

MTS ELECTRICAL SAFETY RULES

M1 METRO NORTHWEST AND BANKSTOWN LINE

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1 Introduction

As an electricity network operator MTS operates a safe system of work known as an electricity network safety management system. Our safety rules are the part of this system that sets out how workers interacting with the network maintain their safety. These rules are supported by procedures on key aspects to provide additional information that assists workers to comply with their electrical safety obligations.

1.1 Purpose

As a part of the MTS Electrical (Electricity) Network Safety Management System, the MTS Electrical Safety Rules (ESR) sets out the rules and procedures to be applied for the safe operation and access to the MTS electrical network.

The ESRs include the following components:

- Hazards and Warnings
- General information
- Safe Approach to Electrical Equipment
- Access for Work on or near Electrical Equipment
- Permits

If a conflict is identified between the ESR and the contents of any Electrical Operation manual or procedure, the ESR will apply.

1.2 Scope

The MTS electrical safety rules are applicable to the MTS electrical network, comprising of the low voltage distribution network, high voltage distribution network, and the traction power system.

These rules do not apply to MTS electrical installation equipment.

1.3 Electricity Network Safety Management System

This document forms part of the MTS Electricity Network Safety Management System (ENSMS) Element 32: Management of the Electrical Distribution Network. Rules developed for this document support and comply with the requirements of Element 32.

1.4 Document Review

This ESR will be reviewed and updated as required at intervals not exceeding three years in accordance with the requirements of the MTS SMS Element 6: Document Control and Information Management.

1.5 Exception to these Rules

Approval for work in exception to these rules may be given by the General Manager Safety, Quality, Risk and Environment and/or General Manager Engineering and Maintenance Delivery in consultation with the Electrical Network Manager,

where a change request has been completed, all hazards have been identified, risk assessed, and effective controls measures have been implemented.

For any such approval to be given it shall be proved that existing rules and procedures will prevent the work from being done.

An application for approval of exceptional work shall be supported by a plan of work, a description of the process to be adopted, a risk analysis, steps to be taken to advise all persons involved of the actions to be implemented and any emergency control measures to be applied.

Applications shall be in writing. Approval or refusal of the application will also be in writing.

2 Hazards & Warnings

2.1 Electric arcs, electric shocks & explosion

2.1.1 Electric arc

Serious injury can result from burns caused by electric arcs. Arcs can be caused by attempting to apply, though inadvertently in most cases, an earth or rail connection to energised equipment, or by opening non-load breaking isolating switches carrying current.

Electric arcs may be the source of an explosion which will scatter molten material, radiate intense light and heat, and emit dangerous quantities of hot gas or plasma. Severe burns to the body due to radiated heat and contact with molten materials, and flash injuries to the eyes may result. Airway burns from plasma is a serious risk.



WARNING: Burns may initially appear minor despite significant deep tissue injury. If burnt it is essential that appropriate medical treatment is obtained

Burns from high voltage may appear minor at the surface whilst causing significant damage to underlying deeper tissue. Skin with high resistance will transmit energy to deeper tissues with lower resistance.

2.1.2 Electric Shocks and the Human Body

The human body is a conductor of electricity, and severe injury or death may result if a conducting path that allows electric current to pass through the body is formed.

Burns are most often severe at the source (usually hands or head) and ground contact point (usually feet). The severity and extent of tissue damage are influenced by the strength and duration of contact with the source.



WARNING: If a person receives an electric shock, it is essential that appropriate first aid is provided without delay and checked by a medical professional

2.1.3 Mitigation Measures against Electric Arcs, Electric Shocks and Explosions

Mitigation measures against the occurrence of electric arcs and explosions include, but not limited to, the following:

- Never operate off-load isolating switches on load.

- Follow the correct procedure when undertaking operating work, (e.g. prove dead/de-energised at every location immediately prior to the application of earths or rail connections).
- Wear the appropriate Personal Protective Equipment when undertaking switching operations, energised work, or other work within substations.
- Work under Electrical Permit to Work conditions.
- Where live work is to be carried out, appropriately Authorised Persons undertaking such work shall strictly adhere to the appropriate Safe Work Method Statements, including the correct use of insulated tools.
- Follow MTS Personal Protective Equipment Procedure.

2.2 Earthing system

2.2.1 Disconnected or broken earth connections

Earth connections between equipment and the earthing system shall not be removed while the equipment is in service unless a suitable alternative earth connection is provided first.



WARNING: If an earth or neutral connection is broken or removed from equipment that is in service, a dangerous voltage may appear on the neutral or earth cable connected to that equipment.

Equipment that can produce dangerous voltages under these conditions includes voltage transformers and surge arresters.

2.2.2 Substation earth grid voltages and transferred earth potentials

Under fault conditions, substation earth grids can rise to hazardous voltages.

Care shall be taken when working on power cables, metallic telecommunications cables and signalling cable entering a substation. Dangerous voltages could arise between the earth grid and the cable if a substation fault or a remote earth fault occurs during the work.

Appropriate bridging connections shall be made between the equipment being worked on and the substation earth grid.

2.2.3 Earth grid and earth electrodes

If part of an earthing system is separated, a voltage may appear at the break. When it is necessary to break a part of any earthing system and there is no parallel connection, bridges of equivalent current carrying capacity shall be connected across the part of the earthing system before it is broken, unless all associated equipment has been isolated.



WARNING: Additional care shall be taken when repairing or reconnecting broken earth leads.

2.2.4 Check to ensure no missing earthing connections

Incidents of copper theft and other vandalism acts create electrical safety hazards.

To avoid possible electric shock, it is essential that all persons gaining access to or working inside substations reasonably check to ensure that there are no missing or damaged earthing connections at substation access gates, fencing and

switch operating handles etc. prior to touching such items or undertaking switching operations. Use the voltage tester if there is any uncertainty regarding the earthing system.

2.2.5 Neutral and Earth circuits

Prior to working on neutral or earth circuits, confirmation of isolation using a voltage tester is not considered sufficient to establish safe conditions. It is necessary to make sure that no current is flowing as breaking a neutral or earth connection that is carrying current will result in line voltage appearing across the break.

A clamp-on ammeter is to be used to prove that no current is flowing.

When working on neutral circuits, other precautions include:

- Confirming that the number of connections is as expected - additional unexpected connections could indicate additional hazards and shall be investigated before work proceeds.
- Checking any labels on all conductors connected to a bar or link, not just labels on the conductors being worked on.

2.3 1500V Negative

Prior to working on 1500V negative cables or bars, confirmation of isolation using a voltage tester is not considered sufficient to establish safe conditions. It is necessary to make sure that no current is flowing as breaking a 1500V negative connection that is carrying current will result in line voltage appearing across the break.

A clamp-on dc tong meter shall be used, to confirm no current is flowing.

When working on 1500V negative cables or bars, other precautions include:

- Confirming that the number of connections is as expected - additional unexpected connections could indicate additional hazards and shall be investigated before work proceeds.
- Checking any labels on all conductors connected to a bar or link, not just labels on the conductors being worked on.
- Where all connections between a substation and rail are being disconnected, all rectifiers in the affected substation shall be Isolated and Earthed.

2.4 Capacitors

Capacitors store electrical energy and care shall be taken when working on equipment with capacitors. Large capacitors or banks of capacitors shall be:

1. Isolated, and then
2. Discharged through an appropriately rated load or allowed to discharge over an appropriate time frame, and
3. then proved dead/de-energised prior to commencement of work.



WARNING: Ensure that capacitors are isolated, completely discharged (for at least 5 minutes) and “Test before Touch” prior to working on the equipment.

Capacitors are found in rectifiers, harmonic filters, lighting control and other equipment. Lengths of screened or metallic sheathed cable also have significant capacitance and shall be treated in the same manner.

2.5 Battery rooms

For routine inspection and maintenance work, eye protection safety glasses shall be worn.

Unprotected hands and clothing shall always be kept away from battery cells.

Work performed on a battery in service shall use methods which prevent circuit interruption or arcing in the vicinity of the battery including:

- ensuring using insulated tools,
- using insulated ladders,
- ensuring test equipment leads are firmly connected with enough length of cable to prevent accidental arcing in the vicinity of the battery,
- ensuring connections to load test equipment include short-circuit protection,

The operation of electric hand tools, the use of open flames and the operation of equipment that produces electric arcs are prohibited in the immediate vicinity of the battery.

Any spilled electrolyte shall be diluted or neutralised immediately and removed.

If electrolyte splashes in the eye or on the skin, immediately flood the eye or skin with water. Portable eye wash stations are provided in MTS substations for this purpose. Following irrigation of the eye or skin, immediate medical attention shall be sought.

2.6 Work on Maintenance Roads fitted with e-Fortress Key System

Work on a Maintenance Road fitted with a functional e-Fortress Key System (eFKS) does not require the issuing of a Switching Program and Electrical Permit.

Persons working within the Safe Approach Distance of Overhead Wiring within an eFKS zone are to:

- Comply with the applicable eFKS procedure,
- avoid contact with the overhead wire,

Note: Infrastructure work on overhead wiring or the supporting structure within an eFKS zone is not exempt from the requirement to issue a switching program and electrical permit.

2.7 Operation of field switches fitted with eFKS

Operation of 1500V field switches fitted with a functional eFKS are exempt from the requirement to be operated under a switching program under these rules. Persons operating the eFKS shall:

- be specifically trained and authorised in the operation of the eFKS; or
- hold authorisation as an MTS Switching Operator.

Note: Manual operation of a field switch fitted with an eFKS shall be undertaken by an authorised MTS Switching Operator under the direction of the duty engineering controller.

2.8 Securing of damaged pantographs

Care shall be taken when it is necessary to secure or make safe a damaged pantograph of an electric vehicle. Prove dead/de-energised before commencing any work to secure or make safe the damaged pantograph.

If a damaged pantograph is tied down and it is within 50mm of the roof, the pantograph isolating switch shall be opened.

2.9 Conductive measuring tapes, Ladders and Extension Handles

Conductive measuring tapes, metal reinforced linen tapes and long steel rules conduct electricity and are NOT to be used on the MTS Network.

Portable Conductive (metal) Ladders shall NOT be used in the rail corridor, electrical substations or near high voltage equipment.

The use of conductive tools (extension handles etc.) or materials shall be risk assessed prior to use in the MTS Network.

2.10 Scaffolding

All mobile scaffolding used on the MTS Network shall be non-conductive unless an Electrical Permit to Work has been issued for any MTS Electrical Network equipment within the vicinity of the work area.

Fixed scaffolding within 4 metres of energised MTS Electrical Network equipment or 1500V DC Overhead Wiring and Structures shall be undertaken in accordance with an Approved Engineering Design (e.g. Static Load, Dynamic Load, Earthing Requirements etc), Risk Assessment and Safe Work Method Statement and be approved by the Electrical Network Manager.

2.11 Rail voltage

The MTS network is a Direct Current (DC) Traction Power System (TPS) and uses the track rails as part of the return electrical current path to the substations. The MTS track rails are electrically isolated from all surrounding corridor infrastructure. This means a varying electrical voltage exists between the MTS track rails and all surrounding corridor infrastructure, including adjacent train network track rails. This electrical voltage is controlled to be compliant with EN50122-1 engineering standard. This notation of track rail voltage compliant to EN50122-1 is commonplace around the world on railways with a DC Traction Power System. To manage touch potential risks on DC railway network, Contact with rail track is to be avoided where possible.

Workers are required to implement safe working practices to manage track rail volts, including mitigating:

- The voltage between MTS track rail volts and adjacent train network track rails (such as in a parallel running corridor at Chatswood and Sydenham).
- The voltage between MTS track rail volts and surrounding corridor electrically conductive infrastructure (such as electrically conductive cable trays, posts, frames, walkways, platform edge doors, structural members, points machines, fences, fixed equipment, equipment cubicles, panels and pipes).
- The voltage between MTS track rail volts and any other voltage source.

Typical safe working practices may include:

- Avoiding contact with the MTS track rails where viable.

- Avoiding electrically conductive concurrent contact between MTS track rails and surrounding corridor electrically conductive corridor infrastructure.
- When assessed by electrical and safety competent persons, temporary bonding between the MTS track rails and other infrastructure. Equipping workers and personnel with appropriate PPE

Personnel operating on or adjacent to the track and surrounding infrastructure during partial line possessions may request the Electrical Controller (EC) to Close the Voltage Limiting Device (VLD) at the Traction Substation on each side of the worksite for a maximum duration of 30 minutes.

2.12 Interfering with negative connections to rail

If the negative cables connecting a substation to the rail or to the rail bonding equipment are broken or disconnected, equipment in the substation could cause the cable voltage to rise to a hazardous level. Similarly, separating a section of rail to which these negative cables are connected from the rest of the track could cause the separated rail to become live at a hazardous voltage.

Broken or disconnected cables are to be reported to Engineering Control and the responsible Maintenance Delivery Manager.

Maintenance Delivery Manager – Electrical is to coordinate any work requiring disconnection of negative cables (traction bonds), such as re-railing, with the work crew. Appropriate bridging connections are to be made when negative cables or conductors are connected or disconnected, or the 1500V supply is to be removed and the persons involved signed on to the appropriate Electrical Permit to work.

2.13 Disconnecting or removing sections of rail

When removing or disconnecting sections of rail, work crews shall apply control measures for traction return current. Return current may be the result of electric traffic on an adjacent track or may be current returning to a nearby substation from more distant electric traffic on the same track.

All work crews shall ensure that a continuous path for traction return current is maintained. This may include the use of temporary bonds between rail and/or verification that sufficient cross rail traction bonds are in place.

If it is necessary to de-energise the 1500V supply to make the work safe, an Electrical Permit is to be issued to ensure that supply is not restored until the rails or traction bonds are reconnected.

2.14 Application of portable earths or rail connections

A person applying portable earths or rail connections shall only be undertaken by a suitable qualified and authorised person.

Portable Earths or Rail Connections shall be listed on the respective switching program or permit for which they are applied.

A Permit Holder may instruct the application and removal of Portable Earths or Rail Connections (working Earths/Rail Connections) within the work area listed on the Electrical Permit to Work, these shall be listed in Section 10 of the Electrical Permit to Work.

2.15 Removal of portable rail connections

A person breaking the connection of portable rail connection equipment to rail could inadvertently become part of the 1500V circuit, potentially exposing themselves to an electrical hazard and could also render the rail connection ineffective in protecting other workers.



WARNING: Do not interfere with or remove portable rail connecting equipment without the proper authority.

All persons are to make sure that connections to rail of portable rail connecting equipment are not damaged or disconnected. Contact the duty Engineering Controller immediately if accidental damage or disconnection occurs. Engineering Control will arrange with electrical staff if it is necessary for a portable rail connection to be relocated for work to proceed.

2.16 1500 Volt DC Overhead Wiring structures or Equipment

There is a possibility that overhead wiring structures may rise to an electrical potential above earth. The risk of persons receiving an electric shock when standing beside an overhead wiring structure and touching the structure, or when standing on the rail, is low but not impossible.

When working on or near 1500 Volt DC OHW structures or equipment, only use electric power tools that are:

1. battery operated, or
2. supplied from an isolating transformer, generator, or inverter.

This applies to all electric power tools and equipment to be used in the rail corridor and substations, including work on:

- overhead wiring structures
- rail, and
- rail connected equipment, (including trains/plant standing on the rails)

2.17 Testing HV equipment at Line Voltage to Carry out Phase Checking

When restoring equipment to service following work that has disturbed the primary electrical connections confirmation of phasing and sequence is required.

Phase checking is considered a switching operation and may only be carried out by MTS Switching Operators as a step in a switching program.

If phase checking is found to be incorrect, the MTS Switching Operator is to contact Engineering Control to arrange isolation of the equipment to allow rectification under an Electrical Permit to Work.

2.18 Work on Current Transformers

To prevent dangerous induced voltages, you must not open the secondary winding of any energised current transformer.

Workers must not make uninsulated contact with exposed conductors on secondary circuits of energised current transformers.

When HV testing or current injection testing HV apparatus containing CT's, the secondary terminals of the current transformer must be short-circuited before testing.

Disconnection or shorting on Current Transformers is to be undertaken as part of the associated Switching Program. This is to ensure Current Transformers are safely managed and not left out of service.

3 General

This section provides general information about the application of the MTS electrical safety rules including authorisation, communication, tags and warnings, and substation access.

3.1 Instruction & Authorisation

MTS provides specific certification to persons, with a demonstrated business need, instructing or authorising that person to undertake the nominated tasks on the MTS electrical network.

Instructed and Authorised roles are set out in Table 1.

Table 1 Instructed and Authorised roles

	<i>Enter & work in a substation</i>	<i>Supervise work in a substation</i>	<i>Electrical Permit to Work</i>	<i>Test Permit</i>	<i>High Voltage and 1500V Switching</i>	<i>Engineering Controller</i>	<i>Restrict Authorisations</i>
MTS Qualified Worker	May only enter a substation under the supervision of an MTS Substation Supervisor						
Substation Access	✓						
Permit Holder			✓	✓			
MTS Substation Supervisor	✓	✓	If MTS Permit Holder is held				
MTS Switching Operator	✓	✓	✓	✓	✓		✓
Engineering Controller	✓	✓	✓	✓	✓	✓	✓

3.1.1 Requirements for work on the Electrical Network

A person shall not carry out work on the MTS electrical network equipment unless:

- that person fulfils the requirements for the role being undertaken as listed in NWRLOTS-NRT-SWD-HV-SPC-720350 Electrical Authorisations, or
- that person is undertaking directly supervised training for the role being undertaken,

and

- the person is physically fit to safely perform the required work,
- the person is qualified for the task to be performed.

3.1.2 Qualifications required for Authorised Roles

MTS requires that a person undertaking an authorised role hold appropriate underpinning qualifications and knowledge. This ensures that the person undertaking the authorised role can complete their duties safely and effectively.

Where AQF qualifications are identified, the qualification shall be issued by a Registered Training Organisation or an Australian recognised issuing body.

3.1.3 Training scope

A person who fulfils the requirements for an authorised role, and has completed training beyond their initial qualification, is permitted to undertake activities to the extent of the recognised training which they have received.



Example:

- Persons qualified to work on or near overhead or underground electrical equipment (other than live high voltage lines) can perform the work if they:
- Possess a relevant certification issued by a Registered Training Organisation, or recognised issuing body; or
- Are undertaking work for which they have been trained. For example, an Electrician may do work on an overhead line, if that work falls within the limits of their training and competency, or a Cable Joints may attach fittings or make connection to an overhead line.

and

- Have received the relevant MTS approvals for the work.

3.1.4 MTS Approved Electrical Network Qualifications

A person seeking certification under these rules, shall fulfil the requirements for the role as listed in NWRLOTS-NRT-SWD-HV-SPC-720350 Electrical Authorisations.

3.2 Communication

MTS requires that clear and effective communication takes place between all personnel when undertaking safety critical tasks.

Further detail on electrical switching communication can be found in MTS-AEL-PR-78213 Electrical Switching Communication Procedure.

3.2.1 Verbal Communication

Adherence to the communication protocol is essential to maintain understanding, safety, and to prevent incidents.

Effective communication involves three principles:

Table 2 Communication principles

Clear	Ensure that what you say is easy to understand and is not confusing
Concise	Minimise banter and use proper and specific terms (simplified instructions are preferred over complex instructions)
Confirmed	Information shall be repeated by the receiver for confirmation

It is essential to speak clearly, listen carefully, and thoroughly understand verbal communications. A clear communication protocol is shown in Table 3

Table 3 Communication protocol

Stage	Purpose / Activity
Introduction	Greeting and purpose (name and role)
Confirm	Scope of the work and that both parties are working on the same task (switching program number)
Context	Establish the present status of the job/work (location and switching activities)
Communicate	Clearly and concisely communicate and confirm the tasks are understood (receive and repeat back the communication)
Close	Clearly close out the call

Safety critical instructions shall be confirmed by repeating them back to the communicator. This prevents misunderstandings between parties.

3.2.2 Written communication

Written communication shall be legible, clear, concise, and unambiguous. Documents shall be filled-in using MTS terminology.

Where an approved form or template is provided for an activity, this form shall be used. Forms shall be completed fully, with all required sections filled out.

Where documents are issued for field use, the currency of the document shall be confirmed prior to commencement of the work activity. This is essential for switching programs – operators shall confirm the version of the switching program they hold with engineering control prior to commencement of switching.

Changes to forms is controlled using the MTS document management process. Superseded forms shall not be used.

3.2.3 Electrical Operating Diagrams

All Electrical Operating Diagrams shall meet the requirements of MTS-AEL-PR-78211 - Electrical Operating Diagram Submission and Approval Procedure.

3.2.4 Substation Documentation

All documentation available within MTS Substations shall comply with MTS-AEL-GL-78322 – Substation Documentation.

3.3 Tags and Warning Signs

3.3.1 Danger do not operate tags (Danger tags)

'Danger - Do Not Operate' tags are a notice attached to a controlling switch or other equipment as a warning not to operate such equipment where this could cause injury to staff or damage to equipment. This tag shall be a label or other device with the word "DANGER – DO NOT OPERATE" displayed on it along with other relevant details.

'Danger Do Not Operate' tags shall:

- be durable and securely fixed to the controlling switch,
- clearly list the device & switching program under which the tag is applied,
- be dated by the worker applying the tag,
- be attached in a prominent position on each isolation point or device (locked to the controlling switch or access panel where this facility is available),
- only be removed with the authorisation of the duty Engineering Controller.

Figure 1 Danger – Do not operate tag

	
DANGER	DANGER
DO NOT OPERATE	DO NOT OPERATE
DO NOT REMOVE THIS TAG	PROGRAM/ PERMIT NUMBER _____
OPERATION OF THIS DEVICE EXCEPT AS AUTHORISED MAY BE LIFE THREATENING	EQUIPMENT NUMBER _____
SEE OTHER SIDE	ATTACHED BY (PRINT NAME) _____
	PHONE NUMBER _____
	DATE _____
	THIS TAG ONLY TO BE REMOVED BY THE ABOVE OR AUTHORISED



WARNING: DANGER Do Not Operate Tags shall not be interfered with or removed without authorisation from the duty Engineering Controller.

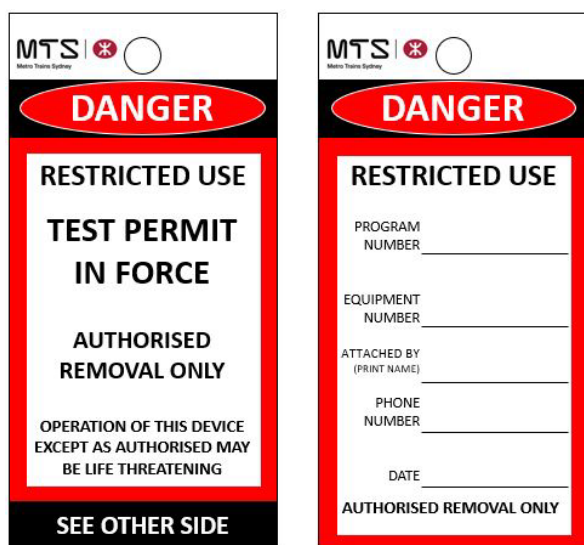
3.3.2 Restricted use tags

'Restricted Use' tags are a notice attached to a controlling switch or other equipment associated with an earthing or rail connecting device as a warning that the equipment is only available for restricted use associated with a test permit. This tag shall be a label with the words "RESTRICTED USE" displayed in black text on a white background along with other relevant details.

'Restricted Use' tags shall:

- be durable and securely fixed to the controlling switch,
- clearly list the device & switching program under which the tag is applied,
- be dated and signed by the worker applying the tag,
- be attached in a prominent position on each device (locked to the controlling switch or shutter where this facility is available),
- only be lifted temporarily at the instruction of the test Permit Holder,
- only be removed with the authorisation of the duty Engineering Controller.

Figure 2 Danger – Restricted use



3.3.3 Out of service tags

‘Out of service’ tags are a notice attached to a controlling switch or other equipment as a warning that the equipment is not fit for service. This tag shall be a label, tape or other device with the words "OUT OF SERVICE" displayed on a yellow background along with other relevant details.

‘Out of service’ tags shall:

- be durable and securely fixed to the isolator
- clearly state the reason why the equipment is out of service
- be dated and signed by the worker applying the tag,
- be attached in a prominent position on each isolation point or device (locked to the controlling switch or shutter where this facility is available).
- only be removed after notifying the duty Engineering Controller.

Figure 3 Out of service tag





OUT OF SERVICE

DO NOT USE OR
OPERATE

REASON _____

EQUIPMENT
NUMBER _____

ATTACHED BY
(PRINT NAME) _____

PHONE
NUMBER _____

DATE _____

I confirm that this OOS
equipment has been
registered with
Engineering Control
(sign) _____



OUT OF SERVICE

DO NOT USE OR
OPERATE

THIS TAG MUST NOT BE REMOVED
UNTIL THE COMPLETION OF REPAIRS

Additional Details:

SEE OTHER SIDE

3.3.4 Application of Tags

Tags shall be affixed to the controlling device or switch using an operator lock where this facility is available. Locks shall be secured to prevent unauthorised removal.

Figure 4 Operator lock



3.3.5 Warning signs and protection measures

Appropriate permanent or temporary work area markers, safety fences, demarcation taping, warning signs, barriers, guards, plates, warning lights and other protective devices, shall be used as required where hazards exist to employees, contractors, or the public.

Note: Section 5.4 provides further information on the use of work area markers

3.4 Access to MTS Electrical Network Substations and Facilities

3.4.1 General

Access to MTS Electrical Network Substations & Facilities is limited to those persons with:

- Substation Access Authorisation (see Table 4) or,
- be under the supervision of an MTS Substation Supervisor or MTS Switching Operator.

Entry to the Traction and Distribution substation is prohibited for any individual with a pacemaker or implanted cardiac device due to elevated electromagnetic field (EMF) exposure risks.

Prior to entering an MTS Electrical Network Substation or Facility all persons shall:

- confirm that they have a demonstrated need to enter the facility,
- assess the risk of their planned activity and apply controls,
- apply any other mandated safe access procedures,

On exit of an MTS Electrical Network Facility all persons shall:

- ensure all equipment is returned to normal operating state or as agreed with the duty Engineering Controller,
- ensure all workgroup waste, tools, and equipment is removed from the facility,
- ensure the substation is secured,

- contact the duty engineering controller and advise that they are clear of the facility.

3.4.2 Ordinary Persons

Ordinary Persons may enter a substation for inspection purposes only under the supervision of an MTS Substation Supervisor.

Ordinary Persons may undertake work, for which they are suitably trained, in a substation only under the direct supervision of an MTS Substation Supervisor or MTS Switching Operator.

Work shall be risk assessed and any hazards identified shall be controlled to the satisfaction of the MTS Substation Supervisor or MTS Switching Operator prior to commencement.

3.4.3 Substation Access

Persons holding Substation Access are permitted to enter a substation without supervision.

Holders of this authorisation are only permitted to undertake work for which they hold the relevant Training, Qualifications and Authorisations/Certifications.

Substation Access does NOT allow a person to hold a permit within a substation, irrelevant of Permit Holder Authorisation.

3.4.4 MTS Substation Supervisors

MTS Substation Supervisors are permitted to enter a substation without supervision. MTS Substation Supervisors may also undertake work unsupervised and supervise the work of persons holding substation access.

Where an MTS Substation Supervisor is providing direct supervision of ordinary persons, they are only permitted to supervise those persons inclusive of inspection and work activities, at a single location within the substation. They are NOT permitted to undertake work while supervising Ordinary Persons.

MTS Substation Supervisors, who also hold MTS Permit Holder, are permitted to hold an Electrical Permit to Work within a Substation.

3.4.5 MTS Switching Operators

MTS Switching Operators are permitted to enter, work, and supervise the work of others (including Ordinary Persons) in a substation.

MTS Switching Operators are permitted to operate HV and 1500V Equipment on the MTS Electrical Network.

3.5 Operational Switching

Operational Switching is High Voltage switching undertaken by the Engineering Controller for the purpose of network reconfiguration and does not require a pre-written Switching Program, operation of High Voltage Equipment shall be recorded on the Engineering Controller log sheet and switching is undertaken in the field shall be recorded in the Substation Logbook.

Operational Switching, at the discretion of the Duty Engineering Controller, may be conducted utilising a Switching Program, where it is deemed to be too complex to manage without.

Operational Switching SHALL NOT be used where switching for isolations or permit issue.

4 Safe approach to Electrical Equipment

4.1 General

To ensure the safety of persons in the vicinity of electrical equipment Safe Approach Distances (SADs) shall be maintained.

Safe Approach Distances in these Electrical Safety Rules are based on an exclusion zone surrounding exposed electrical equipment where access is prohibited. This defines an area around exposed electrical equipment into which no part of the worker, mobile plant, or object (other than approved insulated tools) may encroach.

When working in the vicinity of electrical equipment work practices shall be established to ensure workers, mobile plant and unapproved objects do not encroach on the safe approach distances.

Refer to the following tables to determine the minimum safe approach distance that shall be maintained from exposed conductors for ordinary persons, instructed persons and authorised persons.

Limit exposure to electrical equipment to the necessary duration for work completion, minimizing overall exposure whenever possible.

4.2 Safe approach distances - persons

Safe approach distance (mm) to live exposed or non-screened conductors for ordinary, instructed and authorised persons.

Table 4 Safe approach distances - persons

Voltage Nominal phase to phase AC (kV)	Ordinary Person	Instructed Person	Authorised Person
Low Voltage - above 50V AC but not exceeding 1kV	3000	1000	500
Above 1kV up to and including 11kV	3000	1200	700
Above 11kV up to and including 33kV	3000	1500	1000
Above 33kV up to and including 132kV	3000	2000	1500
DC - Nominal Voltage			
Above 120V	3000	1000	500
Up to and including 1500V			

Exemptions to Table 4

- Authorised persons may undertake work within the safe approach distance to Low Voltage AC conductors with the appropriate qualifications, skills and Personal Protective Equipment including 1000V insulated gloves on each hand with a protective outer glove.

4.2.1 Safe Approach distance - Ordinary Persons

The safe approach distances for an ordinary person approaching insulated, covered or exposed live conductors are shown in Table 4.

These are the distances beyond the reach of any part of the ordinary person's body or any conducting or unapproved object touching any part of the ordinary person's body.

To maintain these minimum distances from overhead conductors, appropriate allowance shall be made for inadvertent movement, and conductor sag and sway under a variety of conditions.

4.2.2 Safe Approach distances – Ordinary Persons under the supervision of Instructed and Authorised Persons

Where an ordinary person is undertaking work under the direct supervision of an Instructed or Authorised person, instructed person safe approach distances shall apply.

Where continuous direct supervision is not provided to an ordinary person, default ordinary person safe approach distances apply. Dependent on the activity undertaken consideration shall be given to applying greater approach distances than those given in Table 4.

4.2.3 Work by Instructed Person

When instructed persons are required to work in the vicinity of electrical equipment, the instructed person performing the work, the person in control of the work and the authorised person in charge of the electrical equipment shall cooperate to ensure that the work is performed safely and that specific precautions taken.

Instructed persons are those persons performing non-electrical work at or above track level in the vicinity of live electrical equipment, have completed the Metro Induction to Rail Safety and MTS Electrical Safety Awareness courses and demonstrated competence to perform such non-electrical work in the vicinity of live electrical equipment safely.

The safe approach distances for the instructed person approaching insulated, covered, or exposed live conductors are shown in Table 4.

These are the distances beyond the reach of any part of the instructed person's body or any conducting or unapproved or uninsulated object touching any part of the instructed person's body. To maintain these minimum distances from overhead conductors, appropriate allowance shall be made for inadvertent movement, and conductor sag and sway under a variety of conditions.

4.2.4 Work by Authorised Person

The safe approach distances for the authorised person approaching insulated, covered, or exposed live conductors are shown in Table 4.

These are the distances beyond the reach of any part of the authorised person's body or any conducting or unapproved or uninsulated object touching any part of the authorised person's body. To maintain these minimum distances from overhead conductors, appropriate allowance shall be made for inadvertent movement, and conductor sag and sway under a variety of conditions.

4.3 Safe Approach Distance for Vehicles and Mobile Plant

Table 5 Safe approach distance - vehicles and mobile plant, sets out the Safe Approach Distance (mm) to live exposed or non-screened conductors for motor vehicles and mobile plant.

If there is no Safety Observer present, the Ordinary Person distances in Table 5 apply to all workers.

Vehicle and Mobile Plant are defined in Section 2.3 of this document.

Table 5 Safe approach distance – vehicles and mobile plant

Voltage	Vehicle	Mobile Plant	
Nominal phase to Phase AC (kV)		Ordinary Person	Instructed or Authorised Person
Low Voltage	600	3000	1000
Above 1kV, up to and including 33kV	900	3000	1200
Above 33kV, up to and including 132kV	2100	3000	1800
Nominal DC Voltage			
120V to 1500V	900	3000	1000

Exemptions to Table 5:

- Safe Approach Distance for Rail Bound Plant is 500mm from 1500V DC Overhead Wiring for travel only.

4.3.1 Ordinary Persons in Vehicles

An ordinary person in control of any vehicle, excepting mobile plant when in working mode shall ensure no part of the vehicle or its load is placed or moved within the distances shown in Table 5.

4.3.2 Instructed or Authorised Persons in Vehicles

Instructed or authorised persons in control of any vehicle, excepting mobile plant when in working mode, shall ensure that no part of the vehicle or its load is placed or moved within the distances shown in Table 5.

4.3.3 Safe Approach Distances – Mobile Plant

Because of the physical capabilities of, and potential hazard to mobile plant working adjacent to live conductors and or electrical equipment, specific consideration (including earthing) shall be given to the use of mobile plant during the planning of the work.

For safe approach distances to exposed live conductors for mobile plant refer to Table 5.

4.3.4 Use of Mobile Plant

Mobile plant shall only be used in the vicinity of live conductors and /or electrical equipment after precautions appropriate to the circumstances have been considered and action taken to control the associated hazards and risks.

When mobile plant is operating in working mode in the vicinity of electrical equipment, the possibility of inadvertent contact with live conductors shall be considered during the planning and execution of the work.

The control measures to be considered with the risk assessment shall include:

- isolating and earthing electrical equipment; and
- positioning the mobile plant such that the safe approach distance can be maintained in all circumstances; and
- the use of safety observers, barriers and signs; and
- the use of other precautions such as physical restrictions or control devices in conjunction with barriers; and
- the suppression of auto- reclose; and
- de-energising the conductors and/ or equipment.

When mobile plant may come near live electrical equipment, the mobile plant shall be earthed. This shall be achieved by an approved earthing conductor directly connected to the substation earth, rail, or other approved earthing system.

When mobile plant is in operation, precautions shall be taken to protect the operator from hazardous step and touch potentials. No worker other than the mobile plant operator shall touch the mobile plant whilst in operation.

Suspended loads shall be controlled by means of non-conductive rope (tag line) or other approved insulating medium. Neither the mobile plant or conductive winch rope/load shall be touched by any worker while the mobile plant or any conducting object attached is in motion.

During operation of the mobile plant only those workers at ground level involved in the work associated with the mobile plant shall be near the plant; all other workers shall remain clear.

4.4 Handling Objects/Loads

When objects are being handled manually or by mechanical equipment, care shall be exercised to prevent the objects or mechanical equipment infringing safe approach distances.

For manual handling, appropriate work methods and an appropriate number of workers shall be used to maintain safe approach distances.

For manual handling where there is a risk of infringing the safe approach distances to electrical conductors, the movement of loads shall be controlled by means of approved non-conducting ropes (tag lines) or other approved means.

4.5 Erection of Scaffold

Electrically conductive scaffolding shall only be erected in the vicinity of exposed electrical equipment while working under an Electrical Permit to Work.

Fixed scaffolding within 4 metres of MTS Electrical Network equipment or 1500V DC Overhead Wiring and Structures shall be undertaken in accordance with a Safe Work Method Statement and be approved by the Electrical Network Manager.

4.6 Emergency Situations

4.6.1 General Precautions

In emergency situations where there is a likely risk of electric shock to workers or the public from electrical conductors or electrical equipment, prompt action shall be taken to ensure people are kept well clear of the hazard at greater than safe approach distances.

4.6.2 Fallen Conductors to be Considered Live

All electrical equipment and conductors shall be considered live until proven de-energised by approved means.

Initially for fallen or exposed electrical conductors a safe approach distance of 8 metres.

Safe approach distances listed in Sections 5.2 and 5.3 shall only be applied after Engineering Controller (via an MTS Switching Operator) has confirmed that conductors will remain de-energised.

4.6.3 Protection of Workers and Public

Where practicable an Authorised Person is to remain on site to issue oral warnings to any worker or member of the public making an unsafe approach to fallen or exposed electrical conductors and/or access may be controlled using barriers, signs, or other appropriate means.

4.6.4 Emergency Switching

Where required to protect life or prevent further equipment damage, an MTS Switching Operator may operate a suitable isolating device without prior approval from Engineering Control. Where this occurs, the MTS Switching Operator is to notify Engineering Control immediately once it becomes safe to do so.

4.6.5 Fires

4.6.5.1 1500V Equipment

Electrical testing has confirmed that fires associated with live 1500V electrical equipment can be extinguished using hand-held extinguishers and fire hoses when all the following conditions are complied with:

- fire extinguishers are marked “Suitable for use on electrical fires”. The extinguisher's nozzle is not to be used closer than 1.5m to live 1500V equipment.
- fire hoses may be used. However, the nozzle or branch of the hose is not to be used any closer than 3m to the live 1500V equipment.
- fresh water is used.

Brackish or saltwater may only be used after the electrical supply has been removed.

If a major fire occurs in a train, vehicle, or plant within an electrified area, arrange with the Engineering Controller for supply to be removed from the 1500V overhead wiring to ensure fallen live wires do not create additional hazards.

In case of fire in the vicinity of 1500V equipment along the railway lines, take care to prevent persons contacting the equipment, either by falling material or through water that might eject from broken pipes or hoses.

4.6.5.2 High Voltage Equipment

If the fire is in the vicinity of HV equipment the Engineering Controller will arrange for the equipment to be immediately de-energised followed by isolation and earthing.

4.7 Reduced SADs

4.7.1 Testing and Earthing

Testing and earthing procedures on some equipment might bring the operator within the specified SAD.

Only MTS Switching Operators trained in testing and earthing procedures may undertake this work. The work shall be undertaken in accordance with written instructions.

4.7.2 Work on Low Voltage Equipment by Electrical Personnel

Authorised electrical workers, i.e. Qualified Electricians / Linesmen / Cable Jointers may carry out work on low voltage equipment within 0.5m after the associated risks are identified and the risks of contact with live parts controlled through live work procedures or other approved control measures.

4.7.3 1500V cables

4.7.3.1 Unscreened 1500V Cable

1500V unscreened insulated cable shall be treated as exposed 1500V equipment.

Authorised Persons may approach an unscreened insulated 1500V cable to a distance of not less than 50mm, on condition that:

- Cables are inspected and free from damage,
- The reduced SAD is applied to the normally insulated cable only, and not applied to exposed conductor or conductive components connected to the conductor, and
- Extra care is taken when working at the reduced SAD.

4.7.3.2 Screened 1500V Cable

Persons may touch a screened 1500V cable provided it is visually inspected and found to be in good condition.

4.7.3.3 Rail and Negative Return Cables

Rail and negative return cables form part of the traction power system, however, are designed to remain at, or close to earth potential using voltage limiting equipment. No safe approach distance applies to rail and negative return cables although unnecessary contact shall be avoided. Refer to section 2.12 for information on disturbing rail and negative cable connections.

4.7.4 Approach to live High Voltage (HV) insulated cables

When work is performed near live High Voltage insulated cables, appropriate precautions shall be taken to ensure that the insulation is not damaged:

- Cables shall not be moved whilst energised.

- Insulated cables shall not be directly stood upon wherever practical.
- Where it is unavoidable to stand upon live insulated cables a risk assessment shall be conducted, controls applied, and cables protected before any work is carried out.

In excavated cable trenches or cable joint pits if there are cables that are live, as well as the de-energised cables are to be worked on, those live cables shall be covered by a minimum of 100mm of sand or barriers shall be installed for mechanical protection.

Non-destructive Potholing to confirm live cable locations is allowed. Any excavation work including potholing within 2m of high voltage cables shall be risk assessed and controls implemented as per section 5.2.



WARNING: Abandoned or de-commissioned cables shall be treated as live until proven otherwise.

4.7.5 Earthed Metallic Sheathed or Screened High Voltage (HV) Cable

Contact by workers may be made to external surfaces of live HV cables protected with earthed metallic sheaths or screens.

No contact shall be made to external surfaces of cable terminations that are not screened.

5 Access for Work on or Near Electrical Equipment

5.1 General

To protect people and equipment, access to electrical equipment on the MTS electrical network shall be completed in accordance with these rules. These rules are written to provide safe access by minimising electrical risks. Safety is maintained by:

- Separation; maintaining Safe Approach Distances
- Isolation & earthing; removal and discharge of electrical energy
- Permit issue; administrative control of access

Access to Electrical Network Facilities and Equipment is managed in accordance with MTS-AEL-PR-78225 - Electrical Network Access Request Procedure.

5.2 Risk Assessment

Before any work is performed a risk assessment shall be completed. Control measures and the precautions undertaken shall be recorded. Where control measures are identified during the risk assessment process, then instructions shall be issued to the workers outlining these controls.

Control measures may include:

- defining the work area
- isolating and earthing of the electrical equipment; or
- de-energising live electrical equipment adjacent to the work area; or

- the use of barriers and signs; or
- the use of approved covering; or
- the use of safety observers; or
- the issue of an electrical permit; or
- defining access routes.
- Safe Work Method Statements

Any electrical permits shall be issued in accordance with these rules.

5.3 Permits

An Electrical Permit shall be issued for all work that requires isolation and earthing of electrical equipment except:

- Electrical equipment (cables, OHW, etc) under construction,
- work on abandoned HV cables,
- Low voltage isolation undertaken in accordance with the MTS Lock Out, Tag Out and Test procedure,
- for work by another Network Operator where an Operating Agreement (OA) may be issued.

An Electrical Permit for work may be issued for work on equipment without isolation or earths/rail connections applied, when this occurs a note shall be included in the Special Instructions noting no access to primary conductors or equipment containing hazardous voltages.

Electrical Isolations on the MTS Electrical Network are controlled by the Engineering Controller using a Switching Program.

Where isolation and earthing of another Network Operator's services is required for completion of work, an Operating Agreement shall be received from the Network Operator concerned before commencement of work near the Network Operators services. It is the responsibility of the MTS Switching Operator in charge to receive the OA from the Network Operator.

Arrangements for the isolation of another Network Operators services are to be made through the Electrical Network Manager.

5.4 Defining a Safe Work Area

Where the risk of inadvertent access to live equipment within substations exists, the Electrically Safe Work Area shall be defined using yellow demarcation tape / chain and temporary warning signs.

Work area markers shall be installed by an MTS Switching Operator. The Permit Holder may lower the Barrier temporarily only to allow materials/equipment to be brought into the work area.

Access to the work site shall be defined by appropriate access markers.

5.5 Spiking or Remote Cutting of Cables

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

For LV cables spiking or remote cutting is not required where:

- the LV cable is located clear of HV cables, and
- cable markings clearly indicate that the cable is an LV cable.

In these circumstances it is appropriate to arrange for normal isolation and proving dead/de-energised to be carried out.

5.6 Removal of Supply

Switching Programs are to be used to ensure Electrical equipment is made safe for access by isolation, earthing and/or rail connecting and the issue of permits.

No high voltage or 1500V equipment is to be taken out of service without the prior approval of the Engineering Controller, except where a life-threatening situation exists.

- A Switching Program shall be issued in accordance with MTSMS-EL-PRO-000019 - Switching Program Procedure.
- Prior to the commencement of a Switching Program, the MTS Switching Operator in charge shall contact the Engineering Controller and advise their name, the number of the Switching Program held and the staff arrangements for field switching.

The Engineering Controller shall only give clearance to proceed with switching to an MTS Switching Operator.

5.6.1 Isolation Points

All Isolation Points used for the removal of supply shall be Locked and Danger Tagged.

No work shall be permitted on any Isolation Point while Locked and Danger Tagged under a Switching Program or Permit.

5.6.2 Earthing/Rail Connecting Locations

Earths shall be applied to high voltage equipment between each source of supply and the Safe Work Area.

At least one rail connection shall be applied to each 1500V OHW section.

Where equipment is fully enclosed, and where an earth and/or rail connection has been applied at all sources of supply, the equipment need only be proved dead/de-energised prior to work.

5.7 Additional Requirements for 1500V Switching Programs

5.7.1 Authority for Removal of Supply from 1500V Section

Where work involves the removal of supply from a 1500V OHW section, an 'Authority for removal of supply from 1500V section' shall be used in conjunction with the switching program.

5.7.2 Switching Programs for Section Overlaps or Section Insulators

Where work is required within a Section overlap or on a section insulator, the isolated area shall extend beyond the full length of the section overlap.

5.8 Restoration of Supply

Permit Holders are responsible to ensure that electrical equipment is safe to return to service on the completion of their work. If equipment is not available for return to service, the MTS Engineering Controller is to be advised and arrangements made to isolate the equipment as Out of Service (OOS).

High voltage equipment shall not be returned to service until all necessary tests and phase checks have been satisfactorily carried out, and approval has been obtained from the Engineering Controller.

5.9 Removal of 1500 Volt Supply Under Emergency Conditions

5.9.1 Threat to human life – Rescue Power Outage

Where there is an immediate threat to human life, a Rescue Power Outage (RPO), may be used, to:

- Protect casualties from further injury, and
- Allow rescuers to come near or touch the 1500-volt overhead wiring or High Voltage Equipment for the purpose of effecting a rescue.
- Allow Emergency Services to access the MTS Rail Corridor

On becoming aware of the need for an RPO, the engineering controller shall enact the Rescue Power Outage Procedure.

5.10 Protection of Infrastructure and Sustained Faults

Under emergency or fault conditions, where there is a sustained fault, risk to infrastructure or a train operation irregularity, supply may be removed without a Switching Program.

In such circumstances the Engineering Controller shall undertake remote operation or arrange for local switching to be completed to protect infrastructure and isolate a faulted section. Each switching operation shall be recorded.

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, a Rescue Power Outage (RPO) shall be initiated.

If work is to be completed within the safe approach distance for the equipment an Emergency Switching Program and permit shall be issued.

5.11 Pantographs in Emergency Conditions

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

A Permit shall not be issued for work on a section/subsection of the overhead wiring where a train or other electric vehicle is bridging the isolation for the section, including when pantographs are lowered or secured.

6 Low Voltage Distribution System

This procedure describes the procedures for working on the Low Voltage (LV) Distribution System.

6.1 General

This section is limited to LV systems immediately associated with High Voltage (HV) equipment, 1500V traction power equipment and the LV distribution system.

Requirements for the safe isolation of general LV equipment is contained within MTS-AEL-PR-78220 - MTS Lock Out, Tag Out and Test (LOTOT) procedure.

6.2 Safety Requirements

In general, supply shall be removed from exposed low voltage equipment prior to work on or near such equipment. When supply is to be removed for work on or near LV equipment, the equipment shall be:

- Isolated, and
- DANGER Tagged, and
- Proved dead/de-energised, and
- where required an Electrical Permit to Work issued before any work commences.

The isolation plan shall consider the presence of alternate supplies. It is essential to check the possibility of back-feed or feeding from other energy sources such as back-up supplies, Uninterruptible Power Supplies (UPS) and capacitors. Where circuit configuration warrants, the possibility of induced voltages being present shall also be considered.

Insulated tools are to be used where practicable, even if the supply has been removed.

6.2.1 Specific Safety Requirements

Supply shall be removed before work is to be performed which involves either:

- The connection between the main neutral and the earthing system being disturbed, or
- A neutral conductor which is carrying load current is broken.

If work involves the earth conductor for a portion of the installation becoming discontinuous, supply shall be removed from that portion of the installation.

LV isolation points shall be DANGER Tagged and shall be secured either directly with an MTS Operator lock or by securing the switchboard or switch room.

LV insulating gloves and leather outer gloved shall be worn where there is a risk of inadvertent contact with exposed live LV conductors. At other times, where practicable, mechanical protection gloves are to be worn to protect against minor injuries such as cuts and splinters.

The isolated equipment to be worked on shall be checked to ensure correct isolation.

6.2.2 Live Work (Low Voltage only)

Work shall only be carried out live when it can be performed safely, and either:

- it is necessary in the interests of health and safety that the electrical work is carried out on the equipment while the equipment is energised, or
- it is necessary that the electrical equipment to be worked on is energised for the work to be carried out properly, or
- it is necessary for the purposes of proving dead/de-energised, testing or fault finding, or
- there is no reasonable alternative means of carrying out the work.
- Work shall be in accordance with an approved Safe Work Method Statement.

6.2.3 Non-contact LV Proximity Detectors

When carrying out work on LV equipment, all qualified persons shall have immediate access to an approved non-contact LV proximity detector, also commonly known as a 'volt stick'.

Unless working live in accordance with section 7.2.2 above, each conductor, LV electrical equipment or installation shall be proved dead/de-energised and verified as /de-energised using a non-contact LV proximity detector before work is carried out.

The MTS Switching Operator shall use the LV proximity detector to test a LV cable before cutting if:

- the cable was previously live, or
- both ends of the cable are not local to the work site and not obviously disconnected.

Persons using a non-contact LV proximity detector shall always:

- Prove the LV proximity detector to ensure correct functioning immediately before use by using a known live LV source.
- Ensure that the LV electrical equipment has been de-energised before touching.
- Immediately after use, prove the LV proximity detector is functioning.

Non-contact LV proximity detectors have limited application and cannot be used:

- On DC electrical equipment or installations.
- On extra low voltage equipment, outside of the operating range of the non-contact LV detector.
- Near another live circuit or electrical equipment, the non-contact LV detector works on induction principles and can give a false "live" due to proximity of other conductors.
- On neutral conductors – if there is any doubt about the identification of a neutral conductor and there is potential for it to be carrying current – test with a clamp type ammeter before disconnecting.

6.3 Warnings

Always ensure that all circuits are isolated, otherwise use live work techniques.

Electrical workers are at risk of contact with live parts when:

- Altering or adding to switchboards.

- Cutting into cables, conduits and other wiring enclosures.
- Making connections in junction boxes that contain numerous circuits.
- Touching parts of installations that are not isolated by a main switch.
- Touching neutrals without proving dead/de-energised (as neutrals may become live due to possible cross connections).
- Dual supplies are connected to appliances.
- Circuits are not isolated by control switches.
- Supply could be readily reconnected by others.

6.3.1 Work on Low Voltage Substation Controls and Auxiliaries

All work on low voltage substation equipment, which is not for general power and lighting, shall be carried out by or supervised by an MTS Switching Operator.

6.3.2 Phase Identification of 3-Phase Low Voltage Services

It is essential to identify the neutral and the correct phase conductors for 3-phase LV services.

6.3.3 Tests before Paralleling Two Separate LV Services

Prior to paralleling two separate LV services, tests shall be carried out to ensure the correct connection of phases and the neutrals.

This test may not be required if the two separate LV sources have been paralleled previously, and it is sure that there is no subsequent change in phasing of either circuit.

6.3.4 Isolation of Low Voltage Equipment

6.3.4.1 General

Low voltage equipment shall be isolated from all sources of supply by providing at least one break in each active conductor through which the equipment could be made live from these sources.

Breaks shall be provided by:

- Opening a circuit breaker, or
- Removing fuses, or
- Opening isolating switches, or
- Disconnecting conductors.

Devices operating in a control circuit, such as an emergency stop or limit switch, are not to be used as the sole means of providing isolation.

The devices providing isolating breaks shall be DANGER Tagged and where practicable locked.

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

6.3.4.2 Isolation by the Operation of High Voltage Switches

High voltage (HV) equipment shall be operated under a Switching Program.

Correct isolation procedures for specific equipment are covered in MTS-AEL-MN-78101 Equipment Operating Manual.

6.3.4.3 Isolation by the Breaking of Connections

When isolation of LV equipment is achieved by the breaking of connections, the active conductors shall be disconnected first, followed by the neutral conductor and the earth conductor last. Disconnected conductors are to be secured in a position which will prevent possible contact with any live terminals or equipment.

The reverse of this disconnection procedure shall be followed for reconnection on restoration of supply.

6.3.4.4 Isolation of Back Feeds or Alternative Feeding

Where isolation has been undertaken by the opening of HV or LV switches, it is essential to check the possibility of back feed or feeding from other energy sources such as back-up power supplies, Uninterruptible Power Supplies (UPS), solar grid inverters and capacitors. Where the circuit configuration warrants, the possibility of induced voltages being present shall also be considered.

7 Permits

7.1 General

Permits are used under these rules to manage the safe access to electrical facilities and equipment. Work within the Safe Approach Distance for the equipment is considered access.

Permits are used for access to the following;

- High Voltage (HV) equipment.
- 1500 V DC equipment.
- Low Voltage (LV) distribution equipment.

Access to general low voltage equipment is controlled through the MTS, Lock Out, Tag Out and Test (LOTOT) procedure.

MTS uses the following permits under these rules;

- Electrical Permit to Work (EPTW). Refer to MTS Electrical Permit to Work (NWRLOTS-NRT-SWD-SF-PRM-726004).
- Test Permit.
- Operating Agreement.

7.2 Permit Issuer

A Permit Issuer is the person trained and authorised to issue permits under these rules. A Permit Issuer is normally the nominated MTS Switching Operator or may be a person specifically authorised for this task.

7.2.1 Responsibilities of a Permit Issuer

Permit Issuers are responsible for the following tasks when issuing and cancelling a permit;

1. Where the Safe Work Area is within 0m of any live exposed MTS Electrical Network equipment this shall be specifically noted on the EPTW.
2. To ensure barriers and signage required for the purposes of issuing the EPTW are erected.
3. Instructing the Permit Holder on, and confirming their understanding of the requirements and conditions contained within the permit.
4. Not issue an EPTW to a Holder who is not authorised, considered incompetent, insufficiently interested, inattentive or not fit for duty when the MTS Switching Operator is issuing instruction for the EPTW.
5. Not issue an EPTW when there is concern that the isolation is incorrect for the work to be carried out.

7.3 Permit Holders

Permit Holders shall:

- hold authorisation from MTS as a Permit Holder for the permit held, and
- have been instructed on the details of the permit by an authorised MTS Switching Operator.

Persons who do not hold appropriate certification are not permitted to hold a Permit.

An Operating agreement may be issued to the nominated representative of the organisation requesting the work.

7.3.1 Responsibilities of a Permit Holder

Permit Holders are responsible for the following tasks when receiving, holding, and working under a permit:

- Understand the limits of the EPTW, the precautions and control measures that have been taken and any relevant warnings
- Understand that adjacent electrical equipment shall be regarded as live, and the usage of yellow barriers.
- Ensure that all members of their work group understand the conditions of, and sign on to, the permit,
- Comply with the requirements of the permit,
- Notifying the current holder of the Switching Program, under which the permit is issued, if they transfer a permit,
- Applying and removing working earths and working rail connections.

7.4 Persons Signing onto a Permit

The Permit Holder shall ensure that all persons who will be carrying out work under the Permit understand and sign on to the Permit prior to commencing work.

7.4.1 Responsibilities of a Persons Signing Onto a Permit

Persons signing onto a Permit are responsible for the following:

- understand the instructions given by the Permit Holder,

- understand the limits of the EPTW and are aware of any relevant warnings,
- When workers print their name, sign, they understand and agree with the following:
 - have received information from the Permit Holder about the work to be undertaken which is covered by the EPTW,
 - are aware of the danger of contacting or coming near live equipment,
 - can stay outside the relevant safe approach distances (SAD) from live equipment,
 - When the work is completed or when an individual finishes the work, they must sign under the 'Sign Off' column on the same line as the 'Sign On' column.
- When workers sign off and write in the time and date, it means that they both understand and agree they have stopped work will treat the equipment as live.

7.5 Loss of an Electrical Permit

If the Permit is lost or damaged, the Permit Holder shall immediately report the loss to one of the following:

- The current holder of the Switching Program, under which the permit is issued.
- The Engineering Controller.

The work group shall be stood down.

The MTS Switching Operator who would have cancelled the Permit shall obtain written notification from the Permit Holder that:

- All persons and material are clear of all electrical equipment for which the Permit was issued, and
- All persons who signed on to the original Permit have been instructed to treat the equipment as live.
- A walk of the work area has been completed to ensure that no workers remain onsite.

The MTS Switching Operator shall also ensure that the loss and replacement action is recorded on the Permit Register, and a replacement permit may be issued with a new number.

7.6 Electrical Permit to Work

7.6.1 Overview

An Electrical Permit to Work is the primary safety document for work on or near the following electrical equipment:

- High Voltage (HV) equipment.
- 1500 V DC overhead wiring or cables.
- Low Voltage (LV) distribution equipment.

An Electrical Permit to Work is issued by a Permit Issuer to a Permit Holder as confirmation that the listed electrical equipment has been made safe by some or all the following:

- Isolated,
- Proved dead/de-energised,

- Earthed and / or rail-connected,
- within the defined Electrically Safe Work Area,
- The above conditions will remain in place until the Permit is returned and cancelled.

7.6.2 Inclusion of Low Voltage Equipment

Where LV distribution equipment shall be isolated and proved dead/de-energised for the work, it shall be included on the Electrical Permit to Work.

7.6.3 Construction of New Electrical Equipment

Where construction of new electrical equipment does not encroach on the SAD (Safe Approach Distance) to existing electrical equipment the issue of an Electrical Permit to Work is not required, until the new equipment is connected to the MTS Electrical Network.

7.6.4 ‘No Access’ Electrical Permit to Work

When work is to be undertaken requiring equipment to be de-energised for safety or operational purposes, but access within the Safe Approach Distances is not required, a ‘No Access’ Electrical Permit to Work shall be issued.

The words ‘No Access to Primary Conductors – Treat equipment as LIVE’ shall be entered into the Electrical Safe Work Area.

7.7 Test Permit

7.7.1 Overview

Where it is necessary to apply a hazardous voltage or remove earths or rail connections to enable test equipment to be used, a Test Permit shall be issued.

The following work may be carried out under a Test Permit:

- Connection and disconnection of the test equipment,
- Application of hazardous voltages for the purpose of testing,
- Adjustment of the test equipment,
- Minor works associated with testing (such as making or breaking connections).

Application of test equipment shall be carried out with the electrical equipment earthed or rail connected unless it is carried out in a manner that does not require persons to come within the Safe Approach Distance of the electrical equipment.

Control of earthing and rail connection equipment made available for operation by the “Test Permit” holder and fitted with “restricted use” tags by the Permit Holder for the duration of the testing. This equipment may then be operated only at the discretion and direction of the Permit Holder by suitably qualified persons.

7.7.2 Special Requirements

The electrical equipment to be tested shall be isolated and earthed or rail connected in accordance with the relevant Switching Program prior to the issue of the Test Permit.

Whilst the Test Permit is current:

- All other Permits issued under with the Switching Program shall be cancelled prior to the Test Permit being issued.
- The equipment shall remain isolated.
- The earths or rail connections shall only be removed for the time required to conduct the test.
- The Switching Program is not permitted to be cancelled while a Test Permit is in force.

All other conditions applicable to an Electrical Permit to Work apply to the Test Permit.

7.7.3 Adjustment of Safe Approach Distances

To allow completion of testing adjustment (reducing or increasing) of safe approach distance may be required. Additional care is required during the period for which earths or rail connections are removed and all persons shall remain outside of the required Safe Approach Distance from the electrical equipment. Recommended distance is the greater of that prescribed in Table 7 Safe approach distances - persons for:

- The nominal equipment operating voltage, and
- The test voltage.

7.7.4 Adjacent 1500V DC OHW Sections

Where the test voltage exceeds the rated voltage of the equipment, the overhead wire sections adjacent to the test section shall be rail connected to protect against:

- Leakage across section insulators and insulated knuckles, and
- Danger from pantographs bridging live to dead/de-energised sections.

7.7.5 Person Holding a Switching Program for a Test Permit

The person in charge of the Switching Program shall:

- Be in charge of all current Switching Program's covering the electrical equipment, which is under test, and
- Prior to the issuing of the Test Permit, check with the person carrying out the tests:
- The details of tests to be carried out, and
- The isolation and earthing or rail connecting arrangements.
- Ensure that no other Electrical Permit to Work is in force for the electrical equipment being tested, and
- Issue the Test Permit to a suitably qualified Permit Holder.

7.7.6 Person Carrying Out the Test

The person carrying out the tests shall have sufficient knowledge of the test procedures and is responsible for ensuring that the testing is carried out safely.

7.8 Operating Agreements

7.8.1 Overview

Operating agreements are an administrative control used to communicate an agreed network state between Electrical Network Operators.

An Operating Agreement only certifies the equipment state and confirms that the nominated equipment will remain in the listed state until the Operating Agreement is returned.

7.8.2 Instruction of the Person Receiving the Operating Agreement

As Network Operators use unique procedures and documents it is important that Permit Issuers ensure the holder of the operating agreement clearly understands the content of the Operating Agreement.

Permit Issuers shall ensure that the representative of the other Electrical Network Operator understands:

- which electrical equipment is covered by the operating agreement,
- the requirements of the operating agreement,
- time and date restrictions of the operating agreement,
- equipment state and location relative to the other network operator's equipment.

Permit Issuers shall ensure the holder of the operating agreements provides their name and contact details in the space provided.

APPENDIX A: Version History

Approval Record

Function	Position	Name	Signature	Date
Prepared by	A/Electrical Network Manager	Andrew Heberley		23/09/2026
Reviewed by	Senior Electrical Engineer	Danilo Banganay		22/09/2026
Reviewed by	Principal Engineer - Electrical	Zahir Kureshi	 Zahir Kureshi (22/09/2026 14:49:04 GMT+10)	22/09/2026
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Approved by	Interim General Manager, Safety, Quality, Risk & Environment	Helen Wilkinson	 H Wilkinson (23/09/2026 08:32:05 GMT+10)	23/09/2026
Approved by	General Manager, Engineering & Maintenance Delivery	Michael Leah	 Michael Leah (22/09/2026 16:17:52 GMT+10)	22/09/2026

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Amendment Record

Date	Rev	Amendment description	By
22/02/2017	1	Original issue.	John Minchin
23/06/2017	1.1	Following HV Operator Consultation.	John Minchin
15/12/2017	1.2	Added Authorised Attendant section 6.1 and References Section 7 added ENA standard.	John Minchin
15/12/2017	1.3	Section 4.2.2 d) removal of Engineering Controller as they issued the Authority.	John Minchin
25/01/2019	1.4	Correction of designations per updated MTS organization structure.	Taha Rizvi
1/02/2021	2	Major change. Consolidation and clarification of rules and definitions. Amendment to permit types and application.	Peter Robertson

17/01/2022	2.1	Minor changes, consolidation of instruction and authorisation section.	Peter Robertson
4/06/2024	03	Major Change to document: • Training Requirements for Electrical Workers • Removed procedural content • Changes to Safe Approach Distances • Alignment with business-as-usual processes.	Jeff Gordon
21/09/2026	04	Update relating to AEN-2021-08-04-HV-1S Change of signatories. Conversion to new template. Removed section 1.3 Conventions which specified roman numeral lists must be done in sequential order. Such sequential steps are listed using numbered lists and section 8.2.1 responsibilities of a permit issuer has been made into a numbered list. Added explanation of ENA NENS 04-2006. Added note about people with pacemakers are not allowed to access to MTS Electrical Network Substations due to risks.	Andrew Heberley / Peter Simcic / William Russell

APPENDIX B: Glossary and List of Terms

Term	Definition
EPTW	Electrical Permit to Work
ESR	Electrical Safety Rule
ROM	Railway Operating Manual
1500V DC Traction System	Electrical equipment including Overhead Wiring that normally conducts, isolates or may be energised with a voltage of greater than 1500 volts DC including the secondary circuit of rectifier transformers, for the purpose of supplying electricity to Trains and/or Rollingstock. For the purpose of Safe Approach Distances, negative equipment which is normally at rail potential (connected to rail) is not considered to be 1500-volt equipment. Note: the 1500-volt DC Traction System is treated as High Voltage in the MTS Electrical Safety Management System (except where specifically specified otherwise).
Adjacent section(s)	Adjacent section refers to the section of 1500V OHW or High Voltage equipment at each end of and adjacent to (beside when not physically separated, i.e. separate Tunnel) the incident section.
Approved	Unless otherwise stated, means approved in writing by the Electrical Network Manager or a person nominated for that purpose by the Electrical Network Manager.
Authorised / Authorisation	Has the permission of the appropriate organisation in writing for the duty concerned.
Authorised for substation access	Means a person authorised to enter a substation and in accordance with these rules undertake specific functions.
Authorised Person	‘Authorised Person’ means a person with technical knowledge or sufficient experience who has been approved or has the delegated authority to act on behalf of the network operator, to perform the duty concerned (ENA NENS 04).
Authority for Removal of Supply from 1500 Volt Sections	The MTS form, completed and signed, used whenever it is necessary to remove supply from a section or subsection of the 1500-volt overhead wiring system.
Barrier in	A method of establishing a barrier to define a safe work area which is within the confines of the barrier.
Broad supervision	Means the worker does not require constant supervision but requires personal contact with an authorised person on at least a regular/occasional basis when working on electrical equipment. Regular/occasional basis means being under instruction and direction with checks being carried out on completion of multi-tasks and before energising of circuits and/or equipment.
‘Danger – Do Not Operate’ Tag	A warning notice attached to a controlling switch or other equipment as a warning not to operate such equipment where this could cause injury to staff or damage to

	equipment. This tag shall be a label, tape or other device with the word "DANGER – DO NOT OPERATE" displayed on it along with other relevant details.
Dead	Refer to de-energised.
De-energised	Below a voltage at which it is safe to apply earths or rail connections, by disconnecting from all sources of supply, but not necessarily isolated, earthed / rail connected or out of commission.
De-energised section	A section of 1500 volt overhead wiring from which supply has been removed. Warning: Although a section of OHW is de-energised, this does not mean that the equipment or the section of the OHW is safe to work on.
Direct supervision	Means the personal supervision of a worker on a direct and constant basis, within visual contact and/or earshot (audible range). Constant basis refers to the continuous supervision of tasks being performed (for a trainee, direct supervision is provided until skill is demonstrated for the complexity of the task and work environment).
discharged to earth, discharged	Connected to earth (earthed) or short circuited for sufficient time to ensure that any energy stored in capacitors, or in the electrical equipment or the cable capacitance, is discharged.
Disconnected	Electrical equipment to which there are no electrical connections, and which cannot be made live by switching or the making of bridges. Withdrawable type circuit breakers, switches and switch fuses become disconnected equipment when fully withdrawn.
Earthed	Earthed means directly electrically connected to the general mass of earth to ensure and maintain the effective dissipation of electrical energy.
Electrical Distribution System	The independent electricity distribution network operated by MTS as an integral part of its rail operations. The network interfaces with the high voltage networks of the external adjacent Distributor via bulk supply points and includes associated control wiring. The network consists of insulated cables, High Voltage Switchgear and the associated control and protection equipment and operates as a HVAC and LVAC power distribution network. Note: The 1500VDC Overhead Wire is not considered part of the electricity distribution network.
Electrical equipment	Electrical equipment which includes any generator, transformer, switchgear, reactor, capacitor, control gear, conductor, cable, rectifier or other electrical equipment, parts of which may normally be energised at a high voltage, low voltage or 1500 volts DC. Note: electric rolling stock and electrical equipment within rolling stock are not regarded as electrical equipment.
Electrical Installation	The Electrical Installation within the MTS Network is all Low Voltage equipment permanently connected to a Low Voltage supply.

	The demarcation between the Electrical Installation and Electrical Distribution System is the Main Switch within the Main Switchboard, The Main Switch is part of the Electrical Installation, and the Line Side Cable/Connections are Electrical Distribution Equipment.
Electrical Network	It comprises the: • low voltage, high voltage electrical distribution system, and, • 1500-volt dc traction power system, and • the associated protection and monitoring systems.
Electrical Network Facilities	Any room, building or location that contains High Voltage Electrical equipment, excluding HV Cable Routes.
Electrical Network Manager	The person, specifically authorised under these rules with the appropriate delegated authority, engineering competence and experience to make judgements concerning electrical safety. The electrical network manager is delegated as the electrical authorising officer.
Electrical Permit	An Electrical Permit to Work, a Test Permit, an Operating Agreement or variant as appropriate. Note: in some cases, this is abbreviated to Permit where it is clear from the context that it is referring to an Electrical Permit.
Electrical Permit to Work	The pre-printed form completed and signed, which is issued by an MTS Permit Issuer to an Authorised MTS Permit Holder, to define the electrical distribution or 1500-volt traction power equipment on or near which work may be carried out. The work and the extent of the electrically safe work area are described on the form.
Electrical work	The actual physical work of: • constructing, installing, maintaining, repairing, altering, removing, testing, replacing, adding to commissioning or decommissioning, or • removing or restoring supply to, electrical equipment on the electrical system or the supervising of that work. Note: The erection, modification and dismantling of 1500-volt OHW support structures is not considered to be electrical work. Exemptions to ‘electrical work’ are listed in the Work Health and Safety Regulation section 146.
Energised (live)	Connected to a source of electrical supply or subject to hazardous induced or capacitive voltages.
Engineering Controller	The MTS employee or delegate that is trained, competent and authorised to control the MTS electricity network. This role is a subset of Authorised Person.
Exposed electrical equipment	Electrical equipment where approach to the normally live portion of the equipment is not prevented by a barrier, insulating material or an earthed metal shield. Exposed energised part means a part is: • exposed where it is bare or not effectively insulated or guarded by a fixed barrier or an earthed metal shield; or

	energised until it is isolated and proven to be de-energised and not likely to become re-energised; if the part is a high-voltage conductor, it is considered energised until it is earthed.
Extra low voltage	A nominal voltage not exceeding 50V ac or 120V dc.
Floating	Insulated from earth, rail and all sources of supply but where failure of such insulation may result in it becoming energised.
General supervision	Means the worker does not require constant attendance of the supervisor but requires personal contact with an authorised person on a recurrent/periodic basis when working on electrical equipment. Recurrent/periodic basis means being under instruction and direction for tasks being performed with checks and tests being made prior to commissioning and/or energising of circuits and/or equipment.
High voltage	A nominal voltage that exceeds low voltage. The 1500-volt DC Traction System is treated as High Voltage in the MTS Electrical Safety Management System.
Induction	Production of a magnetic or electrical state in a body by proximity (without contact) of an electrified or magnetised body.
Inspection	Non-invasive activities that do not meet the definition of work.
Instructed Person	Instructed Person means a person adequately advised or supervised by an Authorised Person to enable them to avoid the dangers which electricity may create. (ENA NENS 04)
Insulator	An item or assembly consisting of non-conductive material and any associated intermediate couplings, used for the purpose of mechanically connecting electrical equipment at different potentials.
Isolated (electrically)	Disconnected from all possible sources of supply by opening of switches, withdrawal of circuit breakers, removal of fuses, links, bridges and / or connections, and rendered incapable of being made live without premeditated and deliberate operation, normally by the application of a lock and tag.
Isolation Point	Any device used to isolate an energy source from a 'Safe Work Area' where a Lock and Danger Tag is applied. and Any device included on a Switching Program in the section 'Isolation Points' on a Switching Program or Permit.
Line Manager	Is an MTS employee or delegate who has management responsibility, or in the case of a non-MTS employee, "a person conducting a business or undertaking" (PCBU).
Live (alive, livened up)	Refer to energised
Live line work	All work performed on components of an aerial line or overhead wiring which is energised, or capable of being energised, without implementing the full protective practice of isolating, proving de-energised and earthing / rail connecting at the worksite.

Local instruction	An operating instruction written for a specific item of electrical equipment. Local instructions are in place for electrical equipment for which the generic operating procedures are insufficient.
Lone Worker	Lone working is when work activities are carried out without the direct and immediate support of supervisors or colleagues. Refer to Lone Worker policy for NWRLOTS-NRT-ADM-GN-PPT-720287
Low voltage	A nominal voltage exceeding extra low voltage but not normally exceeding 1000 volts alternating or 1500 volts direct current. The 1500-volt DC Traction System is treated as High Voltage in the MTS Electrical Safety Management System
Low voltage distribution system	A system comprising all the low voltage electric wiring, cables, aerial lines, accessories, fittings, consuming devices, control and protective gear and other equipment used by an Electrical Network Operator for the purpose of the conveyance to, measurement and control of, electricity to one or more electrical installations. A low voltage distribution system may also include isolating transformers, the distribution main earthing system e.g., bond to water pipe, bond to earth electrode, attached earthed LV equipment, and earth bonding to an overbridge or footbridge supporting 1500-volt Equipment, changeover contactors, metering equipment, and other equipment.
Low voltage installation	All the low voltage electric wiring, accessories, fittings, consuming devices, control and protective gear and other equipment associated with the wiring situated in, on, or beyond any building, structure or premises to which electricity is supplied or is to be supplied through any one or more low voltage mains or submains from a substation or distribution aerial line. This includes substation general lighting and power but excludes equipment used for the transmission or distribution of electricity.
Metro Trains Sydney	The company engaged by Transport for NSW to operate the Sydney Metro Northwest, and City and Southwest networks.
Mobile Plant	includes Plant that: (a) moves either under its own power, or is pulled or pushed by other mobile plant (b) moves on or around the work site, enters or leaves the site, or moves past the site (c) includes road vehicles operating at a worksite
MTS Switching Operator	An Authorised Person who is specifically trained and authorised to undertake the role of electrical MTS Switching Operator in accordance with these rules. This role is a subset of Authorised Person.
Network Operating Protocol	An agreement between Electrical Distributors for the isolation and restoration of assets interfaced between the two organisations.
Operating Agreement	A form completed and signed which is issued by one Electrical Network Operator to another, as an undertaking that the listed electrical equipment will remain isolated,

	proved dead/de-energised and if required earthed or rail connected as appropriate until the form is returned. The work on the listed electrical equipment is carried out in accordance with the conditions specified on the Operating Agreement and the receiving Electrical Network Operator's Safety Instructions and Permit System.
Electrical Operating Diagrams	The set of electrical diagrams comprising 1500-volt Sectioning diagrams, and HV System Diagrams.
Operating work	Work involving any of the following: - the operation of switches, link switches and circuit breakers, or - use of specially insulated equipment, or - the opening or closing of links or other connections intended for ready removal, or - the removal or replacement of fuses, or - proving that electrical equipment is de-energised, or - application and removal of earths and short-circuiting links, or - application and removal of rail connections.
Operational Switching	Operation of High Voltage equipment for network configuration purposes not relating to isolations or permits.
Out of Service tag	Out-of-service are used to identify electrical equipment that is not safe to use or fit for purpose. The out-of-service shall: - be an MTS approved out-of-service - be durable and securely attached - clearly state the nature of the defect or reason why the electrical equipment is unsafe - be attached on a prominent position on each isolation point, and - only be removed by a competent person after fixing or rectifying the defect and making the electrical equipment safe or replacing with a danger tag in preparation to work on the equipment.
Overhead Wiring (OHW)	Aerial Electrical Conductors supported from Overhead Wiring Structures for the purpose of supply direct current electricity to Trains and Rollingstock.
Overhead wiring structure	Any structure that supports or registers a catenary and/or contact wire, rigid conductor or supports ancillary equipment such as a field switch or surge arrester. These structures can include masts, portals, wood poles, overline bridges, embankments, and tunnels.
Permit Holder	A person trained and authorised by MTS to hold an MTS Electrical Permit to Work and/or Test Permit.
Person / worker	Has the same meaning as 'worker' as defined in the Work Health and Safety Act 2011.
Person conducting a business or undertaking (PCBU)	Has the same meaning as 'PCBU' as defined in the Work Health and Safety Act 2011.
Person in Charge of the Switching Program	The MTS Switching Operator who is authorised to, and holds the Switching Program for an isolation
Personnel Register	A pre-printed form bound to an electrical permit and used to record the names and signatures of all persons working under the Permit.

Plant	Equipment that when in an operating mode could inadvertently encroach on clearances to electrical equipment.
Portable rail connecting equipment	A portable rail connecting equipment set consists of assemblies of insulated flexible cables and clamps and suitable insulated handles, which are used for connecting de-energised 1500-volt Overhead Wiring to rail. The equipment is designed to be applied from ground level.
Prove dead/de-energised	The process of proving that electrical equipment de-energised
Rail Bound Plant	A vehicle and/or plant that when operating on-track, the vehicle and/or plant has a fixed kinetic envelope. The vehicle and/or plant has a fixed and enclosed structure that does not allow for the operators of the vehicle and/or plant to be exposed to the OHW wire. The vehicle and/or plant does not have the ability to carry and transport tooling equipment and/or materials other than handheld tools.
Rail connected or rail connections	The connection of the 1500-volt equipment to the negative return rail or busbar (traction rail) in the approved manner to ensure the immediate effective discharge of electrical energy from the 1500-volt equipment to rail in the event of the equipment concerned being, or becoming, energised. Rail connection may be completed using a suitable connection including a switch or portable rail connection. While equipment may use terms including “short circuiting device”, “maintenance” and “to rail” the term “rail connect / rail connection” is preferred.
Safe Approach Distance (SAD)	The minimum separation, in air, from an exposed conductor or exposed electrical equipment that shall be maintained by a person, or any object held by or in contact with that person (other than insulated objects designed for contact with energised conductors), or any mobile plant operated or controlled by that person. Note: Safe Approach Distances are defined in section 5
Safe Work Method Statement (SWMS)	Means a statement that: - Describes how the work is to be carried out - Identifies the work activities as having safety risks - Identifies the safety risks, and - Describes the control measures that will be applied to the work activities and includes a description of the equipment used in the work, the standards or codes to be complied with, the qualifications of the personnel doing the work and the training required to do the work.
Safety earths	Those earths that are applied to the electrical equipment as close as practicable to the points of isolation. It is not necessary that the conductors be continuous between the point at which the safety earths are applied and the worksite.
Safety Observer	A worker with sufficient knowledge and experience of the task being performed and assessed as competent for the duty of observing and warning against unsafe approach to electrical equipment or other unsafe conditions.

Shall	Indicates that a statement is mandatory.
Short circuit and earth	The procedure for connecting conductors together and connecting them to earth by approved means so that the conductors are at earth potential.
Short circuiting	The bonding of conductors by approved means to minimise potential difference between the conductors.
Spiking, spiked	The procedure for proving that a high voltage cable is dead/de-energised prior to cutting the cable.
Substation	A substation, traction substation, transformer room, Switch room, Sectioning Hut, 1500V link area, 1500V switch area containing switches that connect DCCB's to OHW sections, pole or pad mounted transformer location, containing either high voltage or 1500V electrical equipment.
Switching Program	Refer to MTS-AEL-PR-78218 – Switching Program Procedure.
Traction rail (negative return rail)	The rail(s) by which a return path is provided for the 1500-volt dc traction current from the train to the traction substation.
Vehicle	Equipment (including motor vehicles) that have a fixed transit envelope when crossing or traversing the network.
Work	Physical work of installing, repairing, altering, removing, or adding to equipment or infrastructure. This includes activities that may impact on the operation of equipment or infrastructure.
Work in the vicinity of (exposed electrical equipment)	Work at a distance greater than the Safe Approach Distance but still close enough that the presence of the electrical hazard is to be considered in the planning of the work. Note: There is no single specified outer boundary of the area that is “in the vicinity of” as the boundary varies according to each situation and the work method, materials, and tools to be used.
Work near (exposed electrical equipment)	Work within or potentially within the Safe Approach Distance. Note: The work near distance varies with the equipment voltage and competence of the people performing the work.
Work on (exposed electrical equipment)	Work that requires contact with the normally energised parts of the electrical equipment, either directly or indirectly.
Work party	A group of workers, undertaking a combined activity within a discrete location or portion of the network.
Working earths	Earths that are applied to all AC conductors on which the work is being carried out, on each side of the worksite, to ensure equipotential conditions at the worksite are maintained.

Working rail connection	Rail connection, applied to equipment where work is being carried out, to ensure equipotential conditions of the traction power equipment at the worksite are maintained.
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Site Abbreviations

Term	Definition
ATS	Artarmon Traction Substation
BLV	Bellavista Station
BSP	Bulk Supply Point Substation
BSS	Bellavista Traction Substation
CHE	Cherrybrook Station
CHT	Cherrybrook Traction Substation
CHW	Chatswood Station
CSF	Cheltenham Service Facility
CSH	Castle Hill Station
CTN	Chatswood North Traction Substation
CUD	Tallawong Station
DLS	Delhi Rd Traction Substation
DSY	Southern Dive Substation
ENA NENS 04-2006	National guidelines for safe approach distances to electrical and mechanical apparatus.
EPP	Epping Station
EST	Epping Traction Substation
KVE	Kellyville Station
LGD	Lady Game Drive Traction Substation
MQP	Macquarie Park Station
MQU	Macquarie University Traction Substation
NRW	Norwest Station
NTR	North Ryde Station
RSH	Rouse Hill Station
RSS	Rouse Hill Traction Substation

SBR	Barangaroo Traction Substation
SHT	Hills Showground Traction Substation
SHW	Hills Showground Station
SMTF-N	Sydney Metro Trains Facility – North
SMTF-S	Sydney Metro Trains Facility – South
SPS	Pitt St Traction Substation
SVC	Victoria Cross Traction Substation
SWL	Waterloo Traction Substation
TCR	Canterbury Traction Power Substation
TCS	Campsie Traction Power Substation
TDH	Dulwich Hill Traction Power Substation
TLS	Lakemba Traction Power Substation
TPS	Punchbowl Traction Power Substation

APPENDIX C: Related Documents

Note: some documents will be closely interconnected and will need to be reviewed when this one is changed. Those will be marked yes in the review column below.

Others are simply related content that supplement the material in this document.

Document #	Document Title	Review
NWRLOTS-NRT-SWD-SF-PRM-726006	Authority for Removal of Supply from 1500 Volt Sections	Yes
MTS-AEL-PR-78211	Electrical Operating Diagram Submission and Approval Procedure	No
NWRLOTS-NRT-SWD-SF-PRM-726004	Electrical Permit to Work	Yes
MTS-AEL-PR-78220	MTS Lock Out, Tag Out and Test procedure	Yes
NWRLOTS-NRT-PRD-SF-PRO-727049	MTS Personal Protective Equipment Procedure	Yes
NWRLOTS-NRT-SWD-RS-FRW-720732	MTS SMS Element 32 – Management of Electrical Distribution Network	No
NWRLOTS-NRT-SWD-SF-FRM-726009	Operating Agreement	Yes
NWRLOTS-NRT-SWD-SF-REG-726007	Personnel Register	No
NWRLOTS-NRT-SWD-SF-PRM-726003	Request for Electrical Permit to Work	Yes
MTS-AFR-PR-77204	Rescue Power Outage Procedure	Yes
MTS-AEL-GL-78322	Substation Documentation	Yes
MTSMS-EL-PRO-000019	Switching Program Procedure	Yes

NWRLOTS-NRT-SWD-SF-FRW-726001 MTS Electrical Safety Rules rev04 final

Final Audit Report

2026-09-22

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