with SMS-06-EN-0567 1500 Volt Authority.
- Restore supply in accordance with Section 3.5.
- After the 1500 volt supply has been restored, withdraw all PR D 78301 FM 01 forms issued in relation to the cancelled authority. The PR D 78301 FM 01 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 PR D 78301 FM 01 form.

**NOTE:** *The withdrawal of the copies of the PR D 78301 FM 01 form is an assurance that the 1500 volt supply has been restored to the isolated sections/subsections listed on the form.*

## 6. Removal of 1500 Volt Supply Under Emergency Conditions

### 6.1. 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 Electrical System Operator 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 Permits will be required for emergency work, an Authority must be issued in accordance with SMS-06-EN-0567 1500 Volt Authority, section 4 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 (as described in Section 6.2) and to restore supply to unaffected sections once an appropriate clearance has been obtained from the Train Controller.

### 6.2. Pantographs

Special care must be taken when electric locomotives, Tangara, Millennium, Oscar or Waratah type vehicle sets are stranded at air gaps or section insulators.

- On electric locomotives the two pantographs on each locomotive are electrically connected and one raised pantograph will energise the other pantograph.

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

- On Tangara, Millennium, Oscar or Waratah type vehicle sets 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.

A Permit must not be issued for work on a section/subsection of overhead wiring above a pantograph of a 4 car Tangara, Millennium, Oscar or Waratah set if there is live overhead wiring above the other pantograph, regardless of that pantograph being lowered and / or isolated.

## 7. References

SMS-06-GD-0268	Working around Electrical Equipment
SMS-06-EN-0567	1500 Volt Authority
PR D 78305	1500 Volt Operating Procedures
Stock Code 002064459 & 002064475	Electrical Permit to Work
PR D 78302 FM 01	Authority for Removal of Supply from 1500 Volt Sections
PR D 78301 FM 01	Notification for the Removal of 1500Volt Supply in EVMCs

## 8. Appendices

### Appendix A Sample "Notification for the Removal of 1500 Volt Supply for Engineering Work in Electric Vehicle Maintenance Centres" (SMS-06-FM-0604) Form

## Appendix A Sample "Notification for the Removal of 1500 Volt Supply for Engineering Work in Electric Vehicle Maintenance Centres" (SMS-06-FM-0604) Form

### Notification for the Removal of 1500 Volt Supply for Engineering Work in EVMCs

Issue date: 30/06/10

Review date: 30/06/13

Number: 306 / 10

TO: Officer in Charge Hornsby Maintenance Centre Maintenance Centre  
Signaller(s): Hornsby Signal Complex

Engineering work requiring the 1500 Volt supply to be removed is planned to be carried out on:

Date of work: 10<sup>th</sup> June 2010 to 15<sup>th</sup> June 2010 Times: 1233 hrs to 0220 hrs

This work is advertised in STN and/or Telegram No: 0600 – 2010

The 1500 Volt supply will be removed in accordance with "Authority for Removal of Supply from 1500 volt Sections" No: 306 / 10

Sections	Lines
SN 5/1	Outwards Car Shed Road
SN 5/11	Roads 1 to 7, Shunting Neck, Loop Road, Lifting Shop Road
SN 6/1	Inwards Car Shed Road
SN 6/11	Roads 8 to 11 and 12 to 16, Tow Car Siding

No electric vehicle with a raised pantograph is to be permitted to enter the sections mentioned above until the withdrawal of this notice by an Authorised Person (Mains).

<b>Issued by:</b>	Print: <u>J. Bloggs</u>	Authorised Person (Mains)	Time: <u>1245 hrs</u>
	Sign: <u>J. Bloggs</u>	(Original to remain in book until cancelled)	Date: <u>10/6/10</u>
<b>Received by:</b>	Officer in Charge:	Print: <u>F. Controller</u>	1 <sup>st</sup> Blue copy
		Sign: <u>F. Controller</u>	Date: <u>10/6/10</u>
	Signaller No.1:	Print: <u>J. Signalman</u>	2nd Blue copy
		Sign: <u>J. Signalman</u>	Date: <u>10/6/10</u>
	Signaller No.2: (If applicable)	Print: _____	Additional copy
		Sign: _____	Date: _____
If required, to be issued with the 1 <sup>st</sup> Blue copy to the Officer In Charge for the attention of the Running Supervisor. (See NPR 706).	Safeworking employee operating the groundframe:	Print: <u>M Frameworker</u>	3 <sup>rd</sup> Blue copy
		Sign: <u>M Frameworker</u>	Date: <u>10/6/10</u>

#### RESTORATION OF 1500 VOLT SUPPLY [to be completed on the original (green colour) form]

The withdrawal of the blue colour copies of this notice is an assurance that the 1500 volt supply has been restored to the isolated sections listed above.

<b>Withdrawn and cancelled by:</b>	Print: <u>J. Bloggs</u>	Authorised Person (Mains)	Time: <u>0100 hrs</u>
	Sign: <u>J. Bloggs</u>		Date: <u>15/6/10</u>
<b>Acknowledged by:</b>	Running Supervisor:	Print: <u>R. Supervisor</u>	Time: <u>0100 hrs</u>
		Sign: <u>R. Supervisor</u>	Date: <u>15/6/10</u>
	Signaller No.1:	Print: <u>J. Signalman</u>	Time: <u>0115 hrs</u>
		Sign: <u>J. Signalman</u>	Date: <u>15/6/10</u>
	Signaller No.2: (If applicable)	Print: _____	Time: _____
		Sign: _____	Date: _____
	Safeworking employee operating the ground frame (If involved)	Print: <u>M Frameworker</u>	Time: <u>0115 hrs</u>
		Sign: <u>M Frameworker</u>	Date: <u>15/6/10</u>

RETURN THE CANCELLED ORIGINAL (GREEN COLOUR) FORM TO THE APPROPRIATE ELECTRICAL ENGINEER'S OFFICE

Custodian: Chief Engineer Electrical  
Approved by: GM Chief Engineer  
Number: SMS-06-FM-0604

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