



**Industry &
Investment**

GUIDELINES

MDG 42.2

**Guideline for person-riding
hoists in Gem mines**

Part 2 : Maintenance

**Produced by Mine Safety Operations Branch
Industry and Investment NSW**

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The Department would like to thank the Lightning Ridge Miners Association, Glengarry Grawin Sheeppark Miners Association, local designers and users for their support of this publication.

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The compilation of information contained in this document relies upon material and data derived from a number of third party sources and is intended as a guide only in devising risk and safety management systems for the working of mines and is not designed to replace or be used instead of an appropriately designed safety management plan for each individual mine. Users should rely on their own advice, skills and experience in applying risk and safety management systems in individual workplaces.

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Alternatively, phone (02) 4931 6666.

Foreword

In recent years there has been an increase in the number of injuries involving person-riding hoists in gem mines.

The MDG 42 series of guidelines is intended to help deal with the risks associated with operating this type of hoist.

These guidelines come in two parts:

Part 1 provides guidance on the design of person-riding hoists in gem mines

Part 2 provides guidance on the maintenance of person-riding hoists in gem mines.

This guideline is Part 2 of the series. It provides a good industry benchmark for engineering standards and fit for purpose equipment.

The guideline represents good industry practice for reducing the risks associated with the use of person-riding hoists in gem mines and provides practical guidance to stop people being injured.

This is a Published Guideline.

The principles contained in this document are intended as information to assist industry to devise safety standards. Designers, manufacturers, owners and users of person-riding hoists for gem mines should rely upon the advice, skills and experience available to them when applying safety standards in individual workplaces.

Following this guideline does not in itself assure compliance with the general duty of care.

MDG 42.2, *Guideline for person-riding hoists in gem mines, Part 2: Maintenance*, was distributed to industry for consultation and was also distributed to the Lightning Ridge Miners Association and Glengarry Grawin Sheepyard Miners Association

A feedback sheet is provided at Appendix C. Constructive comment is essential to help the Department improve these industry guidelines.



R. Regan

Director

Mine Safety Operations

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1. Purpose and scope

1.1 Purpose

Minimise risk This guideline provides information to assist in the maintenance of personnel carrying hoists in gem mines in order to minimise risks to the health and safety of people using such hoists.

1.2 Scope

Minimum maintenance requirements This guideline recommends minimum requirements for the maintenance of mining hoists which are used by one or two people in gem mines to a maximum depth of 40 metres.

It provides assistance for the maintenance of these mining hoists by:

- a) providing guidance in operational and maintenance risk assessments (identifying potential hazards, assessing risk and implementing appropriate risk controls), refer Appendix B
- b) recommending minimum requirements for operation, refer Section 2
- c) recommending minimum requirements for maintenance, see Section 3.

Item registration This guideline also provides maintenance recommendations for the purpose of item registration of mining hoists in gem mines, see clause 113 and 136 of the *Occupational Health and Safety Regulation 2001*.

Note: Appendix A provides information on reference documents and definitions used in this guideline.

1.3 Application

All gem fields This guideline applies to all Gem fields in New South Wales.

Using, maintaining or auditing hoists This guideline should be used by users and maintainers of hoists when:

- a) using person-riding hoists in gem mines
- b) maintaining person-riding hoists in gem mines
- c) auditing existing hoists used by people.

2. Operation

2.1 General

Owners or persons in control of mining hoists must ensure:

- a) mining hoists are used in accordance with its intended operational envelope and the designers recommendations
- b) adequate information, training and supervision is available
- c) mining hoists are only used for the purpose for which they were designed, (unless a competent persons assesses that the change does not present an increase in risk to safety)
- d) safety features are used as intended by the designer of the mining hoist
- e) the risk of entanglement is controlled by safe guarding systems or by application of safe systems of work if guarding is not possible
- f) people do not work near fixed and traversing parts of the mining hoist, where there is a risk to health or safety
- g) persons do not work in the immediate area of remotely or automatically energised parts of the mining hoist without appropriate controls and systems of work in place
- h) hot parts are adequately guarded
- i) measures are provided to prevent unauthorised alterations or use of the mining hoist

Note: Alterations to safety critical aspects of the hoist should be done with the involvement of the designer or competent person.

- j) appropriate tests, checks and inspections are made on the hoist as necessary for safety
- k) mining hoists are not used if there is an immediate risk to safety, and are only returned to use when risks are eliminated or adequately controlled
- l) only competent operators operate the hoist.

Note: For occupational health and safety obligations related to plant see Chapter 5 of the Occupational Health and Safety Regulation 2001 at www.legislation.nsw.gov.au

2.2 Control

- a) A procedure should be established so that a competent person investigates the cause of any over travel condition.

- b) The safety circuit should have reset facilities located on the surface and the resetting of the safety circuit should only be carried out by the competent person nominated by the owner. The competent person should only reset the safety circuit after they have investigated the cause of the operation of the safety circuit and taken any action necessary to ensure that it is safe to do so.
- c) Hoisting of small tools and equipment is permitted while a person is in the cage / platform provided it is safe to do so and does not exceed the rated payload of the hoist.

3. Maintenance

3.1 General

Note:

Details of relevant occupational health and safety obligations can be found in Chapter 5 of the OHS Regulation 2001 at www.legislation.nsw.gov.au

Owners or persons in control of mining hoists must ensure that:

- a) necessary facilities and systems of work are provided and maintained
- b) inspections, maintenance, testing and cleaning is carried out with regard to information from designers and manufacturers or guidance from a competent person
- c) all safety features and warning devices on mining hoists are tested and maintained
- d) competent persons assess any damage to mining hoists, where the risk to safety may be increased
- e) during maintenance or repair, the hoist is stopped, isolated and controls or safe systems of work are used to safeguard people doing the work.
- f) repair, inspection and testing is carried out by a competent person
- g) repairs to a mining hoist keep the mining hoist within its design limits.
- h) if access to the mining hoist is required for maintenance work, the mining hoist is stopped and a lockout, danger tag, permit or other control measure is used.

Note:

This is to prevent inadvertent movement or energising of the hoist controls.

3.2 Maintenance management

A maintenance management system should be established and maintained by the owner of the hoist. This maintenance management system should:

- a) identify all lifecycle maintenance activities that are required for the hoist to remain in a safe condition to use
- b) identify all inspection and tests to be carried out and the competencies of people carrying out those inspections or tests
- c) be documented
- d) be developed by a competent person(s) giving consideration to:
 - information provided by the manufacturer (see Clause 2.2)
 - site specific conditions

- the intended application
- duty cycle of the hoist.

3.3 Making sure hoists are safe

Controlling risks often means carrying out regular inspections, tests and preventative maintenance. This should include:

- a) regularly inspect the hoist, its brake, the rope, clamps, and all safety critical items
- b) carry out routine maintenance
- c) make sure guards and other safety devices are routinely checked and kept in working order
- d) make necessary adjustments
- e) replace damaged or worn parts
- f) keep maintenance records.

3.4 The Winch

- a) Check that all moving components of the drive system are effectively guarded so that no part of the body can come into contact or be entangled by moving parts.
- b) Check for any vibration, unusual noises etc coming from the hoist by running it down and then back up.

3.4.1 Brakes and holding devices

- a) The hoist brakes and holding devices should be inspected and maintained according to the manufacturer's recommendations.
- b) Check the brake or holding device is functioning .i.e. holding a loaded cage/platform stationary
- c) The brake path should be regularly inspected for contamination if exposed to the elements or if the brakes are operated by hydraulic or pneumatic means.
- d) If the brakes are hydraulic or pneumatically operated the brake lines and brake callipers or actuators should be regularly checked for leaks.
- e) The brake pads should be regularly inspected for wear.
- f) All components of the brake and holding device system should be regularly checked for security.

3.4.2 Drives

- a) Inspect electric motor junction box is intact, undamaged and securely fastened.
- b) Inspect motor mounting bolts are in place and secure.
- c) Inspect electric motor fan and cowling is in place, secure and undamaged.

Note: Drives may be electric, hydraulic or pneumatic.

3.4.3 Hydraulic circuits

- a) Check regularly the motor to hydraulic pump connection is tight.
- b) Check regularly the hydraulic pump for oil leaks.
- c) Check regularly the hydraulic motor to drum connection is tight.
- d) Check regularly the hydraulic motor for oil leaks.
- e) Check regularly the hydraulic control valves for security and operation.
- f) Check regularly the control valves for oil leaks.
- g) Check regularly all hydraulic hoses for oil leaks.
- h) Check regularly all hydraulic hoses for abrasion or damage.
- i) Check periodically the system flow, operating pressure and pressure relief valve settings.
- j) Check the oil filtration as to the manufacturer's recommendations.

3.4.4 Pneumatic driven hoists

- a) Check oil and, if required, top up the oil in lubrication bottle.
- b) Check the pneumatic motor is securely fastened to the drum.
- c) Check the pneumatic motor for air leaks
- d) Check the muffler is in place and undamaged
- e) Check hoses for damage
- f) Check that safety clips are in the hose couplings.
- g) Check the hoses for air leaks.
- h) Check the compressor for loose or missing guards
- i) Check the relief valve is operating
- j) Check the compressor is unloading at the required setting
- k) Check the oil level in the compressor
- l) Check the compressor air filter
- m) Check the pressure receiver which stores the compressed air for corrosion or damage.
- n) Drain water regularly from air receiver.

3.4.5 Gearbox

- a) Check the gearbox oil level after running the hoist down and up. Also check the oil for a milky colour as this indicates water in the oil.
- b) Check the gearbox for oil leaks.
- c) Check the gearbox mounting bolts are in place and secure.
- d) Check for metal in the oil by taking a sample from the drain plug. If metal is present it could indicate damaged gears or bearings.
- e) Check the input and output shafts for lift and play.

3.4.6 Couplings and shafts

- a) Check the couplings are secure on the shaft.
- b) Check the keys are intact and undamaged and the lock screws are secure.
- c) Check the coupling bolts and rubbers are secure and intact.

3.4.7 Drive belts / pulleys

- a) Check the drive belts for wear, cuts and damage.
- b) Check the belt tension.
- c) Check the pulleys for damage.
- d) Check the pulleys are secure on the shafts.
- e) Check the keys are intact and undamaged and the lock screws are secure.

3.4.8 Chains / sprockets

- a) Check the chain is safe for continued operation.
- b) Check the chain tension.
- c) Check the sprockets for damage.
- d) Check the sprockets for wear of the teeth.
- e) Check the sprockets are secure on the shaft.
- f) Check the keys are intact and undamaged and the lock screws are secure.

3.4.9 Drive drum

- a) Check the drum mounting bolts are in place and secure
- b) Check the drum for worn or collapsed bearings
- c) Check the lay of the rope on the drum to make sure it is distributed evenly over the drum. The lay of the rope on the drum should be evenly layered and not bunched up to one side.
- d) Check that bearings are secure, lubricated and serviceable.
- e) Check the drum for any cracks or damage.

3.5 Ropes

Regular inspections

Regular (e.g. daily) inspections / tests should include:

- a) Inspect the rope while running the empty cage / platform to the shaft bottom and back up to ensure it is adequately lubricated and free from obvious defects.
- b) Ropes should be regularly examined for corrosion, broken wires, kinks, loose wires, proud strands, deformation, damage and wear.
- c) A rope should be discarded whenever any of the above conditions are found and the affected part cannot be cut out because it would leave the rope too short.
- d) The rope connections should be regularly checked for security.
- e) Check the rope is not rubbing on any stationary object.

Periodic inspections

Periodic inspections / tests should include:

- a) checking that the rope to cage connection is secure, at least 3 rope clamps are in place and have not moved and 'd' shackles pins are prevented from working loose by a locking mechanism
- b) checking the lay of the rope on the drum to make sure it is evenly layered and not bunched up to one side
- c) checking that the rope is kept lubricated

Note: Do not use grease for lubricating the rope. Hydraulic oil, gear oil etc. should be used.

- d) checking that a spliced rope is never used on a hoist that is to carry people
- e) checking that a used rope is never used unless it is proven to be safe.

3.6 Sheaves

- a) Check that the rope sheave retention bracket and the guards are in place and secure.
- b) Check for collapsed or worn bearings.
- c) Check regularly the holding down bolts to make sure they are tight.
- d) Check the head sheave is guarded to stop entanglement between the rope and the sheave.
- e) Check the sheaves carefully for any sign of cracks or pieces broken from the flanges.

Note: If the flange breaks off it will allow the rope to jump free with disastrous results. If even a small portion of the flange is broken the rope is liable to be cut completely through by the edge of the break.

- f) Lubricate the sheave bearings according to the designer's recommendations.
- g) Check that the rope is not being squashed in the sheave. It should have no contact apart from around the bottom radius of the rope, refer MDG 42.1 Appendix B.
- h) If the hoist has a removable sheave block it should be attached to the head frame by a shackle which has a split pin to stop the nut from coming off, or if attached by a swivel hook, the hook must have a safety clip.

3.7 Cage / platform

- a) The broken rope emergency arresting system should be lubricated and regularly checked to make sure it is operating freely.
- b) Check the cage/platform door or gate for operation and security.
- c) Check regularly the broken rope emergency arresting system for loose or missing bolts and for broken welds or other defects that may affect its operation.
- d) Visually inspect regularly the cage/platform guides/rollers.
- e) Check periodically the cage/platform frame for loose bolts, cracks, rusted sections and broken welds.
- f) Check periodically the cage/platform floor for rust, or if the floor is of timber, check for damage or rot.

3.8 Control system

- a) Check that all the hoist raise and lower controls are working.
- b) Check that the emergency stop(s) work.
- c) Check that the upper and lower limits and any other controls work.
- d) All safety critical components of the control system should be tested periodically.

3.9 Head frame

- a) The hoist head frame should be visually inspected for missing bolts, broken welds, bent or loose structural members.
- b) All holding down bolts should be checked regularly.
- c) Check regularly the head frame for rust, especially around the base.
- d) Check that the fences and gate around the head frame and shaft are secure and in place.

3.10 Shaft

3.10.1 Guides

- a) Check the guides and joints for security.
- b) Check the guides for security to the shaft walls.
- c) Check the guides for alignment.
- d) Check the guides for cracks or broken welds.
- e) Check the shaft walls for security and loose material.
- f) Check the shaft walls and the hoist ladder by riding the cage / platform to the shaft bottom.

- 3.10.2 Landings**
- a) Check the surface landing fences and gate for security and operation.
 - b) Check that no one can fall down the shaft and that access is prevented by an appropriate locking system. This should be done daily before the mine is left unattended.
 - c) Check the shaft bottom fences and gate for security and operation.

3.11 Electrical maintenance

All electrical maintenance work should be carried out by a competent person. Electrical inspections and tests should include:

- a) Verification of circuit schematic diagrams
- b) Cabling integrity
- c) Emergency stops
- d) Gear loss protection
- e) Over speed protection
- f) Over travel protection
- g) Pre start warning
- h) Gate interlocks
- i) Motion detection
- j) Slack rope protection
- k) Signalling and communications
- l) Insulation and continuity testing
- m) Earth leakage devices

3.12 Periodic testing

- a) The system should be tested by lowering and raising the hoist each working day before a person rides the cage to the bottom. Check for any unusual noises or vibration when the hoist runs down and returns up the shaft.
- b) The emergency arresting system should be periodically tested for correct operation according to an appropriate documented procedure.
- c) The brake holding capacity should be periodically tested for holding capacity at appropriate intervals, including before using the hoist after an extended period of non-operation. Brake testing should be to twice the rated static load.
- d) All control and limiting devices should be periodically tested during regular operations or before start up when the hoist has been out of operation for an extended period.
- e) A thorough yearly examination of the entire hoist should be carried out, looking for rusted sections, cracks or breaks in the structure. This should include chipping off any scale, wire brush joints etc.

- f) A close examination of the rope should be done 6 monthly when in constant use and before use after extended non-operation of the hoist.

3.13 Inspection and maintenance records

All inspections and maintenance carried out should be entered into an inspections log under the mine safety management plans. A copy of the results of all inspections and maintenance should be kept.

All tests should be recorded with a copy of the test results kept for the life of the hoist.

Inspection and maintenance records should cover all inspection, tests and maintenance performed.

4. Hoist use – risk management

4.1 Occupational health and safety obligations

Note:

Details of occupational health and safety obligations can be found in relevant parts of the OHS Act and OHS Regulation at www.legislation.nsw.gov.au This guideline gives guidance on how to meet these requirements.

Employers

Employers must ensure the health, safety and welfare of their employees and others at the employer's place of work through a process of risk management and consultation. That duty extends to:

- ensuring that plant provided for use is safe and without risk to health when properly used
- ensuring that systems of work and the working environment are safe and without risk to health
- providing information, instruction, training and supervision as necessary to ensure health and safety is provided.

4.1.1 Consultation

Employers should consult with users (miners) when taking steps to assess and control risks associated with mining hoists.

4.2 Risk Management

A risk management process should be used in the operation and maintenance of mining hoists.

The owner or person in control of the hoist must:

- a) Identify all operational and maintenance hazards associated with the use of the mining hoist
- b) Evaluate and assess the risks arising from all identified hazards (identify, analyse and evaluate)
- c) Control the identified risks to reduce exposure to the lowest level reasonably practicable.

Consideration should be given to reasonably foreseeable misuse and previous accidents/incidents relating to mining hoists.

Note:

For more detailed guidance on the risk management process see MDG 42.1 Design.

4.2.1 Control of risk

Risks that cannot be reasonably eliminated must be controlled by a method(s) in the following order of preference:

- a) Substitute the hazard for a hazard with a lesser risk exposure.
- b) Isolate the hazard from people at risk.
- c) Minimise the risk by the use of engineering means.

- d) Minimise the risk by administrative means (e.g. safe work procedures, training, instruction, and information).
- e) Use of personal protective equipment (PPE).

Note: A combination of methods may be required to minimise the risk to the lowest level reasonable practicable.

5. Appendices

Appendix A Reference Documents and Definitions

Appendix B Sample daily inspection for electrically driven hoists

Appendix C Feedback Sheet

5.1 Appendix A : Reference Documents and Definitions

5.1.1 Applicable Legislation

Principal legislation for mine safety includes:

- a) The *Occupational Health and Safety Act 2000*
- b) The *Occupational Health and Safety Regulation 2001*
- c) The *Mine Health and Safety Act 2004*
- d) The *Mine Health and Safety Regulation 2007*

Note: Copies of this legislation are available at www.legislation.nsw.gov.au

5.1.2 References

Some relevant documents that provide additional information include:

- Lightning Ridge Opal Mining Safety Guidelines, 2002
- Minerals Industry Safety Handbook, 2002
- AS 3569 Steel wire ropes - Product specification
- AS 3637.6 Underground mining-Winding suspension equipment. Part 6 Shackles & chains.
- AS/NZS ISO 31000 Risk Management-Principles
- ISO/IEC 31010 Risk Management- Risk Assessment Techniques
- MDG 26 Guideline for examination and discard of mine winder ropes for use in mines.
- MDG 33 Guideline for Design, Commissioning and Maintenance of Drum Winders (Parts 1 and 2)
- MDG 1010 Risk Management Handbook
- AS/NZS 4812 Non-destructive examination and discard criteria for wire ropes in mine winding systems

5.1.3 Abbreviations

AS/NZS Australian / New Zealand Standard
MDG Mining Design Guide

5.1.4 Definitions

For the purposes of this document the following definitions apply.

Competent person	A person who has, through a combination of training, education and experience, acquired knowledge and skills enabling that person to correctly perform a specific task
Guard	Part of machine specifically used to provide protection by means of a physical barrier
Hazard	A situation that may cause injury or illness to people and damage to property
Mining hoist	A powered winding system that is used in a mining workplace that is a 'gem mine' where the powered winding system does not lift more than 40m and carries one or two people
Life cycle	Includes design, manufacture, construction or installation, commissioning, operation, maintenance, repair, decommissioning and disposal
Must	Indicates a mandatory legislative requirement, something that is required by law arising from an Act or Regulation
Rated payload	The maximum allowable load placed into the cage or on the platform
Risk	Combination of the probability of occurrence of harm and the severity of that harm
Risk assessment	Process comprising a risk analysis and risk evaluation (see AS/NZ ISO 31010 Risk Management – Risk Assessment Techniques)
Risk management	The systematic application of management policies, procedures and practices to the tasks of communication, establishing the context, identifying, analysing, evaluating, treating, monitoring and reviewing risk (see AS/NZ ISO 31010 Risk Management – Risk Assessment Techniques)
Should	Indicates a statement that is recommended

5.2 Appendix B : Sample daily inspection sheet for electrically driven hoists

The frequency of inspections and maintenance should be based on the manufacturer's recommendations, operational experience and current state of the hoist.

Inspection points	Result ✓Yes ✗No N/A	Comment / Action
Landings		
1. Are the hoist shaft, platform fences and gates intact and secure?		
2. Can anyone fall down the shaft?		
Headframe		
3. Is the headframe stable?		
4. Does the headframe have any loose or missing bolts, broken welds or damaged structural components?		
Winch		
5. Are all covers and guards in place and securely fastened?		
6. Is the brake path contaminated?		
7. Is the brake or holding device functioning (ie holding a loaded cage/platform stationary)?		
8. Is the electric motor junction box intact, undamaged and securely fastened?		
9. Are the couplings secure on the shaft?		
10. Is there any damage to the gearbox and is it securely mounted?		
11. Are there any oil leaks evident on the gear box and is the oil level satisfactory?		
12. Are the electric motor, the electric motor fan and cowling and the 'J' box in place, secure and undamaged?		
13. Are the gearbox to drum shaft couplings and the pulleys or sprockets on the electric motor and gearbox shafts secure?		
14. Are the 'vee' belts or chain drive showing any cracks or broken links and is the tension correct?		
15. Is the hoist drum damaged and are the bearings secure and serviceable?		
16. Is there any vibration or unusual noises etc when the empty hoist is run down and then up again?		

Inspection points	Result ✓Yes ✗No N/A	Comment / Action
Ropes / Sheaves		
17. Is the lay of the rope on the drum evenly layered and not bunched to one side?		
18. While running the empty cage/platform to the bottom of the shaft and back up can you see that the rope is adequately lubricated and free from obvious defects, such as corrosion, broken wires, kinks, loose wires, proud stands, deformation, damage, wear?		
19. Is the rope rubbing on any stationary object?		
20. Are all rope connections secure?		
21. Are the rope to cage connections secure, with at least 3 rope clamps in place and have not moved and 'd' shackles pins are prevented from working loose by a locking mechanism?		
22. Are the head sheave rope retention bracket and guards in place and secure?		
23. Is the rope sheave showing any damage or collapse and are the sheave mountings, bearings and shaft all secure?		
Cage / platform		
24. Is the cage/platform emergency arresting device operating freely, is it securely mounted and adequately lubricated?		
25. Is the cage/platform door or gate fully operational and secure?		
26. Does the cage/platform have any loose or missing bolts, broken welds or other structural damage?		
Control system		
27. Are the emergency stops working?		
28. Are all the hoist raise and lower controls working?		
29. Are the upper and lower limits and all other controls working?		
30. Are all the hoist electrical controls working?		
31. Are there any cuts or damage evident on the hoist electrical enclosures, control and supply cables?		

Inspection points	Result ✓Yes ×No N/A	Comment / Action
Shaft		
32. While riding the cage/platform to the shaft bottom see if the shaft walls and hoist ladder have appropriate security and alignment and if they show any visible cracks?		
33. Are the shaft walls secure and do they show any loose material?		
Signature of operator:		
Date corrective action completed:		

5.3 Appendix C – Feedback Sheet

Your comment on this Guideline is essential for its review and improvement.

Please make a copy of this Feedback Sheet and send your comments to:

The Senior Inspector of Mechanical Engineering
Industry and Investment NSW
PO Box 344
Hunter Region Mail Centre NSW 2310
Ph: 02 4931 6666
Fax: 02 4931 6790

How did you use (or intend to use) this Guideline?	
What did you find most useful about the Guideline?	
What did you find least useful about the Guideline?	
Do you have any suggestions to improve the Guideline?	

Thank you for completing and returning the Feedback Sheet.