Electrical Practices for Construction Work

Document no.	Work description
SMS-06-SW-0298	Practising electrical safety at all construction sites at RailCorp premises to make sure of compliance with the NSW Code of Practice Electrical Practices for Construction work.
	Scope This SWI applies to electrical equipment utilised for all construction work within RailCorp. Construction work is defined as: • excavation, including the excavation or filling of trenches, ditches, shafts, wells, tunnels, and pier holes • building, including the construction (including the manufacturing of prefabricated elements of a building at the place of work concerned), alteration, renovation, repair, maintenance and demolition of all types of buildings • civil engineering, including the construction, structural alteration, repair, maintenance and demolition of, for example, airports, docks, harbours, inland waterways, dams, river and avalanche and sea defence works, roads and highways, railways, bridges and tunnels, viaducts and works related to the provision of services such as communications, drainage, sewerage, water and energy supplies.
Review date 15/09/09	**References** • AS/NZS 3012 Electrical installations - Construction and demolition sites • AS 2790 - 1989 Electricity generating sets - Transportable (up to 25 kW) • AS/NZS 3000 Electrical Installations (known as the Australian/New Zealand wiring rules) • AS/NZS 5762 Safety inspection and testing - Repaired electrical equipment • WorkCover Code of Practice - Electrical practices for construction work • SMS-06-SW-0269 Electric Shock Protocol • SMS-06-SW-0271 Rescue from Live Low Voltage • SMS-06-SW-0276 Work on Low Voltage Installations • EP 95 00 30 03 SP Customer Installation Safety Plan

Responsible supervisor *Insert name in BLOCK letters*	PPE and precautions	Competencies or qualifications	Licences or permits required
	As required depending on the work	As required depending on the work	

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 CONTROLS ACCORDING TO SMS-06-PR-0104 WORKPLACE RISK MANAGEMENT.

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 related SWIs.

Construction wiring, accessories and fittings	**Installation and removal**	All wiring at construction sites is to comply with the relevant requirements of AS/NZS 3000 and any specific requirements of the supply authority. Construction wiring is to be installed and removed by a licensed electrician and notification requirements to the supply authority fulfilled. Where supply is derived from the RailCorp Electrical Network the requirements of RailCorp's Relevant Engineering Standards (EP17 Series) apply Refer to the Engineering Standards web site. Note also that there are no accredited Service Providers (ASPs) for the RailCorp distribution system. All work required on the distribution system is to be managed directly by the Regional Electrical staff. All construction wiring is to be installed in a manner which will prevent personal injury and damage to property consistent with the requirements of AS/NZS 3000.

Construction wiring, accessories and fittings cont	**Electrical equipment near 1500 Volt DC electrified lines**	To prevent 1500 volt DC entering the low voltage earthing system via earthed electrical equipment used near the 1500 Volt DC electrified lines equipment is to be: • double insulated • battery operated, or • supplied from an isolating transformer or generator. This applies to electrical equipment that is to be used in the 1500 volt DC electrified area on: • rail • rail connected equipment, (including trains standing on the rails) • overhead wiring structures.
	Wiring for lift and service shafts	Construction wiring for lift and service shafts is to originate at a separate final sub circuit protected by a RCD that supplies only lift and service shaft equipment. Wiring may be construction wiring or permanent wiring.
	Residual Current Devices (RCDs)	Residual Current Devices (RCD)—also known as Core Balance Earth Leakage Devices or Safety Switches—are to be fitted to each single phase final sub circuit supplying hand held or portable equipment. RCD protection is to also be provided for single phase final sub circuits supplying lighting at the site. RCDs are to comply with AS/NZS 3190 Approval and test specification RCDs (current-operated earth-leakage devices) and have tripping current of 30mA or less. Fit RCDs at the switchboard where the final sub circuit originates and protect individual circuits or a group of identified circuits.
	Switchboards	Construction supply switchboards are to be: • of robust and weatherproof construction • fitted with a locking device • fitted with doors or lids which will not damage cords • fitted with bushings in cord access holes to prevent damage to cords • fitted with an isolating switch which will isolate all outgoing circuits (except a main switchboard) • affixed to a permanent wall or a dedicated temporary structure in accordance with supply authority requirements • located within the construction site boundary.
		Protect sub mains with circuit breakers or HRC fuses. Circuit breakers are to be suitable for locking in the open position by means of a padlock. Protect each final sub circuit with a circuit breaker that identifies the outlets or equipment which it supplies. Distinguish construction wiring from permanent wiring by using different colour cable or affixing tape bearing the words CONSTRUCTION WIRING to be clearly visible along the run and at maximum intervals of 5 metres. 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.
	Lighting	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. 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. Lighting for lift and service shafts can be supplied by either construction wiring or permanent wiring and is to be fluorescent type, located either above or below the work area. Festoon lighting is to be used only in underground shafts, wells and tunnels. It is to be supplied at Extra Low Voltage (32VAC or less) and use non-removable fittings which are moulded to the cable. Light fittings installed in site sheds as permanent fixtures (other than lampholders) do not require additional mechanical protection.

Construction wiring, accessories and fittings cont	**Personnel and materials hoists**	Construction wiring for personnel and materials hoists is to be supplied from a separate final sub circuit that originates at the main switchboard and is suitably identified.

Flexible cords and extension cords	**Extension cords and fittings**	Plugs and sockets on power tools and extension cords are to 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. Extension cords are to be heavy duty sheathed type in accordance with AS 3100. Maximum lengths of extension cords are to be as per Table 1. Maximum lengths are **not** to be increased by greater than 5 metres by the attachment of electrical equipment.

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 electrified lines section of this SWI.

Table 1 Maximum length of extension cord

Current rating (amperes)	*Conductor area mm²*	*Maximum length (metres)*
10	1.0	25
	1.5	32
15	1.5	25
	2.5	40
20	2.5	32
	4.0	40

The length of flexible cords or cables supplying non-portable equipment is determined according to the loading requirements of the individual equipment.

Do **not** use cables intended for fixed wiring, such as flat Thermoplastic Sheathed cable, as flexible cords or cables.

Do **not** flexible cords in areas where they may be exposed to moisture or mechanical damage and are to be supported and run above work areas and passageways.

In multi level construction extension cords are to 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).

Do **not** use double adaptors, piggy back plug/socket fittings.

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:

- 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
- RCD protection.

Note

Refer to clause 2.6.10 of AS/NZS 3012 Electrical installations - Construction and demolition sites for further information relating to PSOA use and requirements

Flexible cords and extension cords	Transportable construction buildings supplied by flexible cords	Where transportable construction buildings are supplied via flexible cords the following requirements are to be met: • supply is **not** to be "cascaded" via flexible cords from one transportable building to another • maximum length of flexible cords supplying transportable buildings to be 15 metres • each amenities building is to be connected to a final sub circuit protected by an RCD • Flexible cords are to be suitably protected from mechanical damage.

Inspection and testing	**Pre-use and user inspection**	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. Frequent transportation of equipment in toolboxes and site boxes also increases the risk of damage occurring. 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.
		The supply lead and plug is the most likely part of portable equipment to become damaged and create a risk. 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. For this reason, Line Managers are to make sure that employees are instructed in how to detect obvious defects in leads and equipment and this instruction is to be reinforced in toolbox talks and pre work briefs.
	Defective equipment	All employees are to make sure that any equipment which appears defective from a pre-use or user inspection is: • quarantined to prevent use until inspected, tested and repaired as necessary • tagged with a CAUTION - DO NOT OPERATE tag that states the apparent fault or defect • inspected by a qualified or competent person and, if necessary, repaired and tested by a qualified person before removal of the tag and return to service Line Managers are to 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.
	In-service inspection and testing	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. To verify that equipment is free of defects electrical equipment used on construction sites are to be subject to regular, scheduled in-service inspections and tests conducted by a competent person in accordance with the following requirements.

Inspection and testing cont

Inspection interval

All electrical equipment at construction sites is to be inspected, tested and tagged in accordance with Table 2.

Table 2 Inspection and testing interval

Equipment type	*Inspection and testing interval*
Flexible extension cables, portable tools & electrical plant	Monthly
Portable residual current devices	Push button trip test (by user) - Daily when in use[1] Push button trip test (as part of inspection and test) - Monthly Operating time test - Three monthly
Fixed residual current devices	Push button trip test (as part of inspection and test) - Monthly Operating time test - Three monthly
Appliances located within site offices & amenities sheds	Initially upon arrival at the site Thereafter three monthly
Hired equipment	At suppliers premises at time of supply Thereafter as per equipment type above

Note 1 - Portable RCD Push button trip test by user:

This test does not need to be recorded but is to be included in pre-work briefs and safety briefings.

Users are to be instructed in procedures to follow if the RCD fails the push button test

Conducting and recording inspections and tests

In-service inspection, testing and tagging is to be conducted by a person who holds a Qualified Supervisor Certificate (Electrical) or Contractor Licence (Electrical) - Qualified. These persons can perform tests with either discrete instruments or a Portable Appliance Tester (PAT).

Inspection, testing and tagging may also be performed by a person who is trained and competent in the use of a PAT. The training and experience is to be relevant to the type of tester being used and these persons may not perform tests using discrete instruments.

Inspections and tests are to be conducted in accordance with AS/NZS 3760 In-service safety inspection and testing of electrical equipment as applicable to the type of equipment under test.

Inspections and tests are to be recorded on SMS-06-FM-0278 Electrical equipment inspection and Test Record and retained as part of the site specific safety management plan where such is in place and maintained on site.

Where a Site Specific Safety Management Plan is not in place the records are to be maintained in the workplace safety folder. Details to be recorded are:

- 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.

<table>
<tr><td>Inspection and testing cont</td><td>Conducting and recording inspections and tests cont</td><td>Records of inspections and tests for equipment owned or hired by RailCorp are to 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.
Records of inspections and tests for equipment owned or hired by contractors are to be provided to the relevant RailCorp representative (for a RailCorp managed worksite) or the principal contractor for inclusion in site records where a site specific safety management plan is in place.
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.</td></tr>
<tr><td rowspan="2">Inspection and testing</td><td>Non-compliant equipment</td><td>Equipment which is found to be non compliant when in service inspections and tests are conducted is to be quarantined to make sure that it cannot be returned to service until it has been repaired, inspected and tested by a qualified person.
Where faulty equipment is not (or cannot) be repaired at the time of the in service inspection it is to be tagged with a "CAUTION - DO NOT OPERATE" tag (as per SMS-06-PR-0173 Plant and Equipment Lock-Out/Tag-Out) pending repair by a qualified or competent person. Repairs are to be carried out in accordance with AS/NZS 5762 Safety inspection and testing - Repaired electrical equipment. Details of repairs carried out are to be recorded in the register and the item fitted with an inspection tag.
If the equipment is not to be repaired it is to be disposed of and recorded as disposed in the register.</td></tr>
<tr><td>Tagging of compliant equipment</td><td>Following inspection and testing, compliant equipment is to be fitted with an inspection tag which is;
durable
non metallic
self adhesive or positively secured
incapable of re-use.
Bright and distinctive, predominately coloured to identify the month of the inspection and test as per Table 3
Table 3 Colour code for inspection tags<table><tr><th>Month</th><th>Colour</th></tr><tr><td>January</td><td>Red</td></tr><tr><td>February</td><td>Blue</td></tr><tr><td>March</td><td>Orange</td></tr><tr><td>April</td><td>Green</td></tr><tr><td>May</td><td>White</td></tr><tr><td>June</td><td>Yellow</td></tr><tr><td>July</td><td>Blue</td></tr><tr><td>August</td><td>Green</td></tr><tr><td>September</td><td>Red</td></tr><tr><td>October</td><td>Yellow</td></tr><tr><td>November</td><td>Orange</td></tr><tr><td>December</td><td>White</td></tr></table></td></tr>
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Portable generating sets	Portable generators are to comply with the requirements of Australian Standard AS 2790-1989 Electricity generating sets - Transportable (Up to 25 kW). The power supply for all construction wiring emanating from a portable generating set is to comply with this guide. All generators connected to construction wiring or permanent wiring used during construction are to: • have over current protection • incorporate Residual Current Device protection (RCD) except when the permanent wiring is already protected by a RCD.
	 ***Note***: *Electrical personnel are referred to Clause 2.4.6.3 of AS/NZS 3012 Electrical installations - Construction and demolition sites for specific guidance on the use of generators to supply power to construction sites*

DC to AC inverters	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. Currently no national safety standard exists to establish the safety requirements for inverters used in the construction environment. Pending the development of a suitable standard or guidelines inverters are not to be used on construction sites at RailCorp premises.

Definitions	Qualified person	A person who holds either a Qualified Supervisor Certificate (Electrical) or Contractor Licence (Electrical) - Qualified issued by the NSW Office of Fair Trading
	Competent person	In relation to performing in service inspections and tests of portable electrical equipment, a person who has attended a course relevant to the tester being used (i.e. TAFE course No 9989 - Safety checking of electrical appliances) and has relevant experience

Additional controls