



Electrical Practices for Construction Work

Document no.	Work description	
D2013/81208	To provide information about the hazards, controls and the safety requirements related to electrical work associated with electrical installations on construction and demolition sites.	
	 <p>Note This SWI does not represent the sole technical requirements in relation to electrical practices for construction work and as such full compliance with the relevant standards and in particular identified clauses and WorkCover Code of Practice is required.</p>	
	<p>Scope</p> <p>This SWI is applicable to all workers, employees or contractors, who carry out electrical work at construction or demolition workplaces owned, maintained or managed by Sydney Trains.</p> <p>“Construction work means any work carried out in connection with the construction, alteration, conversion, fitting-out, commissioning, renovation, repair, maintenance, refurbishment, demolition, decommissioning or dismantling of a structure.” (Refer to WHS Regulation 2011 chapter 6 for full details.)</p>	
Review date	References	
08/04/2019	<ul style="list-style-type: none"> AS 2790 - 1989 Electricity generating sets - Transportable (up to 25 kW) AS/NZS 3000:2007 Electrical Installations (known as the Australian/New Zealand wiring rules) AS/NZS 3010:2005 Electrical Installations – Generating sets AS/NZS 3012:2010 Electrical installations - Construction and demolition sites AS/NZS 3190:2011 Approval and test specification RCD's (current-operated earth-leakage devices) AS/NZS 3199:2007 Approval and test specification – Cord extension sets AS/NZS 4763:2011 Safety of portable Inverters AS/NZS 5000 (various parts) Electrical cables – Polymeric insulated AS/NZS 5762:2011 In-service safety inspection and testing - Repaired electrical equipment SP E 70954 Sydney Trains Network Management Plan Chapter 2 – Customer Installation Safety Safe Work Australia “Construction Work” Code of Practice July 2012 Safe Work Australia “Managing Electrical Risks in the Workplace” Code of Practice July 2012 SMS-06-GD-0268 Working around Electrical Equipment PR D 78101 General Requirements for Electrical Work SMS-06-OP-3046 Energy Lock-Out - Tag-Out D2013/80869 Electric Shock Protocol D2013/80870 Rescue from Live Low Voltage Equipment (Including Rescue Kit Care) D2013/80873 Work on Low Voltage Installations D2013/80874 PPE for Electrical Work Work Health and Safety Act 2011 Work Health and Safety Regulation 2011 	
PPE and precautions	Competencies or qualifications	Licences or permits required
D2013/80874 PPE for Electrical Work As determined by Risk Assessment	Refer to Personnel Certification section below	Refer to Personnel Certification section below
Tools and equipment required		
As required depending on the work IF CONTROL MEASURES ARE NOT SUITABLE AND MAJOR CHANGES ARE NEEDED, CONDUCT A RISK ASSESSMENT AND DEVELOP NEW CONTROL MEASURES ACCORDING TO SMS-06-SP-3026 WHS RISK MANAGEMENT		
<p> Warning Severe injury or death results if a conducting path is formed allowing electric current to pass through the body. Read this SWI in conjunction with referenced documents.</p>		
Compliance with regulations / standards	<p>All electrical practices for construction work shall comply with applicable Sydney Trains SMS, Transport for NSW (TfNSW) engineering standards, the Work Health and Safety Regulation and AS/NZS 3012.</p> <p>Should a conflict exist between the abovementioned types of documents, the order of precedence shall be: Sydney Trains SMS, a TfNSW engineering standard, the Work Health and Safety Regulation and lastly AS/NZS 3012.</p>	

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Personnel Certification / Responsibilities

Workers performing risk assessments must hold a NSW Fair Trading:

- Qualified Supervisor Certificate (Electrician) or
- Contractor Licence (Electrical - Q).

Workers performing electrical work, such as connecting/disconnecting electrical supply, installing, removing, adding, testing, replacing, repairing, altering or maintaining electrical equipment, must hold a NSW Fair Trading:

- Qualified Supervisor Certificate (Electrician) or
- Contractor Licence (Electrical - Q), or
- be under the direct/constant supervision of a worker holding either of the abovementioned NSW Fair Trading certificates.

A Person Conducting a Business or Undertaking (PCBU – refer WHS Act section 5), e.g. a Pty Ltd company, working on a low voltage (LV) installation associated with construction or demolition sites must:

- be registered with the Australian Securities and Investment Commission (ASIC). Search the National Names Index here: ASIC names search, and
- provide a current certificate of currency for Public and Product Liability insurance to the value of \$10M, and
- provide a current certificate of currency of Workers Compensation, and
- hold a NSW Fair Trading Contractor Licence (Electrical - Q).

Sydney Trains Line Managers shall ensure that either the Sydney Trains staff or the external company performing electrical work meet the particular requirements indicated above.

Persons planning work around electrical equipment shall ensure that the work is assessed and planned to enable the highest practicable level of risk control to be applied. (Refer SMS-06-GD-0268 Working around Electrical Equipment).

Authorised Persons supervising others should conform to the guidelines set out in PR D 78101 General Requirements for Electrical Work section 10, Pre-Work Briefings and Supervision.

Workers are to carry out their work in accordance with this instruction and seek guidance and / or supervision before attempting to carry out a task for which they have not demonstrated and maintained satisfactory competence.

General Safety Requirements

All work on or near exposed low voltage (LV) equipment shall be planned and carried out in accordance with SMS-06-GD-0268 Working around Electrical Equipment.

In general, supply shall be removed from exposed LV 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 (refer PR D 78105 DANGER Tags for Electrical Equipment), and
- Proved dead,

where required a Low Voltage Access Permit (refer PR D 78503 Low Voltage Access Permits) issued, before any work commences.



Note

Refer to D2013/80873 Work on Low Voltage Installations for particular instructions relating to removal of supply.



Warning


When supply is removed for the work, each conductor shall be proved dead prior to work commencing. *** TEST BEFORE YOU TOUCH ***



Warning

Where a low voltage conductor cannot be proved dead, it shall be treated as being live even though it may have been isolated.


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Construction wiring, accessories and fittings	Installation and removal	<p>All electrical work at construction sites shall comply with the relevant requirements of Sydney Trains SMS, ASA Engineering Standards, AS/NZS 3012 and the Safe Work Australia Codes of Practice.</p> <p>Construction work shall be managed by an Authorised Engineering Organisation accredited by TfNSW and performed in accordance with the relevant TfNSW standards published on the TfNSW Asset Standards Authority website.</p> <p>All maintenance and operation required on the Electrical Distribution System shall be managed directly by relevant Electrical representatives in Sydney Trains. Operation of the electrical network shall be coordinated with and managed by the Electrical System Operators at ICON, and maintenance shall be managed by Network Maintenance Division.</p> <p>All construction wiring shall be installed in a manner which will prevent personal injury and damage to property consistent with the requirements of AS/NZS 3012. Construction is performed by Authorised Engineering Organisations accredited by TfNSW Asset Standards Authority.</p>
	Electrical equipment near 1500 Volt DC Overhead Wiring Structures or Equipment	<p>When working on or near 1500 Volt DC OHW structures or equipment, only use electric power tools that are:</p> <ul style="list-style-type: none"> • battery operated, or • supplied from an isolating transformer, generator or inverter. <p>This applies to electrical power tools and equipment to be used in the rail corridor, substation and section hut, including work on:</p> <ul style="list-style-type: none"> • overhead wiring structures • rail, and • rail connected equipment, (including trains standing on the rails).
	 <p>Note Refer to the <u>Network Rules</u> for additional requirements regarding the use of tools whilst undertaking activities in the Rail Corridor, eg. <u>NWT 308 Absolute Signal Blocking</u> and <u>NWT 310 Lookout Working</u>.</p>	
	Wiring for lift and service shafts	Wiring for lift and service shafts shall be in accordance with AS/NZS 3012. Wiring may be construction wiring or permanent wiring.
	Residual Current Devices (RCDs)	RCDs, also known as Core Balance Earth Leakage Devices or Safety Switches shall comply with AS/NZS 3190, operate in all live (active and neutral) conductors and have a tripping current of 30mA or less.
	Switchboards	<p>AS/NZS 3012 has specific mandatory design, construction, location, mounting and installation requirements for construction supply switchboards.</p> <p>Isolate final sub circuits supplying power to outlets and equipment which are not required outside working hours at the end of work. Lock the main switchboard at the end of work each day.</p>
	Overload protection and marking	<p>Overload protection of sub-mains and final sub-circuits shall be in accordance with AS/NZS 3012 clause 2.4.5.</p> <p>Distinguish construction wiring from permanent wiring by using different colour cable or affixing tape in accordance with AS/NZS 3012 clause 2.5.4.</p>
	Transportable structures	Construction wiring for transportable structures such as personnel and materials hoists, shall be supplied from a separate final sub circuit that originates at the main switchboard and is suitably identified. Other specific mandatory requirements are detailed in AS/NZS 3012 clause 2.9.

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Construction wiring, accessories and fittings (cont.)	Lighting	<p>Install adequate artificial lighting where natural light is not sufficient to provide sufficient lighting for the tasks being performed. Protect all light fittings from mechanical damage by way of wire guards or diffusers suitable for the fitting and location.</p> <p>Install battery back-up lighting of at least one hour capacity where lighting is required to provide safe access and egress in stairwells and passageways and for lighting in lift and service shafts.</p> <p>Lighting for lift and service shafts can be supplied by either construction wiring or permanent wiring and shall be fluorescent type, located either above or below the work area.</p> <p>Festoon lighting shall be used only in underground shafts, wells and tunnels. It shall be supplied at Extra Low Voltage (32VAC or less) and use non-removable fittings which are moulded to the cable.</p> <p>Light fittings installed in site sheds as permanent fixtures (other than lampholders) do not require additional mechanical protection.</p> <p>Recommended minimum lighting levels and other specific mandatory requirements are detailed in AS/NZS 3012 clause 2.7 and 2.8</p>
Portable generating sets		<p>Low voltage portable generators shall comply with the requirements of AS 2790 and be connected in accordance with AS/NZS 3010 and AS/NZS 3012.</p> <p>All generators connected to construction wiring or permanent wiring used during construction shall:</p> <ul style="list-style-type: none"> • have over current protection, and • incorporate Residual Current Device protection (RCD) except when the permanent wiring is already protected by a RCD.
DC to AC inverters		<p>Inverters produce an alternating current output (usually a nominal 240 V) from an extra low voltage direct current input (usually 12-24 V supplied by batteries). The output of most inverters will produce sufficient energy to deliver a fatal electric shock and, for some inverters under certain fault conditions, a hazardous voltage can be imposed on the supply battery terminals and/or exposed metal.</p> <p>Inverters used on construction and demolition sites shall comply with the requirements of AS/NZS 4763 and be used in accordance with AS/NZS 3012 clause 2.4.6.4.</p>
Flexible cords and extension cords	Transportable construction buildings supplied by flexible cords	<p>Where transportable construction buildings are supplied via flexible cords the following requirements shall be met:</p> <ul style="list-style-type: none"> • supply is not to be "cascaded" via flexible cords from one transportable building to another, and • the minimum cross sectional area and maximum length of flexible cords supplying transportable buildings shall be 2.5 mm² and 15 metres respectively, and • each amenities building shall be connected to a final sub circuit protected by an RCD, and • flexible cords shall be suitably protected from mechanical damage. <p>Other specific mandatory requirements are detailed in AS/NZS 3012 clause 2.9.</p>

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Flexible cords and extension cords (cont.)	Extension cords and fittings	<p>Plugs and sockets on power tools and extension cords shall be either moulded non-rewireable type or, if rewireable type, fitted with a transparent cover so that the connections are visible and any damage can be detected.</p> <p>Extension cords shall be heavy duty sheathed type in accordance with AS/NZS 3199. Flexible cables shall comply with AS/NZS 5000.</p> <p>Maximum lengths of flexible cords and flexible cables shall be as per Table 1 of AS/NZS 3012. Maximum lengths are not to be increased by greater than 5 metres by the attachment of electrical equipment.</p> <p>Do not use cables intended for fixed wiring, such as flat Thermoplastic Sheathed cable, as flexible cords or cables.</p> <p>Do not use flexible cords in areas where they may be exposed to moisture or mechanical damage. Flexible cables shall be supported to run above work areas and passageways, or provided with protective mechanical covers if run on the ground</p> <p>In multi level construction extension cords shall be run on the same level as the outlet or, if work is in the stairwell, up or down one level only. (Does not apply to falsework or lift and service shafts).</p> <p>Do not use double adaptors, piggy back plug/socket fittings.</p> <p>Flexible extension cords should not be used while in a coiled or reeled configuration.</p> <p>Electric Portable Outlet Devices (usually known as power boards) intended for household and light duty applications are not suitable for use in a construction environment. Any Portable Socket-Outlet Assembly (PSOA) used is to have:</p> <ul style="list-style-type: none"> • an enclosure of impact resistant and durable material and be double insulated, • socket outlets which are suitably protected against mechanical and environmental damage, • a supply lead which is heavy duty sheathed type and maximum length 1.8 metres overload protection, and • RCD protection. <p>Other specific mandatory requirements are detailed in AS/NZS 3012 clause 2.6.</p>
		<p>Note Particular requirements exist for use of electrical equipment in the 1500 Volt DC electrified area. Refer to the “Electrical equipment near 1500 Volt DC Overhead Wiring Structures or Equipment” section of this SWI.</p>

Defective equipment	Any equipment which appears or is tested as defective shall be:	<ul style="list-style-type: none"> • quarantined to prevent use until inspected, tested and repaired as necessary, and • tagged with a CAUTION - DO NOT OPERATE tag (as per SMS-06-OP-3046 Energy Lock-Out - Tag-Out that states the apparent fault or defect <p>Line Managers shall make sure that a supply of tags to be affixed to non-compliant equipment is kept on site to allow persons to mark equipment suspected of being faulty.</p> <p>Where defective equipment is not (or cannot) be repaired at the time of the in service inspection it shall be tagged with a “CAUTION – DO NOT OPERATE” tag pending repair by a qualified or competent person. Repairs shall be carried out in accordance with AS/NZS 5762. Details of repairs carried out shall be recorded in the register and the item fitted with an inspection tag.</p> <p>If the equipment is not to be repaired it shall be disposed of and recorded as disposed in the register.</p>
		<p>Warning Do not remove the “CAUTION - DO NOT OPERATE” tag until the item has been repaired and retested or destroyed.</p>

Inspection and testing	Components of the electrical installations of construction sites and demolition sites	<p>Construction wiring, switchboards, RCDs, transportable structures, shall be inspected and tested in accordance with AS/NZS 3012 section 3, in particular clauses 3.1, 3.2, 3.4, 3.5, 3.8 and 3.10 where applicable.</p> <p>Portable generators and inverters shall be inspected and tested in accordance with AS/NZS 3012 section 3, in particular clause 3.1, 3.2, 3.7, 3.8 3.9 and 3.10 where applicable.</p>
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	<p>Electrical equipment, such as power tools, flexible cords & portable socket outlets etc</p>	<p><u>Pre-use and user inspection</u></p> <p>Electrical equipment is designed and manufactured to standards and specifications which take into account the environment in which the equipment will operate. When used and maintained in accordance with the recommendations of the manufacturer electrical equipment will perform its intended function safely and not create risks to the operator. However, there is always, the possibility of damage occurring, particularly when equipment is used in a construction environment. Construction environments create an increased risk of exposure to mechanical damage, moisture and misuse.</p> <p>Frequent transportation of equipment in toolboxes and site boxes also increases the risk of damage occurring.</p> <p>This damage may occur at any time during the intervals between in-service inspections (refer to the In-service inspection and testing section) and can usually be detected by way of user inspections.</p> <p>The supply lead and plug is the most likely part of portable equipment to become damaged and create a risk.</p> <p>Where damage which can create a risk of shock has occurred it is usually obvious and can be detected by way of a quick visual inspection prior to using the equipment and after an incident which may have resulted in damage - such as dropping a heavy object on an extension cord.</p> <p>For this reason, Line Managers shall make sure that employees are instructed in how to detect obvious defects in leads and equipment and this instruction shall be reinforced in toolbox talks and pre work briefs</p> <p><u>In-service inspection and testing</u></p> <p>Some defects, whilst detectable by visual inspection, require a trained and experienced person to identify the fault. Other faults which can occur are only detectable by use of test equipment and instrumentation.</p> <p>To verify that equipment is free of defects, electrical equipment used on construction sites shall be subject to regular, scheduled in-service inspections and tests in accordance with AS/NZS 3012.</p>
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<p>Inspection and testing (cont.)</p>	<p>Electrical equipment, such as power tools, flexible cords & portable socket outlets etc (cont.)</p> <p>Records (Applicable to Components of the electrical installations of construction sites and demolition sites and electrical equipment)</p>	<p><u>Periodic verification interval</u></p> <p>All electrical equipment at construction sites shall be inspected, tested and tagged in accordance with AS/NZS 3012 Clause 3 at intervals not exceeding those specified in Table 3 of the Standard.</p> <p>Electrical equipment which has been found to be satisfactory shall be tagged as per AS/NZS 3012 clause 3.8.3.</p> <p>Results may be stored utilising the <u>SMS-06-FM-0278 Electrical Equipment Inspection and Test Record</u> form or any other report/document/register format in compliance with AS/NZS 3760 clause 2.4 and 2.5, accepted and approved by the GM SEQR, Engineering & Maintenance. Results shall be retained as part of the site specific safety management plan where such is in place and maintained on site.</p> <p>Where a Site Specific Safety Management Plan is not in place the records shall be maintained in the workplace safety folder. Details to be recorded are:</p> <ul style="list-style-type: none"> • date of inspection and testing • unique plant identifying number • results of the inspection and test • details of any repair work carried out • licence number (or training identifying number if not licensed) of the person who conducted the inspection and test. <p>Records of inspections and tests for equipment owned or hired by Sydney Trains shall be recorded in the Plant Register database. This may be the sole record provided access to the database is available at the worksite or the location where the equipment is based.</p> <p>Records of inspections and tests for equipment owned or hired by contractors shall be provided to the relevant Sydney Trains representative (for a Sydney Trains managed worksite) or the principal contractor for inclusion in site records where a site specific safety management plan is in place.</p> <p>For worksites not covered by a site specific safety management plan, inspection records maintained by the owner of the equipment need not be sighted provided equipment tags are fitted and current.</p>
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