GUIDELINE

Isolation of hazardous energies associated with plant in Western Australian mining operations

MIAC

Government of **Western Australia**
Department of **Mines and Petroleum**
Resources Safety

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Contents

Guidelines

A guideline is an explanatory document that provides more information on the requirements of legislation, details good practice, and may explain means of compliance with standards prescribed in the legislation. The government, unions or employer groups may issue guidance material.

Compliance with guidelines is not mandatory but they could have legal standing if it were demonstrated that the guideline is the industry norm.

Who should use this guideline?

This guideline should be used by anyone who has responsibilities to develop, authorise, provide, implement, use and maintain workplace safety and health systems in a mining operation where there is the potential for exposure to hazardous energies.

Acknowledgement

This guideline was developed through consultation with industry during the 2014 Mines Safety Roadshow. Early drafts were based on *Isolation of plant – guidance note*, published by the WorkSafe WA in 2010, *Isolation procedures – guidance note 02*, published by the Queensland Government in 2008, and *Managing risks of plant in the workplace – code of practice*, published by the Queensland Government in 2013.

Foreword

This guideline is issued by Resources Safety under the *Mines Safety and Inspection Act 1994*, and has been endorsed by the Mining Industry Advisory Committee.

The Act

The *Mines Safety and Inspection Act 1994* (the Act) sets objectives to promote and improve occupational safety and health standards within the minerals industry.

The Act sets out broad duties, and is supported by regulations, together with codes of practice and guidelines.

Regulations

The Mines Safety and Inspection Regulations 1995 (the regulations) provide more specific requirements for a range of activities. Like the Act, regulations are enforceable and breaches may result in prosecution, fines, or directions to cease operations and undertake remedial action.

Standards

Although specific versions of Australian and other standards may apply under the regulations, references to standards in this guideline are undated and it is good practice to consult the latest versions where applicable.

Application

The provisions of this guideline apply to all mines as defined in section 4(1) of the Act.

This guideline does not cover isolation for high voltage (HV) work.

1 Introduction

1.1 Controlling exposures to hazardous energies

Hazardous energy is any form of energy with the potential to cause harm. Hazardous energies exist in all mining operations. Exposure to the hazardous energies associated with plant continues to be a significant cause of fatal and serious injuries in the Western Australian minerals sector.

Under normal operating conditions, workers are generally protected from contact with hazardous energy through the implementation and monitoring of hazard controls. However, normal operating conditions are interrupted when work is required to install, inspect, repair, adjust, maintain, commission, test, clean, decommission, dismantle, or clear obstructions from plant. It is important to identify and control potential exposures to hazardous energies during this work.

In the past, isolation processes in the mining industry were not given adequate emphasis. It was common practice to use tags alone to identify that a circuit or item of plant was deactivated or de-energised and personnel may be working on or around it. In many instances, isolation was not understood or properly applied.

1.2 Structure of guideline

This guideline will assist mining operations to develop safe systems of work for fixed and mobile plant. It is structured to support a risk management approach to the isolation of hazardous energies where protection is required from:

- movement or operation of plant
- movement of materials handled by plant
- contact with energy used to operate plant
- contact with energy used to carry out processes associated with plant
- contact with energy produced or carried by plant
- contact with energy stored within plant.

Chapter 2 discusses the risk management process.

Chapter 3 provides guidance on the management of isolations.

Chapters 4 and 5 discuss isolation of hazardous energies in fixed and mobile plant, respectively.

Chapter 6 examines locking devices and the use of tags.

Training and competency are covered in Chapter 7.

Chapter 8 covers document control and record keeping.

Appendices 1 and 2 detail relevant legislation and Australian and international standards and codes.

Appendix 3 contains a glossary of terms used in the guideline.

Appendix 4 provides details of relevant guidance material.

2 Risk management process

2.1 Risk-based approach

A risk-based approach to the control of hazardous energies means that mining operations:

- systematically identify hazardous energies associated with mining plant and activities
- identify release modes of, and potential exposures to, hazardous energies
- analyse the risk associated with hazardous energy releases and exposures
- identify, implement, monitor and maintain control measures appropriate to the risk level assigned to hazardous energies.

2.2 Hazardous energy identification

The systematic identification of hazardous energies requires knowledgeable, experienced and appropriate people to be involved in planned and formal processes to identify all potential scenarios for hazardous energy release and exposure across the operation. Input may be sourced from:

- managers and supervisors
- subject specialists (e.g. engineers, tradespeople, manufacturers)
- competent persons (e.g those authorised to conduct isolations)
- suppliers of products and services
- shutdown contractors and temporary site service providers
- safety and health representatives
- safety professionals
- emergency response personnel.

Hazardous energies

Some forms of hazardous energies to consider are listed below.

- **Electrical energy** – energy made available by the flow of electric charge through a conductor. It can be encountered live through power lines, transformers, switchgear, local controls and distributors; or it can be stored in batteries or capacitors. Workers may be harmed through electric shock, exposure to an electric arc, or induced electrical currents in adjacent cables.

  Note: This guideline does not cover high voltage (HV) installations and their isolation.

- **Chemical energy** – energy that is stored in chemicals and that is released and converted into other forms when a substance undergoes a chemical reaction. For example, when explosives go off, stored chemical energy is transferred to the surroundings as thermal, sound and kinetic energies.
- **Mechanical (or kinetic) energy** – the energy an object, component or material possesses due to its motion. Setting an object into motion requires that the object be accelerated to attain motion, and this energy, if hazardous, must be dissipated and isolated. Examples include flywheels, conveyor systems, and fans that can be moved or energised by physical means.
- **Stored (or potential) energy** – the energy stored within a physical system, including gravitational potential, and pneumatic and hydraulic pressure energies. Mine site examples include hydraulic systems, vacuum systems, power presses, blocked pipework and vessels, inflated tyres, accumulators and other pressure vessels, power washers, conveyor counterweights, pneumatic valves with fail-safe spring mechanisms, stockpile faces and storage dams.

- **Thermal energy** – the internal energy present in a system or substance by virtue of its temperature. Experienced as either heat or cold, thermal energy is commonly produced by mechanical devices (combustion or friction), electrical resistance, and chemical reactions or change of state (e.g. melting, evaporation, sublimation).
- **Radiation energy** – energy from electromagnetic sources such as lasers, microwave transmitters, equipment that generates infra-red or ultraviolet light, and X-ray machines. Workers may be harmed through exposure to laser beams and ultraviolet light (e.g. skin and eye damage), and X-rays (e.g. cancer).

  Potential radiation energy sources used at mining operations include downhole or well logging tools, portable XRF analysers, nuclear moisture or density gauges, and material-grading devices.

  Note: Isolation of ionising radiation devices is only to be conducted by a competent and authorised radiation safety officer, as required under the mining operation's radiation management plan.

2.3 Hazardous energy release and exposure

When identifying how hazardous energies may be released, and potential exposures to a release, consider hazardous combinations such as:

- electricity and water
- toxic substance and compressed air
- working at height and unexpected noise
- inert gas in a confined space
- magnetic field and metal
- pneumatic and thermal energies.

2.4 Hazardous energy risk analysis

Risk analysis for isolation is about identifying the unwanted events associated with the potential release of and exposure to hazardous energy, and applying a rating to convey the level of risk.

The release of, or exposure to, hazardous energies may lead to a range of consequences. Determining the likelihood of energy release or exposure should be based on industry-wide and operation-specific information, theory, and informed or expert opinions.

2.5 Hazardous energy control

The greater the risk, the greater the level of control required to maintain a working environment where, so far as is practicable, workers are not exposed to hazards. The hierarchy of risk control (Figure 1) should be used when choosing the hazardous energy isolation processes and equipment to prevent release or exposure.

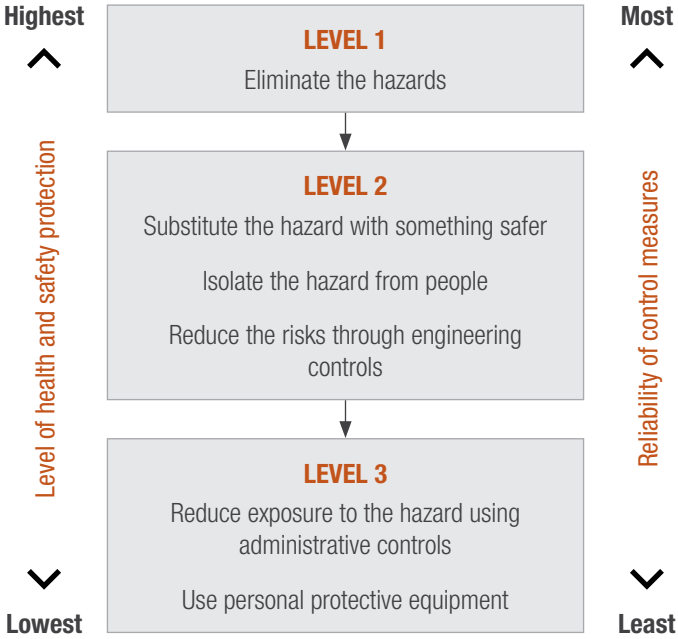


Figure 1 *Hierarchy of risk control (adapted from Safe Work Australia's model code of practice "How to manage work health and safety risks")*

3 Management of isolations

3.1 Principles

Management systems for the isolation of hazardous energy should be integrated within the operation's safety management system (SMS). They should be reviewed periodically and in response to emerging industry knowledge (e.g. safety alerts) and be risk assessed during the change management process for new installations, selection of equipment or modifications to existing equipment and installations.

The basic principles of isolation are **lock**, **tag** and **try**. To effectively apply these principles, all hazardous energies and their sources need to be correctly identified, and the isolation methods must be appropriate to the risk. The following requirements should be incorporated into the management system for isolations.

- **Identify, risk assess and document**
  - all hazardous energies and sources
  - methods selected for dissipation, disconnection or de-activation of each energy
  - methods selected to prevent the inadvertent re-activation or re-accumulation of hazardous energies.
- **Isolate**
  - deactivate, de-energise, discharge or dissipate the hazardous energy
  - apply the specified isolation method or device
  - verify the effectiveness of the isolation at both remote and local controls, by observing and listening for a "change of state", when attempting to operate the plant with the isolation control in place
  - authorise the isolation once proven positive.
- **Monitor and review**
  - monitor the security and effectiveness of the isolation over the period that work is being conducted
  - stop work and make changes if isolation integrity is compromised.

The complexity of the isolation design and application will vary depending on factors such as:

- types of hazardous energies encountered
- complexity of the plant being isolated
- nature of the tasks being undertaken.

3.2 Design

The opportunity to achieve an inherently safe design is greatest for new plant. Wherever practicable, a safe design approach should be followed for plant modifications.

The design of new plant and modifications should include facilities for positive isolation, particularly where plant-associated work tasks or activities will be undertaken that pose significant risks, such as:

- confined space entry
- work involving potential exposure to toxic, corrosive or flammable substances
- work involving exposure to moving parts or stored energy.

Unless risk assessment indicates otherwise, isolation points and dissipation or bleed points should be as close as possible to the hazardous energy source. Isolation points should be easily accessible for device installation (e.g. temporary pressure gauges where there is the potential for energy to be stored or to re-accumulate), testing, and isolation effectiveness monitoring. Bleed points should be easily accessible for checking and locking in the open position, and arranged so their discharge cannot harm personnel or plant.

The potential for human failure or error should be addressed and, where practicable, eliminated or minimised in the design. To achieve this, the approach should include, where applicable:

- a system to uniquely identify all plant components, such as piping, valves and electrical equipment
- permanent labelling of essential components and those components having both a “duty” (or “active”) and “standby” status, which removes ambiguity or the potential for misrecognition

- clear demarcation of isolation points
- direct linking of all in-field plant identifiers to site piping and instrumentation diagrams (P&IDs), process flow diagrams (PFDs), and electrical drawings
- reducing the number of isolation points required (e.g. use "process isolators" that electrically isolate areas of the plant).

When up-to-date and accessible, P&IDs, PFDs and electrical drawings provide valuable information regarding plant design and identification. The selection of energy isolation points and methods should be consistent with information supplied in the P&IDs, PFDs and electrical drawings, which can then be used to develop isolation permits and increase the accuracy of hazardous energy identification and energy source isolation.

Note: Emerging technologies such as robotic, remote and autonomous equipment pose specific challenges, not generally evident with conventional plant, with regard to hazardous energy identification, interactions and isolation. These alternative designs and capabilities require rigorous assessment to ensure isolation requirements are clearly defined, understood and applied.

3.3 Human factors

Human errors, whether intended or not, can have a negative effect on the integrity of isolations and their ability to prevent exposure to hazardous energies. Contributing factors in isolation incidents in Western Australian mining operations include failures to:

- identify all hazardous energies associated with a work task or activity
- isolate hazardous energies from inadvertent activation or releases
- apply isolation processes to the correct item of plant
- test that an isolation is effective.

The potential for human error should be covered in risk assessments associated with isolations. In addition to considering isolation-friendly plant design, those conducting isolations need to be:

- assessed as competent to design and conduct the isolation
- re-assessed periodically
- effectively supervised in their duties
- involved in the development of isolation standards and procedures.

3.4 Roles and responsibilities

Effective isolation of hazardous energy requires the clear allocation of defined roles and responsibilities.

The registered manager, on behalf of the principal employer, is responsible for the mine's isolation systems and should:

- offer visible leadership and commitment
- resource the development, implementation and review of the system
- review significant results of inspections and audits, including any recommendations made
- investigate incidents involving isolation failures or breaches
- allocate the necessary resources for system amendments and plant modifications.

Management is responsible for ensuring the site's isolation system is fully implemented and, in particular, that:

- procedures and safe systems of work are documented and records maintained to support the implementation of the isolation system
- items of plant necessary to comply with isolation procedures are available
- those involved or affected by isolations have the necessary competency
- supervision arrangements are adequate

- the isolation system is monitored, audited and reviewed and specialist advice is sought if required
- remedial actions and necessary plant modifications are implemented for identified hazards.

Supervisors are responsible for ensuring the site's safe system of work for isolation is fully implemented at the worker level and, in particular, that:

- the isolation system is fully understood and followed by affected workers, including contractors
- isolations are conducted to the required standard
- isolation and de-isolation work is planned and progressed through the safe system of work
- information is effectively communicated between all relevant parties
- documentation of the isolation system is accurate and current
- tasks are undertaken by competent persons
- tasks are effectively supervised
- planned monitoring of the isolation system is carried out and remedial action taken if required.

The electrical supervisor is responsible to the manager of the mine for the safety of electrical equipment at the mine, and therefore should be involved in the development of electrical isolation procedures.

People who work on plant are responsible for carrying out work in accordance with the site's safe system of work for isolation and, in particular, they should:

- understand and work in compliance with the procedures
- work within the safe system of work and use the associated documentation
- not proceed with a variation from the existing isolation procedures without appropriate assessment and authorisation
- adequately identify, test and secure isolations

- cooperate with supervisors to ensure the effective implementation of the isolation system
- communicate effectively with other parties involved with or adjacent to the work.

3.5 Monitoring, audit and review

A risk-based approach requires monitoring, auditing and review of isolation systems, methods and compliance. An audit schedule should be developed to promote the conduct of these activities. During monitoring and review, it is vital to determine, and subsequently act on, any gaps between what is stated in the safe system of work and what is actually happening in regard to the isolation of hazardous energies.

Workers have the right to review and challenge isolation and lock-out locations, methods and documentation. Any challenge should be recorded and investigated, and changes made where deficiencies are identified.

Mining operations should:

- review isolation and lock-out locations, methods and documentation whenever there is a new installation, modification, or change to process
- change a sub-standard isolation process that has the potential to result in harm — review the process, revise as required, and ensure the risk of exposure to hazardous energies is as low as reasonably practicable
- ensure personnel receive training for the revised system.

3.6 Other considerations

Follow original equipment manufacturer (OEM) instructions and develop safe work procedures (SWPs) as necessary.

Safe work procedures should consider scenarios such as:

- absent person and authority to remove a lock
- key misplaced and authority to remove a lock
- inability to lock an isolation point
- de-isolation and re-energisation of plant.

4 Isolation of hazardous energies in fixed plant

4.1 Introduction

The safe system of work adopted for isolating fixed plant at a mining operation should reflect the level of risk associated with hazardous energy exposures at the site. Familiarity with fixed plant will vary across the workforce and so the safe system of work should provide sufficient information to ensure no workers are inadvertently exposed to hazards.

All workers required to work on isolated plant should be told the:

- scope of work to be conducted under the isolation
- requirements to participate in and review task-based risk assessments
- location of isolated plant
- isolation design and isolation points
- relevant process flow diagrams
- persons authorised to conduct isolations and permit-to-work activities
- requirements to sign on and off permit-to-work documentation
- location of personal locking points (if group isolation)
- designer and manufacturer instructions relating to plant isolation.

4.2 Personal isolation

For routine work assessed or classified by the site as low risk, personal isolation may be appropriate and implemented in accordance with safe work procedures and written instructions. Strict criteria need to be defined so the personal isolation process is not abused or misused.

A personal isolation is the isolation of plant by one person and should require:

- that same person to conduct the work and de-isolate the plant
- that person to be trained and assessed as competent to perform the isolation, conduct the task, and de-isolate the plant
- the isolation remain under the control of that person only
- the isolation, conduct of work and de-isolation be completed before the end of that person's shift
- the isolation points and methods of isolation be identified within the relevant procedure or safe work instruction
- that person involved to attach their personal lock and danger tag at each isolation point to provide security against inadvertent activation, and identify who is conducting work.

Where these criteria cannot be met, a permit-to-work system should apply.

Note: Sites should include within their safe work procedures and written instructions the maximum number of personal isolations allowed on any one isolation point before a permit-to-work system is applied.

4.3 Permit-to-work systems

The management of isolations is commonly part of a permit-to-work system, which should promote the review of activities and implementation of appropriate controls by competent and authorised persons.

A permit-to-work system aims to reduce risks associated with work of a hazardous or non-routine nature to as low as reasonably practicable. As a minimum, the system should be applied to work that:

- requires group isolation (see Section 4.4)
- has an impact on critical safety systems or process controls

- is routine but the criteria for personal isolations cannot be met
- is not routine.

The permit-to-work system should:

- clearly identify the nature and extent of the job and hazards involved to the people conducting work, and any limitations on the extent of work and the timeline within which it must be completed
- clearly detail precautions to be taken, including the method and list of hazardous energy isolations
- provide a system and record of control that details the methods, checks and their authorisation
- provide for the control of work that may affect other personnel or processes
- provide a formal hand-over and hand-back process
- provide a process for identifying, assessing and responding to change.

In its simplest form, the system is a record of communicating:

- what has been undertaken to prepare for work
- what will be undertaken in the conduct of work
- how and why the work will be conducted.

This methodology supports transparency around a process where more than one person is involved in work preparation, supervision and conduct.

If workers consider the permit-to-work system as just another administrative control, it will not be effectively utilised. The success of the system will ultimately be determined by the people or work groups given the responsibility for:

- preparing for the work
- supervising the work
- conducting the work.

It is essential that the permit specifies the scope of work it covers, and any subsidiary permits, such as work-at-height, confined space entry or hot work permits, are directly linked to it.

Copies of the permit should be displayed and accessible at the task location and with the isolation list. The isolation list, permit to work, or associated document should clearly define the method and authority for de-isolation and return of plant to service.

4.4 Group isolation

All group isolations should be performed under a permit-to-work system.

Group isolations are generally performed by the people who will be handing over the isolated plant to a secondary group to conduct the work, and who will subsequently receive back the isolated plant for de-isolation. This process necessarily requires clear communication and comprehension, which are objectives of a permit-to-work system.

Group isolation may be applied based on either multiple worker involvement in a task, or multiple isolation points associated with a task. The mining operation should clearly specify the requirement for escalation from multiple-point isolation and personal locking to use of lock boxes, permit boxes, or similar personal locking centralisation methods. Consideration in regard to this specification should be given to the requirement to restrict access to electrical sub-stations to authorised personnel only.

Isolation locks used for group isolations should have a high level of security applied to prevent misuse by unauthorised personnel and should not be used for other general purpose tasks. Group isolations should be installed by a minimum of two people competent in isolation application and knowledge of the hazardous energy sources being isolated. Introducing a second person to the process:

- allows isolation efficiency to be verified
- improves confidence in the effectiveness of the isolation and permit-to-work systems.

4.5 Work requiring partial or complete energisation

Some tasks require plant to be either partially or completely energised. Examples include the inching of mills during relining, and assessing the source of a fault or damage where information can only be obtained during plant operation.

Using a risk-based approach, the controls implemented need to prevent exposure of persons to the hazardous energies involved, rather than prevent release of those energies.

The increased risk associated with such tasks requires thorough risk assessment, supervisor involvement, control implementation and management approval to proceed.

5 Isolation of hazardous energies in mobile plant

5.1 Introduction

The safe system of work adopted for isolating mobile plant at a mining operation should reflect the level of risk associated with hazardous energy exposures at the site.

While the isolation of mobile plant is generally less complex than isolations in fixed plant, the hazardous energies involved are potentially equally damaging. Only competent persons familiar with the equipment should undertake the isolation of mobile plant, and subsequently the de-isolation of mobile plant following task completion.

5.2 Preparation

To prepare for the isolation of mobile plant, operators should:

- park equipment on level ground, where practicable
- lower plant components if possible (e.g. blade, bucket) or use rated support stands
- chock equipment or apply other safe parking techniques to prevent movement.

5.3 Isolation

The isolation needs to be conducted by a competent person, who confirms that all energies have been identified, deactivated, dissipated and isolated before work commences.

Operators generally perform isolations for the purpose of conducting pre-starts, post-operational checks and minor servicing. This isolation is generally a personal, single-point isolation at the battery isolator. It is recommended that mobile plant is equipped with an accessible electrical supply isolation device for this purpose.

Work performed by maintenance personnel generally requires more complex isolation, and consideration of stored energy sources, such as:

- accumulators
- tensioners
- hydraulics
- pneumatics
- batteries, inverters and solenoids
- radiators
- tyres.

Where more than one person is performing the work, each person should apply their personal lock and danger tag as a minimum.

The maintenance manuals provided by OEMs should be available, and procedures developed where applicable to meet manufacturer's specifications and recommendations.

Note: Where equipment has two or more electrical supply isolators, a risk assessment should be conducted to determine whether one or more isolators need to be locked out. Isolation of HV electrical plant (e.g. electric shovels) must be conducted by a competent HV operator appointed for the site.

5.4 Work requiring partial or complete energisation

Mobile plant may need to be either partially or completely energised for fault finding or calibration. Examples include:

- testing hydraulic pump performance
- fault-finding in electrical wiring harnesses
- assessing alternator performance
- checking the condition or performance of wet braking systems
- checking accumulator pressures
- fitting tracks.

Using a risk-based approach, the controls implemented need to prevent exposure to the hazardous energies involved, rather than prevent the release of those energies. Only competent persons should undertake such work.

In addition to direct worker exposure, the risk assessment should consider restricting work area entry to prevent inadvertent exposure to hazardous energies.

Note: Remove all tools, cleaning gear and consumables from mobile plant prior to returning to service.

6 Locking and tagging

6.1 Locks and lock-out devices

Where a device is used for isolating, dissipating or restraining energy on the plant, it should be locked by a competent person. The locking should be carried out using a padlock with an appropriate tag affixed.

Only devices that incorporate a lock or can accommodate one or more padlocks are suitable lock-out devices. Such devices include:

- switches with built-in locking points
- lock-out circuit breakers
- lockable fuse and valve handle covers
- lock-out jaws (also known as hasps) and safety padlocks.

Isolation locks should only be used to isolate hazardous energy sources. They should not be used for other general purposes.

When isolating an energy source for group isolation, a device that allows one or more padlocks to be fitted should be used. If more than one person is working on the same plant, each person should attach their personal lock to prevent the isolator being opened before all locks have been removed or opened. The isolation procedure should identify common lock-out points to ensure hazardous energy sources cannot be restored while someone is still working on the plant.

Isolation locks and personal locks are distinct, and operations should apply strict security measures to the availability and use of both forms. The following practices are recommended.

- Personal locks assigned to an individual should not be able to be opened by another person or another person's key. Removal of a worker's personal lock from an isolation point or points may be required in some circumstances (e.g. medical emergency). However, authorisation to remove a personal lock should only be given by a

management representative after a formal process has been followed to ensure the person identified on the lock and tag is not present at the work site.

- Isolation locks should only be able to be opened by authorised isolators or permit-to-work personnel following the removal of all personal locks and danger tags from isolation points.

Note: Traditional forms of locking devices are discussed above. However, where applicable, consider other isolation devices such as controllable switching devices or programmable remote isolation systems.

6.2 Tags

A tag is ***not*** an isolation device. A tag is only a means of providing information to others at the workplace. It should never be used as an isolation device.

A personal danger tag should accompany each personal lock used in an isolation procedure and clearly identify the person who applied the lock.

The following types of tags are commonly used when a piece of plant is isolated from other plant:

- personal danger tags
- isolation tags
- out-of-service tags
- commissioning or testing tags

It is recommended that the colour coding of tags is consistent with Australian Standard AS 1319 *Safety signs for the occupational environment*.

Personal danger tags

A personal danger tag attached to a personal lock on an isolation device or lock box means:

- the person is currently engaged in work on the plant
- the person could be injured if the isolation is not maintained.

The personal lock and danger tag should be removed from the isolation device as soon as practicable after completing the work.

In every case, a personal lock and danger tag should be removed by the person before leaving the site at the end of the shift. The isolation procedure needs to include the action to be taken if someone fails to remove a personal lock and danger tag before leaving the site.

If work on plant is not completed by the end of a working shift and the plant is required to remain isolated, arrangements need to be made for out-of-service tags to be secured at each isolating point before personal locks and danger tags are removed. If work on the plant is to continue during the next shift, there needs to be a hand-over briefing by the shift leaving the site to those taking over the work. This briefing should include:

- the status of the work
- known hazards
- the removal and replacement of personal locks and danger tags.

Personal danger tags must have a "DANGER" symbol on both sides of the tag, with a message indicating the tag is not to be removed by anyone other than the person whose name appears on the tag. As a minimum, the tag should also provide the following information:

- full name of person placing the danger tag
- name of the company the person works for.

Note: A nickname can also be included on the tag to assist with identification, but should not be used as the primary identifier.

Permanent employees and long-term contractors at a mining operation may use re-usable personal danger tags. These danger tags may include a photograph of the tag owner to assist with identification. However, all sites should have disposable personal danger tags available, which are destroyed after use.

Isolation tags

Isolation tags should provide the following information:

- descriptor for plant being isolated
- any unique identifier for the plant being isolated
- if applicable, permit number that the isolation is associated with
- reason for the isolation
- full name of the person conducting the isolation.

Note: An isolation tag may also contain the name of the second person conducting isolation verification if a second tag is not used in this process.

Out-of-service tags

An out-of-service tag on a piece of plant indicates that it is unserviceable and must not be used. It can be attached to non-powered plant such as ladders, jacks and trolleys as well as powered plant. The tag should be attached to the main isolation point, if possible, or to a prominent part if there is no isolation point (e.g. a damaged ladder).

These tags indicate that plant is removed from service for repairs, maintenance, cleaning, or installation. Out-of-service tags are intended to convey a clear "DO NOT OPERATE" warning, and a failure to comply may result in damage to the plant or an injury. It is essential that isolating mechanisms with out-of-service tags attached are not switched, manipulated, or interfered with in any way while these tags are in place.

Any worker can place an out-of-service tag on plant. However, it is recommended that only competent persons having specific knowledge relating to the plant remove out-of-service tags. This should not prevent anyone else from attaching an out-of-service tag in situations where it is apparent that the continued use of the plant could be hazardous.

Before attaching an out-of-service tag all details required on the tag need to be entered in the spaces provided. The information should be clear and not alterable.

Tags need to be securely fixed and clearly visible. Out-of-service tags only protect the equipment and do not provide personal protection for those working on the plant.

When attaching an out-of-service tag to plant, it may also be necessary to record that it is out of service on any associated control panels (e.g. in the processing plant control room).

An out-of service tag may only be removed after verifying the plant is safe to be returned to service. In the absence of any personal lock and danger tag, removing an out-of-service tag effectively releases the plant for use. Before doing so, confirm that:

- all personnel known to have been working on the plant are clear of the plant
- all machinery guards are in place
- all protective devices are functional and all maintenance tools and aids have been removed
- the plant is safe for normal use.

Commissioning or testing tags

A commissioning or testing tag indicates that plant is under "live" test conditions and may be energised at any time.

The tag is applied to fixed or mobile plant to allow work on energised systems.

The site's isolation procedure should provide clear instruction on the tagging process and additional controls to prevent accidental activation of plant during testing.

Commissioning or testing should not be conducted in conjunction with other tasks on the same plant.

Commissioning or testing tags and additional controls may only be removed by the person who placed them.

7 Training and competency

7.1 Overview

Training and competency assessment are integral to the effective implementation of the operation's safe system of work for isolations. Personnel need to be assessed as competent in the site's isolation procedures and systems, including permit systems where required, before commencing any work that involves the isolation of hazardous energy sources.

While developing a system for training and assessing competence in the site's isolation and permitting system, the employer should review the current national units of competence relevant to the work processes (e.g. RII – Resources and Infrastructure Industry Training Package unit *RIISAM202D Isolate and access plant*). These national units are the minimum standard set by industry to achieve a particular work outcome. Designing the site training and assessment packages to meet or exceed these standards will promote compliance with expected workplace performance.

A training needs analysis will help identify the skill gaps and training requirements for each position and individual on site, and areas for future development. The analysis should be conducted in consultation with relevant personnel, such as supervisors and managers.

7.2 Achievement of competency

Only authorised persons should undertake the isolation of hazardous energies. They should be assessed as competent by a means appropriate to the level of isolations required within their scope of work (e.g. successfully complete comprehensive theory and practical assessment for complex group isolations).

Any personnel who carry out work on a site should:

- be made aware of the isolation system
- be instructed and assessed at a level appropriate to their use of that system.

Achievement and maintenance of competency requirements should be managed through the site's training management system, including maintenance of formal records of training and assessment. A register of competent persons should also be available and accessible to frontline supervisors and management.

The introduction of new systems or modification of existing systems should be accompanied by refresher and updated training, and re-assessment of competency as necessary.

8 Document control and record keeping

All documentation associated with the isolation management system should be developed and maintained in accordance with the operation's document control procedures, legislative requirements and subsidiary guidance material.

To maintain the effectiveness of the internal auditing program and support continuous improvement of the isolation management system, a clear line of documentation ownership and review should be specified and enforced.

Appendix 1 – Legislative provisions

The parts of the Mines Safety and Inspection Regulations 1995 that are directly applicable to this guideline are listed below.

Mines Safety and Inspection Act 1994

Part 1	**Preliminary**
s. 3(1)(c)	Objects
s. 4	Terms used
Part 2	**General duties relating to occupational safety and health**
s. 9	Employers, duties of
s. 10	Employees, duties of
s. 12	Employers and self-employed persons, duties of
s. 14	Plant designers etc., duties of

Mines Safety and Inspection Regulations 1995

Part 1	**Preliminary**
r. 1.3	Terms used
Part 4	**General safety requirements**
r. 4.13	Induction and training of employees
Part 5	**Electricity in mines**
r. 5.10	Electrical supervisors
Part 6	**Safety in using certain types of plant in mines**
r. 6.1	Terms used
r. 6.2	Plant to be maintained and operated in safe manner
r. 6.21	Employer to prevent unsafe use of plant
r. 6.27	Plant with moving parts

r. 6.29 Electrical plant and plant exposed to electrical hazards

Part 16 Radiation safety

r. 16.16 Control of exposure to radiation

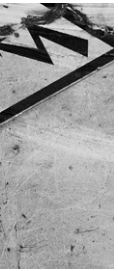
Note: The only authorised versions of the Mines Safety and Inspection Act 1994 and regulations are those available from the State Law Publisher (www.slp.wa.gov.au), the official publisher of Western Australian legislation and statutory information.

Appendix 2 – Selected Australian and international standards and codes

List of published technical standards that provide guidance on the design, manufacture and use of certain types of plant, and whether the guidance is applicable to the design, manufacture or the use of the plant.

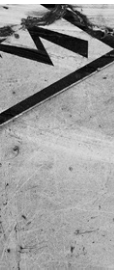
Reference: Adapted from appendix C "Examples of technical standards" of Safe Work Australia's model code of practice, Managing Risks of Plant in the Workplace, released in September 2013.

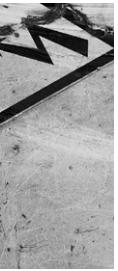
AMBSC	Australian Miniature Boiler Safety Committee, www.aals.asn.au/AMBSC/AMBSC.htm
API	American Petroleum Institute, www.api.org
AS and AS/NZS	Standards Australia, www.standards.org.au
ASME	American Society of Mechanical Engineers, www.asme.org
ANSI	American National Standards Institute, www.ansi.org
BS EN	British Standards Institute, www.standardsuk.com/bsi
CSA	CSA Group, www.csagroup.org
IEC	International Electrotechnical Committee, www.iec.ch
ISO	International Organisation for Standardization, www.iso.org
SAE	SAE International, www.sae.org/standards



Plant description	Standard/Code	Title	Design	Make	Use
Cranes including hoists and winches	AS 1418 (Series)	Cranes, hoists and winches	X	X	
	AS 4991	Lifting devices	X	X	X
	AS 2550 (Series)	Cranes, hoists and winches – Safe use			X
Workboxes – crane fitted	AS 1418.17	Cranes (including hoists and winches) – Design and construction of workboxes	X	X	
	AS 2550 (Series)	Cranes, hoists and winches – Safe use			X
	AS 3860	Fixed guideway people movers	X	X	X
	ISO 2374	Lifting appliances – Range of maximum capacities for basic models	X	X	
Conveyors	AS/NZS 4024.3610	Safety of machinery – Conveyors – General requirements	X	X	X
	AS/NZS 4024.3611	Safety of machinery – Conveyors – Belt conveyors for bulk materials handling	X	X	X
Electrical installation	AS/NZS 3000	Electrical installations (known as the *Australian/New Zealand Wiring Rules*)			X
Electrical installations within an industrial plant	AS 60204.1 (also IEC 60204.1)	Safety of machinery – Electrical equipment of machines – General requirements	X	X	
Hand-held electric tools	AS/NZS 60745.1	Hand-held motor-operated electric tools – Safety – General requirements	X	X	X

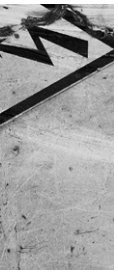
Plant description	Standard/Code	Title	Design	Make	Use
Earth-moving machinery	AS 2294.1	Earth-moving machinery – Protective structures – General	X	X	
	AS 2958.1	Earth-moving Machinery – Safety – Wheeled machines – Brakes	X	X	X
	ISO 6165	Earth-moving machinery – Basic types – Identification and terms and definitions	X		
	ISO 6746.1	Earth-moving machinery – Definitions of dimensions and codes – Part 1: Base machine	X		
	ISO 6746.2	Earth-moving machinery – Definitions of dimensions and codes – Part 2: Equipment and attachments	X		
	ISO 7133	Earth-moving machinery – Scrapers – Terminology and commercial specifications	X		
Industrial (forklift) trucks	AS 2359 (Series)	Powered industrial trucks	X	X	X
Machinery	AS 4024 (Series)	Safety of machinery	X	X	X
	AS 1657	Fixed platforms, walkways, stairways and ladders – Design, construction and installation	X	X	
	AS 1788.2	Abrasive wheels – Selection, care, and use	X	X	X
	AS 1893	Code of practice for the guarding and safe use of metal and paper cutting guillotines	X	X	X
	AS 2661	Vapour degreasing plant – Design, installation and operation – Safety requirements	X	X	X

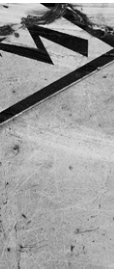




Plant description	Standard/Code	Title	Design	Make	Use
Machinery (continued)	AS/NZS IEC 60947.3	Low-voltage switchgear and controlgear – Switches, disconnectors, switch-disconnectors and fuse-combination units	X		X
	AS 61508.6	Functional safety of electrical/electronic/ programmable electronic safety-related systems – Guidelines on the application of IEC 61508-2 and IEC 61508-3	X	X	X
	AS IEC 61511 (Series)	Functional safety – Safety instrumented system for the process industry sector	X	X	X
	AS 62061	Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems	X	X	X
	ISO 13849.1	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design	X	X	X
	IEC 61496.2	Safety of machinery – Electro-sensitive protective equipment – Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)	X		X
	AS 1121.1	Agricultural tractor power take-offs – Rear-mounted power take-off types 1, 2 and 3 – General specifications, safety requirements, dimensions for master shield and clearance zone	X	X	

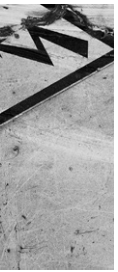
Plant description	Standard/Code	Title	Design	Make	Use
Machinery *(continued)*	AS 1636 (Series)	Tractors – Roll-over protective structures – Criteria and tests	X	X	
	AS/NZS 2153.1	Tractors and machinery for agriculture and forestry – Technical means for ensuring safety – General	X	X	
	SAE J 167	Overhead protection for agricultural tractors – Test procedures and performance requirements	X	X	
Machinery guarding	AS 4024 (Series)	Safety of machinery	X	X	X
	ISO 12100	Safety of machinery – General principles for design – Risk assessment and risk reduction	X	X	X
Fall arrest	AS/NZS 1891.1	Industrial fall-arrest systems and devices – Harnesses and ancillary equipment	X	X	
	AS/NZS 1891.4	Industrial fall-arrest systems and devices – Selection, use and maintenance			X
	BS EN 1263.1	Temporary works equipment – Safety nets – Part 1: Safety requirements, test methods	X		
Gas cylinders	AS 2030.1	Gas cylinders – General requirements (known as *SAA Gas Cylinders Code*)	X	X	
	AS 2337.2	Gas cylinder test stations – LP Gas fuel vessels for automotive			X
	AS/NZS 3509	LP Gas fuel vessels for automotive use	X	X	





Plant description	Standard/Code	Title	Design	Make	Use
Miniature boilers	AMBSC Code	Part 1: Copper boilers	X	X	
		Part 2: Steel boilers	X	X	
		Part 3: Sub-Miniature boilers	X	X	
		Part 4: Duplex steel boilers	X	X	
Pressure equipment	AS/NZS 1200	Pressure equipment	X	X	X
	AS 2593	Boilers – Safety management and supervision systems	X		X
	AS 2971	Serially produced pressure vessels	X	X	
	AS/NZS 3788	Pressure equipment – In-service inspection			X
	AS 3873	Pressure equipment – Operation and maintenance			X
	AS 3920	Pressure equipment – Conformity assessment	X	X	
	ASME Boiler and Pressure Vessel Code (BPVC)	Section I: Rules for construction of power boilers	X	X	
		Section II: Materials	X	X	
		Section V: Nondestructive examination	X	X	
		Section VIII: Rules for construction of pressure vessels	X	X	
		Section IX: Welding, brazing, and fusing qualifications	X	X	
	ANSI NGV2	Basic requirements for compressed natural gas vehicle fuel containers	X	X	

Plant description	Standard/Code	Title	Design	Make	Use
Pressure equipment *(continued)*	CSA B51-14 Boiler, Pressure Vessel, and Pressure Piping Code	Part 2: High-pressure cylinders for the on-board storage of natural gas and hydrogen as fuels for automotive vehicles	X	X	
	ISO 11439	Gas cylinders – High pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles	X	X	
	ISO 21009/EN 13458 (Series)	Cryogenic vessels – Static vacuum insulated vessels	X	X	X
	AS 3892	Pressure equipment – Installation			X
Pressure piping	AS 4041	Pressure piping	X	X	
Turbines	BS EN 60953.2	Rules for steam turbine thermal acceptance tests. Wide range of accuracy for various types and sizes of turbines	X		
	API 612	Petroleum, petrochemical, and natural gas industries – Steam turbines – Special-purpose applications	X		
Ventilation	AS 1668.2	The use of ventilation and air conditioning in buildings – Mechanical ventilation in buildings	X	X	X



Appendix 3 – Glossary

For the purposes of this guideline, the following terms are defined.

Authorised person	a person who is authorised by the responsible person to conduct isolations or permit-to-work activities
Competent person	a person who is appointed or designated by the employer to perform specified duties that the person is qualified to perform by knowledge, training and experience
Dissipation	the controlled discharge of energy stored or contained in plant
Fixed plant	process equipment or machinery in the mining operation that remains in a fixed position during operation, and includes tanks, silos, piping, conveyors, crushing and screening equipment, and milling equipment
Group isolation	isolation carried out by competent persons to protect a group of workers, or provide a single point of personal locking for multiple location isolations
Hazardous energy	any energy that has the potential to cause harm
Isolation	the act of ensuring, through accurate and appropriate identification, assessment, lock-out and verification, that hazardous energies cannot harm
Isolation list	a consistently reviewed and updated list of hazardous energies and their methods of isolation associated with a task or items of plant

Mobile plant	equipment that is self-propelled or towed and is mounted on track, rubber-tyred wheels, steel wheels or sleds
Permit-to-work	a formal written statement of work to be undertaken, safety precautions to be implemented, and confirmation that associated risks and hazards have been identified
Personal isolation	application of an isolation process by a competent person who has personally locked out the isolation point
Personal locking	application of a personal lock and danger tag to a personal isolation, a group isolation or lock box to indicate a person is conducting work on isolated plant
Plant	generic term for machinery, equipment and associated components
Positive isolation	checking for “dead” once an isolation process has been implemented
Responsible person	this may be the principal employer and any other employer at the mine, and the mine manager
Routine	in relation to work requiring the isolation of hazardous energy, refers to a task that is conducted repeatedly, whether daily or weekly

Appendix 4 – Further guidance

Resources Safety, Department of Mines and Petroleum
www.dmp.wa.gov.au/ResourcesSafety

Codes of practice

- Safe design of buildings and structures
- Safeguarding of machinery and plant
- Safe mobile autonomous mining in Western Australia

Guideline

- General duty of care in Western Australian mines

Commission for Occupational Safety and Health
www.worksafe.wa.gov.au

Guidance notes

- Isolation of plant
- Plant design – Making it safe
- Powered mobile plant – Making it safe
- Working alone

Safe Work Australia
www.safework.gov.au

Model codes of practice

- Managing electrical risks in the workplace
- Managing risks of plant in the workplace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