

**Engineering System Integrity
Electrical Network Safety Rules**

**Engineering Procedure
Electrical Distribution Unit**

One Method of Safe Working

PR D 78100

**Definitions and Conventions for
Electrical Safety**

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OFFICIAL

Approved by: Associate Director
Electrical Distribution Unit
Engineering System Integrity

Authorised by: Engineering Technical
Publications Manager
System Integrity

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Document control

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1.1	10 September 2018	Amy Atkins	Update of WHS regulation reference
1.2	19 February 2019	Nick Loveday	Update roles and position names to reflect the current organisation
1.3	1 February 2022	ENSR Project Team	Reviewed as part of the ENSR Project.
1.4	9 July 2026	Deepak Sinha	Review to republish on RailSafe.

Summary of changes from previous version

Summary of change	Section
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1 Purpose and scope

To define the Electrical terms used in Sydney Trains *RL D 79800 Electrical Network Safety Rules*.

2 Conventions used in the Sydney Trains Electrical Network Safety Rules

Where instructions contain bullet points, the order in which the list is carried out is not critical. Where instructions contain a list using alphabet letters or Roman numerals, the points shall be carried out in the exact sequential order.

3 Definitions

For the purpose of the Electrical Network Safety Rules, the following meanings and definitions apply:

Term	Definition
Accredited Person	A person who has successfully completed approved Electrical Training.
Aerial line	Any aerial conductor or conductors with associated supports, insulators and other equipment erected, or in the course of erection, for the purpose of the transmission, distribution or conveyance of electrical energy.
Approved	Unless otherwise stated, this means approved in writing by the Associate Director Electrical Distribution Unit or a person nominated for that purpose by the Associate Director Electrical Distribution Unit.
Associate Director Electrical Distribution Unit	Refers to the Associate Director Electrical Distribution Unit, in Engineering and System Integrity, a business unit within Sydney Trains Engineering and Maintenance Branch.
Authorised/ Authorisation	Has the permission of the appropriate organisation in writing for the duty concerned as detailed in <i>PR D 78701 Personnel Certifications – Electrical</i> .
Authorised Person	A person who is specifically authorised to perform the duties defined in <i>PR D 78701 Personnel Certifications – Electrical</i> .
Authority for Removal of Supply from 1500 Volt Sections (Authority)	The Sydney Trains form (refer to <i>PR D 78302 FM01 Authority for Removal of Supply from 1500 Volt Sections</i>), completed and signed, used whenever it is necessary to organise the isolation, proving dead and rail connecting of a section/subsection of the 1500 Volt overhead wiring system.
Certification	The process of assessing competence.
Competency	The consistent application of knowledge and skills to the standard of performance required in the workplace.
DANGER 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" displayed on it along with other relevant details.

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Term	Definition
dead	Below a voltage at which it is safe to apply earths or rail connections.
de-energised	Separated from all sources of supply, but not necessarily isolated, earthed/rail connected or out of commission.
dead section	A section of 1500 Volt overhead wiring from which supply has been removed. WARNING Although electrical equipment or a section of OHW is "dead" or de-energised, this does not mean that the equipment or the section of the OHW is safe to work on.
Design Envelope	The space encapsulating all possible movements of the mobile plant under maximum unrestricted reach, including: - any load attached to the mobile plant, or - any person including tools and equipment occupying the basket of an EWP.
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 means of a visible airgap, e.g. opening a switch, removing a bridge or removing a fuse or circuit breaker.
earthed	Connected to the general mass of earth in the approved manner so as to ensure the immediate effective discharge of electrical energy in the event of the electrical equipment concerned being or becoming live.
Electrical Authorising Officer	A person who has been delegated by the Associate Director Electrical Distribution Unit as the Authorising Authority for specified personnel Authorisations, as detailed in <i>PR D 78701 Personnel Certifications – Electrical</i> .
Electrical Distribution System	The independent electricity distribution network operated by Sydney Trains as an integral part of its rail operations. The network interfaces with the high voltage networks of the external adjacent Distribution Network Service Providers (DNSP) and Transmission Network Service Provider (TNSP) via bulk supply points. The network consists of aerial lines and underground cables. NOTE: The 1500 Volt d.c overhead wire is not considered part of the electricity distribution network.
Electrical Engineer	A person with the appropriate delegated authority and electrical engineering competence and experience to make judgements concerning electrical safety.
Electrical Network Safety Rules (ENSR)	Means the document <i>RL D 79800 Electrical Network Safety Rules</i> and supporting documents as referenced in that document.

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Term	Definition
Electrical Permit	An Electrical Permit to Work, a Substation Access Permit, Low Voltage Access Permit or variant as appropriate (refer to <i>PR D 78500 Electrical Permits</i>). 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 Authorised Person to an Accredited Electrical Permit Holder, to define the safe work area the equipment that has been made safe, any electrical hazards and the safety controls specific to the work area.
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 Volt d.c. NOTE: Electric rolling stock and electrical equipment within rolling stock are not regarded as electrical equipment.
electrical system	• low voltage, high voltage electrical distribution system, and • 1500 Volt d.c overhead wiring system, and • the associated protection and monitoring systems.
Electrical System Operator (ESO)	A person authorised in accordance with PR D 78701 to operate electrical assets.
electrical work	The actual physical work of: • constructing, installing, maintaining, repairing, altering, removing testing, replacing or adding to, or • removing or restoring supply to, electrical equipment 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	Refer to live, livened up.
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.
extra low voltage	A nominal voltage not exceeding 50 Volt a.c or 120 Volt ripple-free d.c.
floating	Insulated from earth, rail and all sources of supply but where failure of such insulation may result in it becoming live.

Term	Definition
height measuring stick	Insulated stick for measuring the height of live aerial conductors or electrical equipment. They are usually telescopic with the lower sections being hollow.
high voltage	A nominal voltage exceeding low voltage. 1500 Volt d.c is treated as a separate case in the Sydney Trains Electrical Network Safety Rules.
ICON Electrical	The Sydney Trains Control and Coordination Unit of Network Maintenance Division embedded within the Infrastructure Control Centre (ICON).
Induction	Production of a magnetic or electrical state in a body by proximity (without contact) of an electrified or magnetised body.
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.
Line Manager	Is a Sydney Trains employee who has management responsibility, or in the case of a non-Sydney Trains employee, “a person conducting a business or undertaking” (PCBU).
live, livened up	Connected to a source of supply, or subject to hazardous induced or capacitive voltages.
live line work	All work performed on components of an aerial line or overhead wiring which is live, 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, found in <i>PR D 78203 High Voltage Operating Procedures</i> and <i>PR D 78305 1500 Volt Operating Procedures</i> , are not sufficient.
low voltage	A nominal voltage exceeding extra low voltage but not normally exceeding 1000 volts alternating or 1500 Volt d.c. 1500 Volt d.c is treated as a separate case in the Sydney Trains Electrical Safety System (<i>RL D 79800 Electrical Network Safety Rules</i> and related documents).
Low Voltage Access Permit (LV Access Permit)	The pre-printed form (<i>PR D 78503 FM01 Low Voltage Access Permit</i>), completed and signed, which is issued by an Authorised Person to define the low voltage electrical equipment near or on/within which work may be carried out. The work and the extent of the electrically safe work area are described on the form.

Term	Definition
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 in one or more 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.
low voltage aerial line	A low voltage aerial conductor or conductors together with insulators, hardware, crossarms, or other associated electrical equipment erected, or in the course of erection, out-of-doors. A low voltage aerial line may be part of a low voltage distribution system or part of an installation. Insulated aerial conductors which are part of an installation and which are erected between a pole or a building and a lighting pole, or between buildings, are not considered to be a low voltage aerial line.
OHW rail connection stick	A specific type of operating stick used for rail connecting, testing and bridging both live and isolated 1500 Volt d.c overhead wiring conductors or equipment.
Operating Agreement	A pre-printed form (refer to <i>PR D 78504 FM01 Operating Agreement</i>), 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 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.
Operating Diagrams	The set of electrical diagrams comprising 1500 Volt sectioning diagrams, Substation a.c diagrams, Substation d.c diagrams, reticulation and system diagrams, signalling and lighting feeder diagrams.
operating stick (rod)	An insulated stick used for operating or working on 1500 Volt conductors or electrical equipment.

Term	Definition
operating work	Work involving any of the following: - the operation of switches, link switches and circuit breakers; or - use of specially insulated apparatus; 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.
Operations Control Officer	The Train Control Officer having jurisdiction over the relevant portion of the rail system.
Ordinary Person	A person who has not received training in, or demonstrated competency in, the specific hazards and risks associated with working around electrical equipment. Ordinary persons include those persons who have completed the Safely Access the Rail corridor (SARC) course and no other electrical awareness training or electrical courses.
overhead line	See aerial line.
Overhead Wiring or 1500 Volt Equipment or 1500 Volt Overhead Wiring or OHW	All 1500 Volt d.c overhead wires and associated equipment that normally conducts, isolates or may be energised with a voltage of 1500 Volt d.c including the secondary circuit of rectifier transformers. 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.
overhead wiring structure	Any structure that supports or registers a catenary and/or contact wire attached to the dead side of 1500 Volt d.c insulators 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.
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.
Personnel Register	A pre-printed form used as follows: - In the case of a Substation Access Permit or Low Voltage Access Permit, to record the names and signatures of all persons working under the Permit, where the space on the Permit is insufficient to record all persons working, or where the same Permit is to be used for multiple shifts. - In the case of an Electrical Permit to Work, to record the names and signatures of all persons working under the Permit, and this form is bound with the Permit to form an Electrical Permit to Work booklet.
portable earthing equipment	Portable HV aerial line earthing set or substation earthing set.

Term	Definition
portable rail connecting equipment	A portable rail connecting equipment set consists of assemblies of insulated flexible cables and clamps and suitable insulated handles or sticks, which are used for connecting de-energised 1500 Volt Overhead Wiring to rail. The equipment is designed to be applied from ground level.
proving dead	The process of proving that electrical equipment is dead.
rail connected or rail connections	The connection of the 1500 Volt overhead wiring to the negative return rail (traction rail) in the approved manner to ensure the immediate effective discharge of electrical energy from the 1500 Volt overhead wiring equipment to the rail in the event of the equipment concerned being, or becoming, live.
Rail vehicle	Approved rail mounted road/rail vehicle.
Signalling Supply	All the low voltage electric wiring, cables, aerial lines, accessories, fittings, consuming devices, control and protective gear and other equipment associated with the wiring, installed for the operation of railway signals, points and associated control equipment to which electricity is supplied, or is to be supplied, through any one or more low voltage service mains from a low voltage distribution system. A Signalling Supply does not include: • any part of any low voltage distribution system; or • any part of any low voltage installation. A Signalling supply generally commences at the secondary terminals of the isolating transformer(s), between the source of supply and the signalling equipment
reasonably practicable	Has the same meaning as ‘reasonably practicable’ as defined in the Work Health and Safety Act 2011. NOTE: Safe Work Australia provides an interpretive guideline for the meaning of ‘reasonably practicable’.
Recertification	The process of re-assessing competence. Recertification may occur at specified intervals, or as deemed necessary; for example, following an incident.
Responsible Manager	A person of sufficient level of responsibility who has the duty to manage risk to health and safety for works under their administration being the PCBU, duty holder, e.g. Sydney Trains Level 5 manager or Transport senior service manager. Further details on requirements can be found in <i>GUI30 Working Near Electrical Equipment</i> .
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 live conductors), or any mobile plant operated or controlled by that person. For Ordinary persons and Accredited Person refer <i>GUI30 Working Near Electrical Equipment</i> . For Authorised persons refer <i>SP D 79049 Safe Approach Distances (SADs)</i> .

Term	Definition
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.
Safe Work Method Statement (SWMS)	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.
section hut, sectioning hut	A building generally located between Substations containing dc circuit breakers providing protection and sectioning of the Overhead Wiring System and, on multiple tracks, improving voltage regulation.
shall	Indicates that a statement is mandatory.
short circuiting	The connecting together of conductors by approved means to ensure that there can be no potential difference between the conductors.
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.
spiking, spiked	The procedure for proving that a high voltage cable is dead prior to cutting the cable.
Stringing	The running out of the conductor from the cable drum, lifting into aerial position and securing of the ends of the conductor which have been detached from the cable drum.
substation	A substation, traction substation, transformer room, switchroom, sectioning hut, 1500 Volt link area, 1500 Volt switch area containing switches that connect DCCBs to OHW sections, pole or pad mounted transformer locations, containing either high voltage or 1500 Volt electrical equipment.
Substation Access Permit	The pre-printed form (<i>PR D 78502 FM01 Substation Access Permit with two Personnel Registers</i> and <i>PR D 78502 FM03 Substation Access Permit with six Personnel Registers</i>), completed and signed, which is issued by an Authorised Person to define the high voltage or 1500 Volt equipment near or on/within which work may be carried out. The work and the extent of the electrically safe work area are described on the form.
Substation Earthing Set	A set of earthing equipment used to electrically connect isolated high voltage equipment within substations to earth. Substation Earthing Sets have only three earthing heads and the cables come together at a plate designed for direct connection to an earthing point.

Term	Definition
Supervision (of unauthorised persons)	Direct/constant 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 the first time and until skill is demonstrated for the complexity of the task and work environment. General intermittent 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 apparatus/equipment. 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 apparatus/equipment.
Technically Assured Organisation (TAO)	Means a legal entity (which may include a Rail Transport Agency as applicable) to whom the Prioritisation and Asset Management (PAM) has issued a TAO Authorisation. Sydney Trains is a TAO.
Temporary Structure	Includes but is not limited to temporary: access platforms, barriers, catch platforms, cantilever platform bays, framework, formwork, landing platforms, loading platforms, scaffolding, stairways, support members and the like, used for construction works or working platforms. A temporary structure can be fixed, transportable or portable.
Temporary structure work(s)	Refers to the erection, alteration, or dismantling of a temporary structure and any associated rigid barriers.
Tiger Tails or temporary line covers	Pipe type cable covers used as a warning to visually indicate the position of low voltage aerial conductors and are not to be regarded as providing sufficient protection against electrical hazards
TfNSW Employee	Means a "person employed as permanent full time" within TfNSW, Sydney Trains, NSW Trains or PAM.
traction rail (negative return rail)	The rail(s) by which a return path is provided for the 1500 Volt d.c traction current from the train to the traction substation.
Transit Envelope	The area encompassing the normal height and width of mobile plant when travelling to or from a worksite.
Transport Senior Services Manager or above	The TfNSW employee directly associated with the work, and holds a TSS Manager, that has currency of knowledge about the project, people, process, tasks, hazards and work site conditions.

Term	Definition
totally enclosed equipment	Electrical equipment in which the conductors can only be exposed by unbolting or unlocking covers or shutters which prevent normal access. Cables which have an earthed metallic sheath or screen are regarded as totally enclosed equipment.
work on/within	Work within the SADs for an electrical asset and requires or may require contact with the normally live parts of the electrical equipment, either directly or indirectly.
work near	Work that potentially creates a situation where there is a reasonable possibility of a person, either directly or through any conducting medium, coming closer than the relevant safe approach distances specified. NOTE: The work near distance varies with the equipment voltage and competence of the people performing the work.
work in the vicinity of	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.
Worker/person	Has the same meaning as defined in the Work Health and Safety Act and as such includes all employees, contractors, subcontractors or an employee of a contractor or subcontractor.
working earths	Earths that are applied to all conductors on which the work is being carried out, on each side of the worksite, in order to ensure equipotential conditions at the worksite.
Working High Voltage Instruction (WHVI)	The Sydney Trains form (refer to <i>PR D 78202 FM01 Working High Voltage Instruction (WHVI)</i>), completed and signed, for work to be carried out on high voltage conductors or cables outside substations.
Workplace Assessor	Holds qualification – TAESS00021 Facilitation Skill set, or an equivalent qualification.

4 Reference documents

PR D 78202 FM01 Working High Voltage Instruction (WHVI)

PR D 78203 High Voltage Operating Procedures

PR D 78302 FM01 Authority for Removal of Supply from 1500 Volt Sections

PR D 78305 1500 Volt Operating Procedures

PR D 78500 Electrical Permits

PR D 78502 FM01 Substation Access Permit with two Personnel Registers

PR D 78502 FM03 Substation Access Permit with six Personnel Registers

PR D 78503 FM01 Low voltage Access Permit

PR D 78504 FM01 Operating Agreement

PR D 78701 Personnel Certifications – Electrical

RL D 79800 Electrical Network Safety Rules

SP D 79049 Safe Approach Distances (SADs)

SP D 79050 Safe Use of Mobile Plant around Electrical Equipment

GUI30 Working Near Electrical Equipment

Work Health and Safety Regulation 2025