

Safe Work Instruction	Issue date: 22/12/09
Train Auxiliary Power Supply System (10): Safe Working	Review date: 15/03/11

Document no.	Work description		
SMS-06-SW-1285	<p>This SWI describes safe work practices related to the maintenance of components within the Train Auxiliary Power Supply System</p> <p>Scope</p> <p>This SWI describes the hazards and controls for work by RSD staff on Rollingstock train auxiliary power supply systems</p> <p>This document does not replace technical 'how to' documents such as Engineering Instructions, Manufacturers' instructions etc</p> <p>In addition to the inclusions of this document, all work is to be carried out in accordance with SMS-06-GD-0268 Working Around Electrical Equipment</p> <p>Additionally reference to SMS-06-SW-1261 Train Diesel Engine Systems (18) Safe Working may be required for some work on diesel fleet</p>		
Review date	References		
15/03/11	<ul style="list-style-type: none"> • OHS Act 2000 • OHS Regulations 2001 • Rail Safety Act 2008 • AS 61010.1-2003 Safety requirements for electrical equipment for measurement, control & laboratory use • HB 187-2006 Guide to Selecting a Safe Multimeter • SMS-12-OI-0886 Red Flagging Trains in stabling yards, depots and Maintenance Centres • SMS-06-SW-0836 Isolating 1500V DC OH using an Annett Key • SMS-06-SW-0838 Pantograph Raising and Lowering • SMS-06-SW-1133 Guard's Emergency Cock Lock-Out • SMS-06-EN-0553 Electrical Hazards Warnings • SMS-06-GD-0268 Working Around Electrical Equipment • SMS-06-SW-0538 PPE for Electrical Work • SMS-06-SW-0269 Electric Shock Protocol • SMS-06-PR-0173 Plant and Equipment Lock-out Tag-out • SMS-06-SW-1130 Electrical Isolation Diesel Fleet • SMS-06-SW-1242 Shore Supply Connection • SMS-06-SW-1151 Overhead Travelling Crane - Safe Operation • SMS-06-SW-1247 Train Lifting Jacks - Safe Operation • SMS-06-SW-1246 Drop Table - Safe Operation • SMS-06-SW-0812 Working in the Pit • SMS-06-PR-0104 Workplace Risk Management • SMS-06-GD-0001 Guide to Manual Handling • SMS-06-SW-1160 Working on High Roads • SMS-06-SW-0487 Entering Trains from Ballast • SMS-06-SW-0488 Climbing out of Trains onto Ballast • SMS-06-SW-0400 Forklift Trucks • SMS-06-SW-1261 Diesel Engine System (18) Safe Working • SMS-06-GD-0323 Personal Protective Equipment 		
Responsible supervisor	PPE and precautions	Competencies or qualifications	Licences or permits required
Line Manager	<ul style="list-style-type: none"> • Non-conductive, high visibility vest • Long sleeve, cotton drill work shirt • Safety Goggles when handling batteries • Safety Footwear • Chemical resistant Gloves when working with batteries • Riggers Gloves when handling sharp edges • All PPE to comply with SMS-06-SW-0538 PPE for Electrical Work 	<ul style="list-style-type: none"> • Rail Industry Safety Induction (RISI) • Site specific induction • Electrical Safety Awareness • Trade Qualifications as required • Manual Handling Training 	

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Tools and equipment required

- Red Flag
- Personal Locks, Multi-locks (Hasps) and/or Danger tags, as required
- Power tools, as required
- Hand tools

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](#).

	<p>Note</p> <p>Pre work brief and task risk assessment</p> <p>Ensure a pre-work brief and detailed task risk assessment is undertaken with all team members involved in the work activity. If any new/additional team members arrive any time later they must be briefed before they commenced work.</p>
	<p>Warning</p> <p><i>The following warnings apply throughout this SWI:</i></p> <ul style="list-style-type: none"> • <i>Isolation of relevant circuit, including the placement of a lock and/or tag in accordance with SMS-06-PR-0173 Plant and Equipment Lock-out Tag-out, is required before any work on electrical components commences, refer to: SMS-06-EN-0553 Electrical Hazards Warnings. Failure to correctly isolate electrical equipment before interacting with electrical equipment could result in injury or death. Always verify isolation has been achieved before proceeding with work</i> • <i>Ensure clothing complies with SMS-06-SW-0538 PPE for Electrical Work to minimise the risk of shock or flash burns. Wearing unacceptable clothing (including short sleeves or shorts) could fail to protect from, or even contribute, to serious injury</i> • <i>Always remove all metal wrist, hand and neck jewellery and chains to prevent them becoming conductors should they come in contact with a live piece of equipment which could result in serious injury or death</i> • <i>On some electric trains there is a risk of electric shock from contact with capacitors, refer to: SMS-06-SW-0269 Electric Shock Protocol, and SMS-06-EN-0553 Electrical Hazards Warnings. Always allow at least 5 minutes discharge time after their electrical isolation, before you interact with them</i>
Competency	<p>Staff are to be trained and supervised to ensure they:</p> <ul style="list-style-type: none"> • Transport required parts, tools and equipment to and from the work area using manual aids (such as trolleys) so as to minimise the risk of manual handling injuries • Carry out the tasks in accordance with relevant Engineering and Operational Instructions • Implement necessary controls, in accordance with this document • Work with Line Manager to identify any additional hazards and implement controls in accordance with relevant SWIs and other SMS components
Place Red Flag	<p>To notify persons that work on the auxiliary power supply system is being carried out on the train, place your Red Flag in accordance with SMS-12-OI-0886 Red Flagging Trains in stabling yards, depots and Maintenance Centres</p>
Investigate Work Required	<p>Once your Red Flag is in place, inspect the relevant component to determine the work required.</p> <p>Identify the relevant tools, equipment and parts that will be required.</p> <p>Identify any other relevant SWIs (eg. SWIs for relevant tools) that will document hazards and their controls.</p> <p>Collect identified items from the store and transport to the location using manual handling aids (eg. trolleys).</p> <p>Where possible, climb in and out of the train from platforms. If using steps or stairs provided always use 3 points of contact when climbing in or out of trains. If it is necessary to access from ballast always do so in accordance with SMS-06-SW-0487 Entering Trains from Ballast and SMS-06-SW-0488 Climbing out of Trains onto Ballast</p>
	<p>Note</p> <p>Should testing / fault finding on live electrical equipment and or wiring be required, this is only to be carried out by qualified electricians or apprentices under their direct supervision and when:</p> <ul style="list-style-type: none"> • Competent in the requirements of electrical shock protocol in accordance with SMS-06-SW-0269 Electric Shock Protocol • Wearing all the PPE for electrical work in accordance with SMS-06-SW-0538 PPE for Electrical Work • Using approved electrical test equipment (e.g. a multimeter that complies with AS 61010.1-2003)

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Isolation – Electrical Energy	<p>Before commencing any work on the auxiliary power supply system, isolation is required to protect from injury or death. The isolation required may vary, depending upon the work, and should be determined in conjunction with relevant technical documents and, if in doubt, in conjunction with the Line Manager.</p> <p>However, to protect from electrical energy within the auxiliary power supply system refer to the following isolation information.</p>
	Isolating Battery
	<p>Electric Fleet</p> <ul style="list-style-type: none"> • Remove all battery fuses • Remove battery leads • Remove 42 pin Jumpers from adjacent cars <p>Diesel Fleet</p> <ul style="list-style-type: none"> • Carry out isolation in accordance with SMS-06-SW-1130 Electrical Isolation Diesel Fleet
	Shore Supply
	<p>Electric Fleet</p> <ul style="list-style-type: none"> • Carry out connection and disconnection in accordance with SMS-06-SW-1242 Shore Supply Connection <p>Diesel Fleet</p> <ul style="list-style-type: none"> • Carry out disconnection in accordance with SMS-06-SW-1130 Electrical Isolation Diesel Fleet
	Overhead Power
	<p>Electric Fleet</p> <ul style="list-style-type: none"> • Lower the pantograph(s), in accordance with SMS-06-SW-0838 Pantograph Raising and Lowering, and • Isolate the road, in accordance with SMS-06-SW-0836 Isolating 1500V DC OH Using an Annett Key
Check	Visually inspect that the pantograph(s) has been lowered from the overhead power supply
	Warning <i>Ensure all pantographs are lowered in accordance with SMS-06-SW-0838 Pantograph Raising and Lowering. Visually check that the pantographs are lowered. Do not simply rely on the pantograph air pressure gauge, this will not guarantee that the pantographs are lowered. Failure to confirm that pantographs are lowered correctly may lead to serious INJURY or DEATH.</i>
	Note If due to its design, it is currently not possible to apply a lock or tag to a switch or circuit breaker: <ul style="list-style-type: none"> • Isolate the circuit • Lock or seal (using tape) the Control Panel • Attach a Danger Tag to the Control Panel door
	Warning <ul style="list-style-type: none"> • Failure to correctly isolate all energy sources could result in serious injury or death. Always verify that isolation has been achieved and, if in doubt, seek assistance from your Line Manager • Before reinstating power always check for Red Flag/s and that equipment is safe to reinstate. Look for and inform other personnel that may be affected by reinstating the circuit. Never remove another person's lock or tag as doing so could result in their injury or death •
Isolation – Train Movement	To protect from the movement of Electric Trains always: <ul style="list-style-type: none"> • Isolate the guard's emergency cock, in accordance with SMS-06-SW-1133 Guard's Emergency Cock Lock-Out as required
	To protect from the movement of Diesel Trains you must : <ul style="list-style-type: none"> • Shut down the engine and apply the park brake fully • Apply local road isolation (e.g. lock the boom gate, position the stop board and position chocks)
Carry Out Auxiliary Power Supply System Work	Once isolation and other relevant controls have been put in place, carry out the auxiliary power supply work.

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	<p>Warning</p> <p>Auxiliary Power Supply work has a number of general hazards. These include...</p> <ul style="list-style-type: none"> • Crane related hazards from the lifting of components. Refer to SMS-06-SW-1151 Overhead Travelling Crane - Safe Operation for all hazard and control information • Electric shock hazard from contact with conductive components and wiring when undertaking auxiliary power supply work. Ensure isolation is in place and verified before commencing work • Manual handling injury when handling large or heavy components or components mounted in difficult to reach positions. To prevent injury, use manual handling aids, seek assistance (team lift) and always work in accordance with your training, Refer to: SMS-06-GD-0001 Guide to Manual Handling
	<p>Warning</p> <p>In addition to the above, some auxiliary power supply work has additional unique hazards. These include...</p>
Alternator Change & Maintenance	<ul style="list-style-type: none"> • Hazards around the use of a drop table, train lifting jack or an overhead travelling crane. Always work in accordance with the relevant equipment SWI, refer to: SMS-06-SW-1246 Drop Table - Safe Operation, SMS-06-SW-1247 Train Lifting Jacks - Safe Operation and SMS-06-SW-1151 Overhead Travelling Crane - Safe Operation • Hazards associated with working in a maintenance pit. Always work in accordance with SMS-06-SW-0812 Working in the Pit • Finger crush injuries and lacerations from sharp edges and protrusions are a hazard when working on auxiliary power supply systems. Always wear protective gloves to prevent injury, refer to: SMS-06-SW-0538 PPE for Electrical Work • Crush and strike hazards when using a forklift. Only trained and competent forklift operators are to drive or otherwise use forklifts and always in accordance with SMS-06-SW-0400 Forklift Trucks. Additionally ensure the operator has a clear path to travel and work at all times. Hydraulics can creep so never allow anyone to work beneath lifted equipment • Injury from brush retaining springs which can cause finger entrapment/crush injuries. To prevent injury, always wear suitable gloves and keep fingers clear when lowering retaining springs, refer to: SMS-06-GD-0001 Guide to Manual Handling • Airborne carbon dust when working on brushes. To prevent injury always wear safety eyewear and respiratory protection when carrying out this step, refer to: SMS-06-GD-0323 Personal Protective Equipment
Battery Maintenance	<ul style="list-style-type: none"> • Injury from battery electrolyte. Electrolyte is very corrosive therefore contamination of any body part especially the eyes, will result in serious injury. To prevent injury: <ol style="list-style-type: none"> 1. Always examine every battery for signs of electrolyte leakage or spillage before interacting with it 2. Ensure you are wearing all the PPE for handling liquid chemicals, which includes, safety goggles and chemical resistant gloves, clothing and footwear 3. Always remove and discard clothing contaminated by electrolyte as soon as practicable • Manual handling injury when handling batteries. To prevent injury seek assistance and use manual handling aids and work in accordance with your training • Explosion risk. Batteries produce both hydrogen and oxygen, which is an explosive gas mixture. To prevent an incident, always ensure adequate ventilation, ensure the batteries are electrically isolated and no ignition sources exist. Only use insulated tools when working on batteries and ensure all electrical connections are tight to prevent the generation of sparks • Hazards associated with working in a maintenance pit. Always work in accordance with SMS-06-SW-0812 Working in the Pit
	<p>Warning</p> <ul style="list-style-type: none"> • Should battery electrolyte enter the eye immediately flush the eye holding open the eyelids with running water for at least 20 minutes even if no pain or discomfort is felt. Call for an ambulance immediately and the nearest first officer • Be aware that the electrolyte from Nickel Cadmium batteries (potassium hydroxide which is an alkaline) is extremely damaging to corneal tissue in the eye. Never delay flushing the eye with water and seek immediate medical attention

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Battery Charger Removal & Replacement	<ul style="list-style-type: none"> <i>Electric shock hazard. Verify all electrical connectors are not 'LIVE' before disconnecting (Refer to Warning isolation of relevant circuit page 2)</i> <i>Manual handling injury when handling batteries. To prevent injury seek assistance and use manual handling aids and work in accordance with your training refer to: SMS-06-GD-0001 Guide to Manual Handling</i>
Static Inverter Variable (SIV) Removal & Replacement	<ul style="list-style-type: none"> <i>Hazards associated with working on the roof. Always work in accordance with SMS-06-SW-1160 Working on High Roads</i> <i>Electric shock hazard. Always isolate all relevant electrical power sources in accordance with SMS-06-PR-0173 Plant and Equipment Lock-out Tag-out (see page 2 & 3)</i> <i>Overhead crane hazards. Always operate the crane in accordance with SMS-06-SW-1151 Overhead Travelling Crane - Safe Operation</i>
Auxiliary Diesel Engine Maintenance	<ul style="list-style-type: none"> <i>Multiple hazards when working with diesel engines. To prevent injury always work in accordance with SMS-06-SW-1261 Diesel Engine System (18): Safe Working</i>
Shore Supply	<ul style="list-style-type: none"> <i>Electric shock hazard. Always use in accordance with SMS-06-SW-1242 Shore Supply Connection and /or SMS-06-SW-1130 Electrical Isolation Diesel Fleet</i>
 Note	<ul style="list-style-type: none"> Always carry out work in accordance with relevant Engineering and Operational Instructions
Reinstate the electrical circuit	<p>Before reinstating power always check for Red Flag/s and that equipment is safe to reinstate. Look for and inform other personnel that may be affected by reinstating the circuit.</p>
Remove Isolation	Once area is safe, remove all previously applied isolations , in accordance with the referenced SWI.
 Warning	<ul style="list-style-type: none"> <i>Only remove your own isolation. The removal of another persons lock and / or tag may result in their injury or death. Offenders will be subject to strict disciplinary action and may be subject to prosecution by the regulator</i>
Function Test	Ensure correct installation of replaced components by function testing, as required.
Clean and Exit	<p>Ensure old components and waste are removed from the train. Dispose of waste so as they can not cause injury to others, such as in a designated bin. Remove your Red Flag in accordance with SMS-12-OI-0886 Red Flagging Trains in Stabling Yards, Depots and Maintenance Centres Notify the Line Manager (supervisor or foreman) of completion, as required.</p>
Remove Red Flag	Remove your Red Flag, in accordance with SMS-12-OI-0886 Red Flagging Trains in Stabling Yards, Depots and Maintenance Centres .
Notify	Notify Line Manager (supervisor or foreman) of completion, as required.

Additional controls

- Other controls may be necessary, depending upon the work being carried out. Refer to relevant SWIs*
- If you identify additional hazards and / or controls relevant to this SWI, notify your Safety Facilitator or Line Manager as soon as practicable, so they can be noted and used to continuously improve this document*