



Government of **Western Australia**
Department of **Mines, Industry Regulation and Safety**
Resources Safety

Management of mobile equipment maintenance audit – guide

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Introduction

This document was reformatted in November 2015. At this time no material changes were made to the content of the guide, which was originally published in October 2014 under the title *Guide to mobile equipment on mines high impact function (HIF) audit 2014 Part 4 – Management of mobile equipment maintenance*.

Note: The Safety Regulation System (SRS) has replaced the AXTAT system and all reporting is done online through SRS.

This audit document is designed to include standards associated with the management of mobile equipment maintenance in mining operations.

The four ‘mobile equipment’ audit documents cover:

- traffic management (Part 1),
- mining operations and equipment selection (Part 2),
- surface and underground operations with site deliveries (Part 3), and
- management of mobile equipment maintenance (Part 4).

This document (Part 4) covers management of mobile equipment maintenance. This part has five elements and a total of 52 individual standards.

This audit includes reference to a wide range of powered mobile equipment including haul trucks, water tankers, industrial lift trucks (forklifts), integrated tool carriers, elevating work platforms, mobile cranes, earthmoving machinery, surface miners, aircraft tugs, light vehicles and other vehicles fitting the title. It includes anything that can be driven or ridden on or in and excludes rail mounted equipment and equipment such as bridge & gantry cranes, stackers, reclaimers, ship loaders, locomotives and rolling stock and tethered mobile equipment (e.g. electric shovels, rope driven equipment).

This audit should be read and utilised in conjunction with the *Safe Work Australia’s model code of practice for roads and other vehicle operator areas*.

This part contains a number of standards that may not be applicable to all mines. Standards that are not applicable should be left out and will not influence audit outcomes.

Where the term “verify” is used in the guideline intent, it implies there is a regulatory requirement for compliance with the standard. Where the term “ensure” is used, there is no mandatory requirement for compliance but the standard sets out a recommended practice, which, if followed, should minimise the risk of incidents.

Mobile equipment guidance material is available from the Department of Mines and Petroleum web site, www.dmp.wa.gov.au.

Further traffic guidance material is provided at:

- <http://www.commerce.wa.gov.au/WorkSafe/Content/Publications/Index.htm>
- http://www.commerce.wa.gov.au/WorkSafe/PDF/Bulletin/Safe_movement_vehicle.pdf
- <http://www.dme.qld.gov.au>
- <http://dpi.nsw.gov.au>
- Personnel access to heavy mining machinery – guideline

Glossary

MSIA	<i>Mines Safety and Inspection Act 1994</i>
MSIR	Mines Safety and Inspection Regulations 1995
MSB	DMP Mines Safety Bulletin
SIR	DMP Mines Safety Significant Incident Report
NSW SA	Safety alerts issued by the Department of Trade and Investment, New South Wales
NSW SB	Safety bulletins issued by the Department of Trade and Investment, New South Wales
QLD SA	Safety alerts issued by the Department of Natural Resources and Mines, Queensland

1 Register of equipment

Register of equipment

Point	Standard	Guideline
1.1	There is a register of mobile equipment, including permanent contractor's equipment and a system to manage the condition and maintenance of itinerant mobile equipment on the mine site.	<p>Intent: To ensure that all the relevant equipment details are readily available.</p> <p>Personnel: Maintenance Manager.</p> <p>Method: View the register of mobile equipment. Check that classified mobile plant is included.</p>
1.2	The register is current.	<p>Intent: To ensure that the register contains up to date records.</p> <p>Personnel: Maintenance Manager.</p> <p>Method: View the register of mobile equipment and correlate against recent purchases and disposals.</p>
1.3	Each item of equipment is clearly identified with the appropriate register number, in lettering sufficiently large enough to be easily read from a distance.	<p>Intent: To ensure that items of equipment can easily be identified for requirements such as seeking permission by radio for overtaking, passing behind etc.</p> <p>Personnel: N/A</p> <p>Method: View various items of mobile equipment such as loaders, dozers, excavators, haul trucks, light vehicles etc.</p>

2 Maintenance program

Maintenance program

Point	Standard	Guideline
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2.1	A competent person is appointed to be in charge of the maintenance program.	<p>Intent: To ensure that maintenance will be under the direction of a suitable competent person.</p> <p>Personnel: Maintenance Supervisor.</p> <p>Method: Sight appointment documentation, interview maintenance supervisor.</p>
2.2	There is an effective routine preventative maintenance program for mobile equipment which is carried out at predetermined intervals of time or distance.	<p>Intent: To verify that mobile equipment is maintained in a safe operating condition.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: View written program and interview maintenance personnel. Refer to MSIR rr. 6.2, 10.37 and 13.2.</p>
2.3	The maintenance program is developed in accordance with the recommendations of the equipment manufacturer.	<p>Intent: To verify that the maintenance program is specific to the equipment.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: Compare OEM maintenance manuals and recommendations with the site maintenance procedures. Refer to MSIR r. 6.2.</p>
2.4	The maintenance program covers all the operating functions of the mobile equipment.	<p>Intent: To verify that the vehicle operating functions are maintained in a safe operable condition</p> <p>Personnel: Maintenance personnel</p> <p>Method: View maintenance documents and interview maintenance personnel. Refer to MSIR r. 6.2.</p>

2.5	The maintenance program covers all ancillary systems and components fitted to the mobile equipment.	<p>Intent:</p> <p>To verify that the vehicle ancillary systems and components are maintained in a safe operable condition</p> <p>Personnel:</p> <p>Maintenance personnel.</p> <p>Method:</p> <p>View maintenance documents and interview maintenance personnel. Refer to MSIR r. 6.2.</p>
2.6	The maintenance program is updated when new equipment is placed into operation.	<p>Intent:</p> <p>To ensure that all new equipment is included in the maintenance program.</p> <p>Personnel:</p> <p>Maintenance personnel.</p> <p>Method:</p> <p>Sight document records, interview maintenance personnel.</p>
2.7	Replacement parts and components are selected in accordance with the mobile equipment manufacturer's specifications.	<p>Intent:</p> <p>To ensure that the replacement parts and components are compatible with the equipment.</p> <p>Personnel:</p> <p>Maintenance personnel</p> <p>Method:</p> <p>View maintenance documents and interview maintenance personnel.</p>
2.8	The defect reporting procedure provides information and accountability for the rectification of faults found on mobile equipment.	<p>Intent:</p> <p>To ensure that there is clear accountability for the rectification of faults found on mobile equipment.</p> <p>Personnel:</p> <p>Maintenance personnel.</p> <p>Method:</p> <p>Observe documentation and interview maintenance personnel.</p>
2.9	Mobile equipment defect reports are attended to in a timely manner.	<p>Intent:</p> <p>To ensure that defects are rectified in a timely and systematic manner.</p> <p>Personnel:</p> <p>Maintenance supervisor.</p> <p>Method:</p> <p>Inspect a sample of equipment defect reports. Confirm that defects reported have been rectified in a reasonable time frame. Confirm if the company has a priority escalation process based on timing.</p>

2.10	Results of mobile equipment inspections are monitored to identify common defects or patterns of defects with a view of preventing recurrences.	<p>Intent: To ensure that trends are identified in order to prevent a recurrence.</p> <p>Personnel: Maintenance planner</p> <p>Method: Review prevention program.</p>
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3 Maintenance of key systems and components

Maintenance of key systems and components

Point	Standard	Guideline
3.1	ROPS/FOPS and their mountings are inspected and where damage is identified the mobile equipment is removed from service.	<p>Intent: To verify that appropriate systems are in place and measures are taken to identify significant damage and make necessary arrangements for repair or replacement.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: Review maintenance procedures, inspect samples of ROPS/FOPS placarding. Refer to MSIR r. 4.15(2)(c), AS 2294 <i>Earth-moving machinery— Protective structures Part 1: General</i>, AS 1636 <i>Tractors – Roll-over protective structures – Criteria and tests</i> and AS 2359.9 <i>Powered industrial trucks – Overhead guards – Specification and testing</i> (ISO 6055:2004, MOD).</p>
3.2	Where a ROPS/FOPS repair is required it is carried out in accordance with the manufacturer's specifications.	<p>Intent: To verify that if repairs are performed, the ROPS/FOPS will function as designed.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: Interview maintenance personnel and view manufacturer's documents. Refer to MSIR r. 4.15(2)(c), AS 2294 <i>Earth-moving machinery— Protective structures Part 1: General</i>, AS 1636 <i>Tractors – Roll-over protective structures – Criteria and tests</i> and AS 2359.9 <i>Powered industrial trucks – Overhead guards – Specification and testing</i> (ISO 6055:2004, MOD).</p>
3.3	Mobile equipment brake components are inspected, repaired or replaced in accordance with the manufacturer's recommendations.	<p>Intent: To verify that mobile equipment brakes will function as designed.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: View manufacturer's service documents and equipment service records. Refer to MSIR rr. 10.38 and 13.2.</p>

3.4	Any braking system installed on a trailer is maintained in an operational condition.	<p>Intent: To ensure that any trailer fitted with a braking system is provided with effective brakes capable to bring the equipment to a safe halt and hold it in all circumstances.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: Inspect maintenance records, the pre-start booklet and a sample of trailer equipment to ensure that the brakes are being checked and maintained on the equipment prior to use.</p>
3.5	Mobile equipment steering components are inspected, maintained, repaired or replaced in accordance with the manufacturer's recommendations.	<p>Intent: To verify that the steering components will function as designed.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: View manufacturer's service documents and equipment service records to verify that components are checked and maintained on mobile equipment service sheet records. Refer to MSIR r. 10.37 and 13.3(4), Mines Safety Bulletin No. 84 and Mines Safety Significant Incident Report No. 128.</p>
3.6	Emergency braking and steering systems, where fitted, are inspected and the results of these inspections are recorded.	<p>Intent: To verify that mobile equipment emergency systems are checked to ensure functionality.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: View equipment records and interview maintenance personnel and service records. Refer to MSIR rr. 10.38(8) and 13.3(4).</p>
3.7	Mobile equipment lighting is inspected and repaired or replaced when found to be defective.	<p>Intent: To verify that mobile equipment lighting will function as designed.</p> <p>Personnel: Maintenance personnel and operators.</p> <p>Method: View equipment service records and interview maintenance personnel and operators of equipment. Confirm that driving, marker, reversing, instrument, tail, indicator and brake lights are checked. Check in-situ. Refer to MSIR r. 13.3(4).</p>

3.8	Mobile equipment audible and visual warning devices are inspected and repaired or replaced when found to be defective.	<p>Intent: To verify that audible and visual warning devices will function as designed.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: View equipment service records and interview maintenance personnel and operators of equipment. Refer to MSIR rr. 10.43 and 13.3(4).</p>
3.9	Where safety cameras or other safety warning sensor devices are installed on equipment regular testing is carried out.	<p>Intent: To ensure that the devices are maintained in good working order.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: Inspect a sample of inspection records for this special equipment to validate whether cameras or other warning sensor devices are tested.</p>
3.10	Mobile equipment seats are inspected and repaired or replaced when found to be defective.	<p>Intent: To verify that mobile equipment seats are installed and fit for purpose.</p> <p>Personnel: Maintenance personnel, equipment operators.</p> <p>Method: Interview maintenance personnel and equipment operators; inspect equipment seats. Refer to MSIR r. 13.3(1)(c).</p>
3.11	Mobile equipment seat belts are inspected and repaired or replaced when found to be defective.	<p>Intent: To verify that personnel travelling in mobile equipment are suitably restrained and protected when seated.</p> <p>Personnel: Maintenance personnel and seat belt users.</p> <p>Method: View maintenance records. Inspect a sample of various seat belts and interview seat belt users. Refer to MSIR r. 4.16, Mines Safety Bulletins No. 20 and 33.</p>

3.12	Mobile equipment wheels and rims are regularly inspected and maintained or replaced as required.	<p>Intent: To ensure that equipment wheels and rims are maintained in a safe condition and function as designed.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: View wheel and rim service records and interview maintenance personnel. Refer to Mines Safety Significant Incident Report No. 72 and QLD SA 208 and 211.</p>
3.13	Mobile equipment tyres are regularly inspected and maintained or replaced as required.	<p>Intent: To ensure that mobile equipment tyres are maintained in a safe condition and function as designed.</p> <p>Personnel: Maintenance personnel, operators</p> <p>Method: View tyre service sheets plus inflation inspection sheets. Interview maintenance personnel and operators. Tyres should be fitted to rims in accordance with the Tyre and Rim Association of Australia (TRAA) standard and/or relevant Australian Standards.</p>
3.14	Wheel/hub/rim/tyre assembly components are regularly inspected and maintained or replaced as required.	<p>Intent: To ensure that wheel components are maintained in a safe condition and function as designed.</p> <p>Personnel: Maintenance personnel and fitters.</p> <p>Method: Interview maintenance personnel and inspect mobile equipment. Enquire that information has been provided on how torque is applied and limited and the removal sequence.</p>
3.15	There is a system, which includes a written SOP, in place to manage the maintenance of mobile equipment that carries explosives.	<p>Intent: To ensure that explosive vehicles are sterilised of explosives and detonators prior to entering the workshop.</p> <p>Personnel: Maintenance personnel and fitters.</p> <p>Method: Check SOP and question personnel.</p>

3.16	Earthing systems on explosives vehicles are inspected regularly.	<p>Intent: To ensure that earthing systems are functional.</p> <p>Personnel: Maintenance personnel and fitters.</p> <p>Method: Interview maintenance personnel and inspect mobile equipment records.</p>
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4 Maintenance of ancillary systems and components

Maintenance of ancillary systems and components

Point	Standard	Guideline
4.1	Mobile equipment windscreens and other glass panels are regularly inspected and maintained or replaced as required.	<p>Intent: To verify that the operator is not placed at risk of injury from windows breaking and/or vision being impaired.</p> <p>Personnel: Maintenance personnel and mobile equipment users.</p> <p>Method: Interview equipment operators and inspect mobile equipment. Check that glass is not cracked, broken or missing. Refer to MSIR r. 10.42 for trackless equipment and MSIA s.9(1)(a) for other equipment.</p>
4.2	Access to cabin and service point locations are regularly inspected and maintained in a safe condition.	<p>Intent: To ensure that safe access is maintained to cabin and service points on mobile equipment.</p> <p>Personnel: Maintenance personnel and mobile equipment users.</p> <p>Method: Interview equipment operators and inspect mobile equipment hand and foot holds. Refer to Mines Safety Significant Incident Report No. 153 and DMIRS <i>Personnel access to heavy mining machinery – guideline</i>.</p>
4.3	Fire extinguishing appliances and systems are regularly inspected and maintained or replaced as required.	<p>Intent: To verify that appropriate fire extinguisher equipment is available when required.</p> <p>Personnel: Maintenance personnel and equipment operators.</p> <p>Method: View fire extinguishers, service tags and inspection records. Refer to MSIR r. 10.59(1) where applicable.</p>
4.4	The two-way communication system is regularly inspected and maintained or replaced as required.	<p>Intent: To ensure that the two-way communication system is capable of being used when required.</p> <p>Personnel: Maintenance personnel and equipment operators.</p> <p>Method: View two-way service records. Interview maintenance personnel and equipment operators.</p>

4.5	Outriggers, where fitted, are inspected and maintained.	<p>Intent: To ensure that outriggers, where fitted, are capable of being used.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: View service records.</p>
4.6	Warning and instruction decals are inspected and maintained or replaced as required.	<p>Intent: To ensure that warning and instruction decals are maintained in a legible condition.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: Check a sample of manufacturer's equipment manuals for the required decals and ensure they are fitted.</p>
4.7	Vehicle identification markings are inspected and maintained in a clean condition.	<p>Intent: To ensure that mobile equipment fleet markings, are being maintained in a legible condition.</p> <p>Personnel: N/A</p> <p>Method: Inspect a sample of mobile equipment to confirm that vehicle identification markings and number plates where applicable are clean and legible.</p>
4.8	Mobile equipment operator cabins are adequately maintained.	<p>Intent: To ensure the cabin working environment is adequately maintained.</p> <p>Personnel: Maintenance supervisors.</p> <p>Method: View a sample of mobile equipment to ensure air-conditioning/ventilation systems are functional and dust resistant where practicable.</p>

4.9	Where mobile equipment is equipped with gas cylinders or pressure equipment these items are inspected and maintained.	<p>Intent:</p> <p>To verify that appropriate inspection and maintenance systems are in place such that the equipment does not expose operators and others to unacceptable levels of risk.</p> <p>Personnel:</p> <p>Plant engineers and operators of mobile equipment.</p> <p>Method:</p> <p>Ensure there is a reliable system of determining system pressure. If any gauges are present they are maintained in working order. Check adequate signage is in place to warn of system pressures and isolation precautions.</p> <p>Refer to MSIR r. 6.26.</p>
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5 Maintenance facilities

Maintenance facilities

Point	Standard	Guideline
5.1	There is a suitable facility available for the maintenance of mobile equipment.	<p>Intent: To ensure that there is a suitable facility for the maintenance and servicing of mobile equipment.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: View facilities and interview maintenance personnel. Confirm that there is sufficient access and egress available for normal and emergency conditions. Also confirm that they meet relevant wind loading requirements for the region.</p>
5.2	Emergency exits are provided, delineated and maintained free from obstruction at large maintenance facilities	<p>Intent: To ensure that emergency exits are provided and clearly identified for use in the event of an emergency.</p> <p>Personnel: N/A</p> <p>Method: View the emergency exits and emergency lighting signage provided. Confirm that the exits are free from obstruction.</p>
5.3	Maintenance equipment is selected for compatibility with the equipment being serviced.	<p>Intent: To ensure that the maintenance equipment is suitable for the equipment being serviced.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: View equipment and interview maintenance personnel.</p>
5.4	Maintenance equipment is itself maintained.	<p>Intent: To ensure that the mobile equipment maintenance equipment is itself capable of working correctly.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: View maintenance equipment, service records and interview maintenance personnel.</p>

5.5	There is an area suitable for the jacking and support of mobile equipment.	<p>Intent:</p> <p>To ensure that there is a hard stand area or suitable load distribution plates for jacking and servicing mobile equipment.</p> <p>Personnel:</p> <p>Maintenance personnel.</p> <p>Method:</p> <p>Interview maintenance personnel and sight hard stand area. Check for procedures and signage about load limits.</p>
5.6	There is an area available for washing down mobile equipment.	<p>Intent:</p> <p>To ensure that mobile equipment can be properly cleaned prior to inspection and maintenance.</p> <p>Personnel:</p> <p>Maintenance engineers.</p> <p>Method:</p> <p>View the wash down area, oil collection and disposal methods.</p>
5.7	The wash down equipment has been reviewed to ensure any associated hazards have been addressed.	<p>Intent:</p> <p>To ensure that the wash down process poses no danger to personnel.</p> <p>Personnel:</p> <p>Maintenance personnel.</p> <p>Method:</p> <p>Interview maintenance engineers and personnel plus view the wash down area. Check for Legionella control, silt and grease traps are guarded, and foundation erosion is prevented.</p>
5.8	Suitable areas for mobile equipment refuelling are provided.	<p>Intent:</p> <p>To ensure that there is a dedicated mobile equipment re-fuelling facility.</p> <p>Personnel:</p> <p>Maintenance personnel and equipment operators.</p> <p>Method:</p> <p>View equipment refuelling facilities.</p>
5.9	The refuelling area has containment provision for fuel spills.	<p>Intent:</p> <p>To ensure that the potential for fuel spills can be controlled in a safe consistent manner.</p> <p>Personnel:</p> <p>Maintenance personnel and equipment operators.</p> <p>Method:</p> <p>View re-fuelling area. Check that there is a procedure to deal with fuel spills, spill kits/media available, spill reporting system in place.</p>

5.10	Fire extinguishing equipment is available at the refuel area.	<p>Intent: To ensure that fires can be immediately dealt with.</p> <p>Personnel: Maintenance personnel and equipment operators.</p> <p>Method: View extinguishers at re-fuelling areas (suitable type, size, location and currency). Refer to AS 2444 - <i>Portable fire extinguishers and fire blankets - Selection and location</i></p>
5.11	Mobile refuelling and service equipment is maintained in a safe operational condition.	<p>Intent: To ensure that the mobile refuelling equipment is maintained in a safe operational condition.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: View the refuel equipment, check that the emergency shut off is operational, there are no hose leaks and etc.</p>
5.12	Safe means to access and alight from vehicles under maintenance and to access other necessary areas are provided.	<p>Intent: To ensure that maintenance personnel, while carrying out tasks or moving about on vehicles, are provided proper and safe of access and egress.</p> <p>Personnel: Maintenance personnel.</p> <p>Method: Interview maintenance supervisor and maintainers. Check provision of access systems and falls from height issues have been addressed. Refer to DMIRS <i>Personnel access to heavy mining machinery – guideline</i>.</p>
5.13	Surfaces on vehicles where employees walk or climb are slip resistant and hand holds are provided where necessary.	<p>Intent: To ensure that adequate provision has been made so that maintenance personnel do not slip or fall.</p> <p>Personnel: Supervisor.</p> <p>Method: Interview maintenance supervisor and drivers. Check grab hold points, and high friction grip surfaces. Determine that unwanted slippery materials have been cleaned off mobile plant prior to maintenance work being carried out.</p>

5.14	Where maintenance cannot be carried out in a dedicated maintenance facility under the normal procedures, specific safe work procedures are developed for each and every task that has to be carried out.	<p>Intent: To ensure that field maintenance work is carried out in a safe manner taking into account the site conditions and limitations and the specific circumstances.</p> <p>Personnel: Maintenance personnel, supervisor.</p> <p>Method: Review procedure to be followed when field repairs are required to be undertaken (JSA, JHA, level of supervision, previous events). Refer to Mines Safety Significant Incident Reports No. 52 and 136.</p>
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