Resources Regulator
Department of Regional NSW

NSW GOVERNMENT

Isolation

Small Mines Roadshow

February to April 2024

Why isolate?

Recent examples of very serious injuries due to lack of, or poor, isolation

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Investigation information release

Date: September 2023

Serious injury of a worker performing maintenance work on a power screen

Incident date: 28 August 2023

Event: Serious injury of a worker while assisting with belt tracking of a power screen

Location: Mt Magometon Quarry

Overview

A worker assisting with tracking the belt on a power screen was seriously injured when his arm became entangled in the screen's rotating tail drum.

The mine

Mt Magometon Quarry is a hard rock quarry about 25 kilometres east of Coonamble in the central west of NSW. The quarry is operated by Coonamble Shire Council. Several workers, including the injured worker, are employed by a contracting company, which provides mobile crushing services to the quarry.

The incident

Two of the contractors' workers were tasked with conducting maintenance tasks on various power screens at the site. In the early afternoon, the workers advised their supervisor (managing director of the contractor) that they were going to track the belt on a power screen identified as screen 7. Their supervisor left the site to travel into Coonamble to pick up some items. The quarry operator's nominated quarry manager was not on site on the day of the incident. The 2 workers began tracking the belt on screen 7.

While undertaking the task, one of workers was in proximity of the right-hand side of the screen toward the rear of the item of plant. The screen was energised with its conveyor operating. The worker's arm became entangled in the rotating tail drum of the screen, pulling the worker into the drum up to his shoulder.

An emergency response was activated. The injured worker was trapped for several hours until emergency services and a medical team released him. The worker's arm was amputated as a result of the incident. The worker was transported to the entrance of the quarry and then airlifted to hospital.

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Safety Alert

Date: August 2023

Serious injury of a Jumbo offsider during drilling work

This safety alert provides safety advice for the NSW mining industry.

Issue

A Jumbo drill rig was being used to conduct drilling, bolting, and meshing for the installation of ground support in a heading of an underground metalliferous mine on 19 June 2023.

One of the drilling offsider's (nipper's) tasks was changing various drilling consumables on the booms of the Jumbo as the ground support work progressed. Immobiliser switches that were used to isolate the booms' movements were on the left and right sides of the Jumbo (Figure 1).

The drilling offsider approached the front of the Jumbo to load a drill rod on the right hand boom when his left arm became entangled. This resulted in the traumatic amputation of his left arm below the elbow. An emergency response was initiated with the drilling offsider being transported to the surface and airlifted to hospital for treatment.

Figure 1: Jumbo drill rig at the incident scene

Isolation definition

MDG40 Guideline for Hazardous Energy Control (Isolation or Treatment).

Definition –

Isolation is the act of removing and disconnecting energy and prevention of inadvertent restoration of energy. It includes removal and disconnecting of energy sources, discharge of residual energies, tagging and or/locking out and testing the removal or disconnection of hazardous energies has been effective.

Introduction

This presentation has been set out to assist the small mines, understand best practice in carrying out isolations to ensure the safety of their personnel and contractors.

Topics covered throughout this presentation include –

- **Energy sources** -
  - Primary Energy Sources
  - Secondary Energy Sources

- **Steps of isolation**
- **Isolation plans, matrixes or registers**
- **Types of isolation devices used**
- **What other operations are currently doing**
  (as best practice across the larger operations and smaller operations).

Introduction

Note that this presentation does not cover high voltage isolation processes.

Energy sources (primary)

Primary energy - Energy that is readily isolated by switching whole current isolators, or through disconnection of components or closing a valve or valves, e.g.

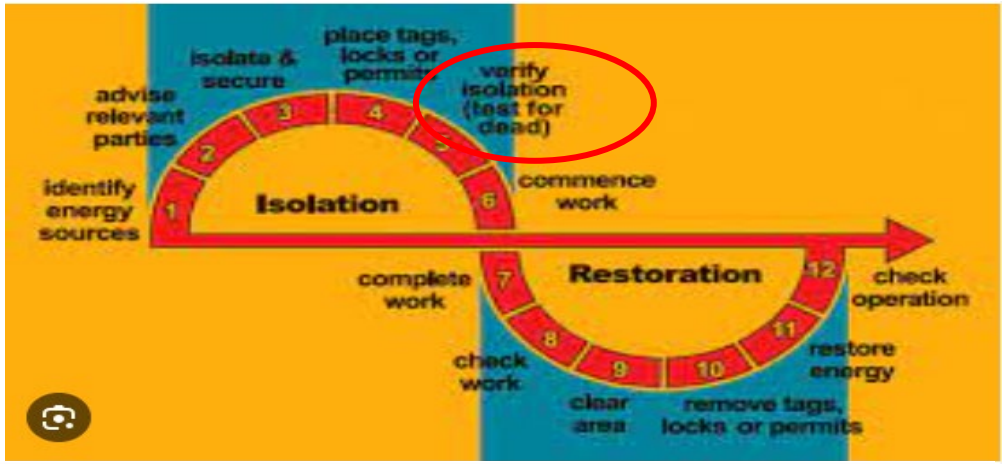
- Electricity
- Engines and electric motors
- Compressors
- Hydraulic lines
- Air lines
- Water lines

Energy sources (secondary)

Secondary energy –or stored energy, isolated by securing, chocking, bleeding off, switching or earthing -

- Stored energy in springs and accumulators.
- Pressures in pressure vessels, tanks, hydraulic lines and equipment.
- Gravitational energy of elevated equipment.
- Stored energy in capacitors.
- Bleeding off stored hydraulic or pneumatic pressure.
- Conveyor loop take ups, springs, material hang up in chutes, hoppers or truck bodies, unplanned movements (chocks for equipment rollaways) etc.

Steps of isolation



On the left are some of the 12 step isolation and restoration processes which a lot of larger mining operations have had in place for a long time.

This is to assist in stepping through the isolation and restoration to ensure there is a clear process so things cannot be missed or overlooked and the isolation and restoration is carried out correctly.

Steps of isolation

7 Steps of Isolation

Step 1: Identify Energy Sources

Step 2: Advise Relevant Parties

Step 3: Isolate and Secure Energy Sources

Step 4: Verify the Isolation (Test for Dead)

Step 5: Complete the task; Check and Clear work area.

Step 6: Remove Locks or Tags

Step 7: Restore Energy

On the left are more streamlined steps of isolation that some smaller operations have implemented as part of their isolation processes.

An important thing to note, that no matter what your isolation steps or processes are, one of the key messages is –

Verify the Isolation TEST for DEAD.

Isolation procedure

For a small site why not use the form in the small mines kit and modify it to suit your site?

FORM 11 G – ISOLATION PROCEDURE – example

APPLICATION:

This procedure is to be used when personnel are carrying out work on faulty equipment and where energy sources need to be isolated. This procedure will be used for all electrical and mechanical equipment and other situations where persons could be harmed due to an uncontrolled release of energy, (gravity, pressure etc).

IDENTIFY → SWITCH / ISOLATE → LOCK → TAG → TEST

PROCEDURES:

- The person placing the lock and tag is responsible to see that correct procedures are followed

Prior to any work commencing:

- The appropriate padlock and key is to be taken from the Isolation (Lockout) Station and used to lock out the field isolation switch.
- Isolator switches are to be turned off, and locked where possible. Where a piece of plant does not have an isolator, the key will be removed and will remain in the custody of the person completing the task.
- Danger tags are to be attached to the field isolating switch in a position readily visible. Where an isolator does not exist affix the tag at the ignition switch where the key was removed from.
- Prior to the commencement of work, a 'test for dead' of the equipment will be undertaken to establish that the plant has been successfully isolated.
- Where more than one person is required to work on the piece of plant each person will place a separate lock on the isolator.

On completion of work:

- A check is made to ensure that there is no danger from placing the equipment back in service.
- Isolation switches can have the tag removed, be unlocked and turned on.
- The padlock and key is to be returned to the Isolation (Lockout Station) along with the personal danger tags.
- The person charged with completing the task will check the immediate area to establish that no other person will be affected by re starting the equipment.
- If a person is not able to be located then they should be contacted directly and requested to return to remove their tag. If they cannot be contacted the supervisor must be sure that the person is off site prior to re energising any equipment and will record his observations.
- The main control panel switches can be turned on and operation re-commenced

End of Shift

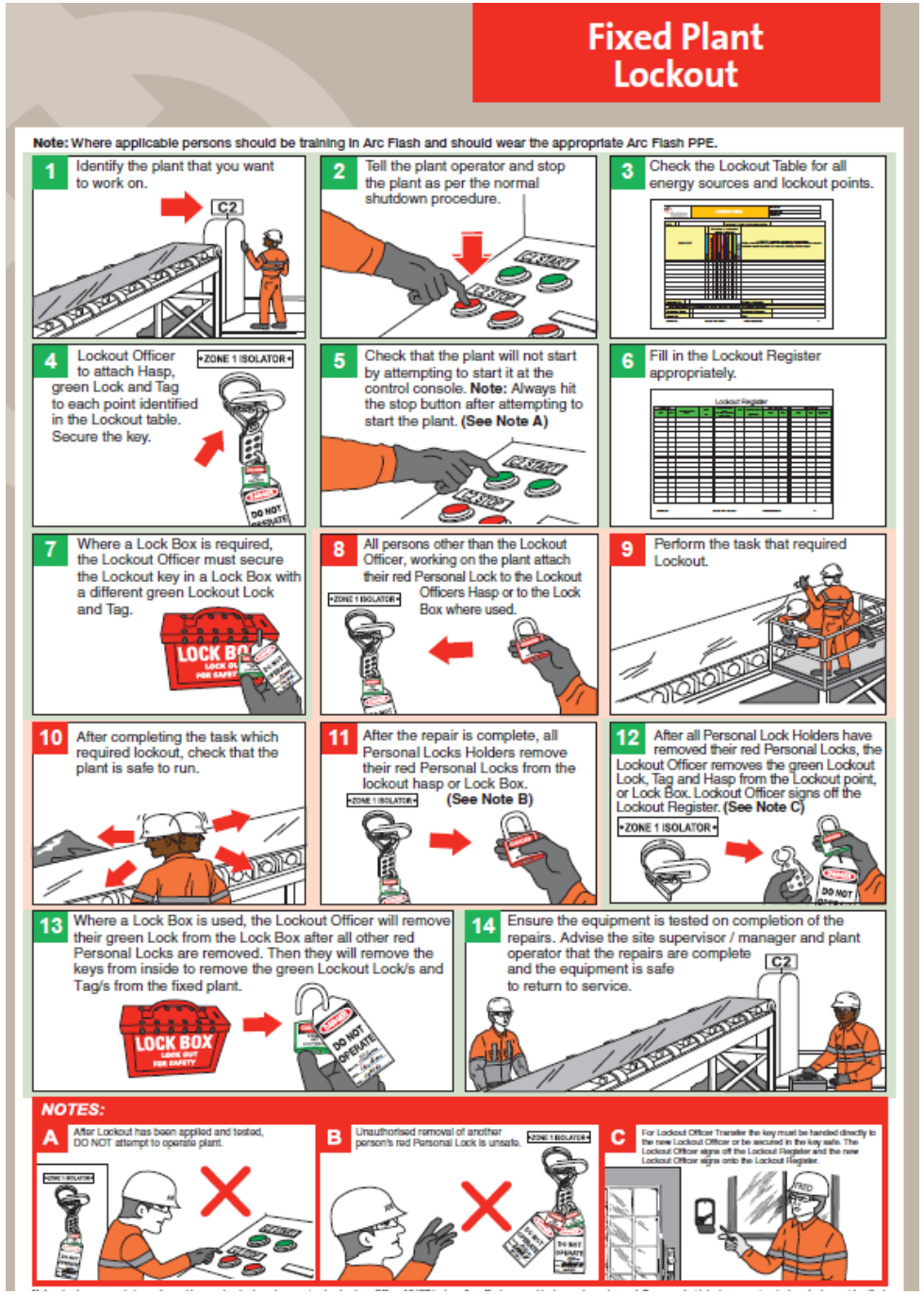
- If work is incomplete at the end of a shift, all personal danger tags are to be removed and replaced with an out of service tag, which indicates the plant is not able to be operated safely.





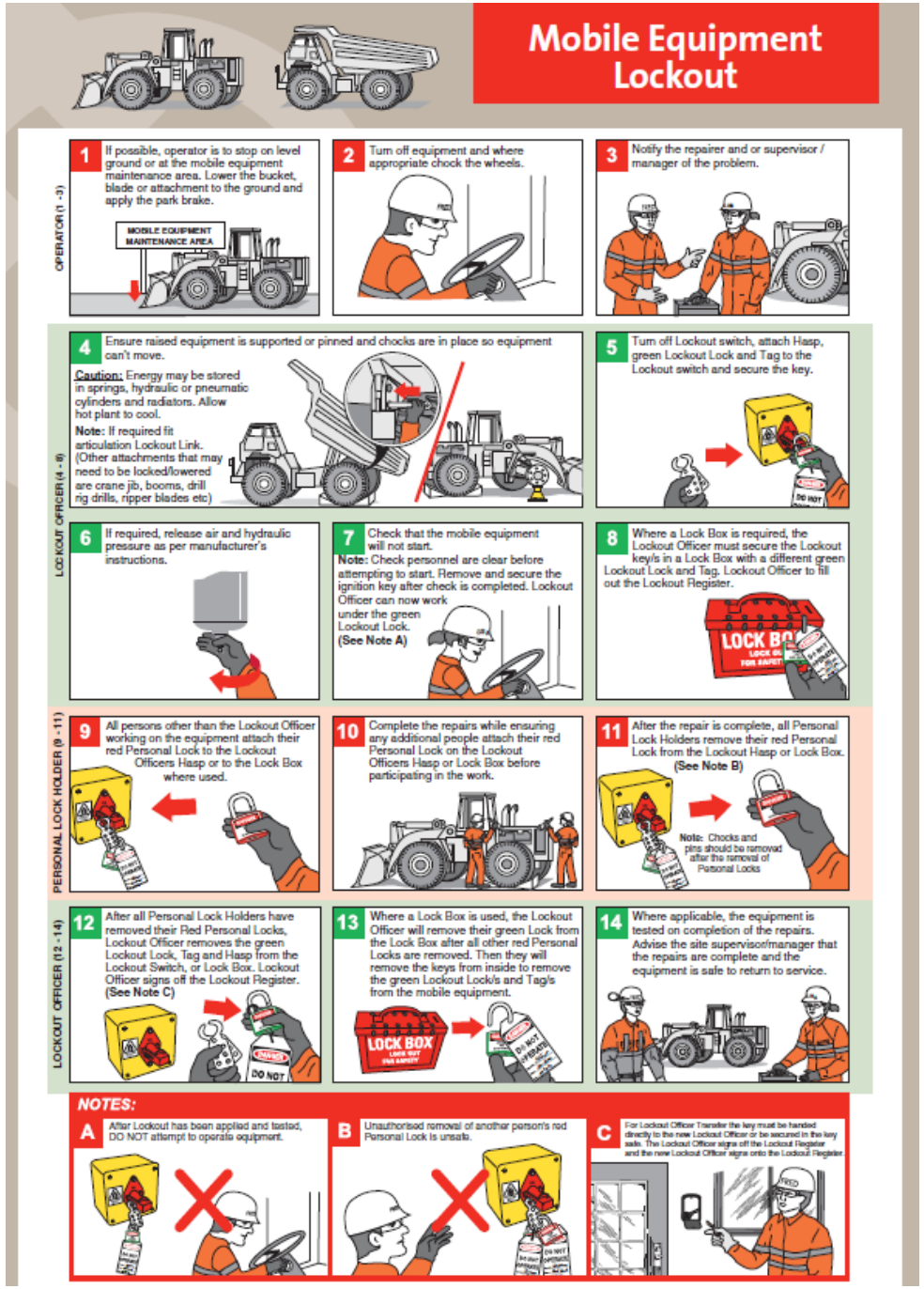

Isolation procedure

For a bigger site why not be inventive?



Isolation procedure

For a bigger site why not be inventive?



Isolation plans, matrixes or registers

(called many things at different operations)

Crushing Plant Isolation Register					
Area of Plant	Isolate	Isolate	Isolate	Isolate	Isolate
Main Feed Bin	VF1	JAW	CONVEYOR 1	BARRIER LIGHT TO RED	
Conveyor 2	VF1	JAW	CONVEYOR 2	CONVEYOR 3	
Conveyor 3	CONVEYOR 2	CONVEYOR 3	SCREEN 1		
Screen 1	CONVEYOR 3	SCREEN 1	CONVEYOR 4		
Conveyor 3a	CONVEYOR 2	CONVEYOR 3	SCREEN 1		
Conveyor 4	SCREEN 1	CONVEYOR 4	OMNICONE CRUSHER		
Omni cone Crusher	CONVEYOR 4	OMNICONE CRUSHER	OMNICONE LUBE PUMP	OMNICONE HYD PUMP	CONVEYOR 5
Conveyor 5	CONVEYOR 4	OMNICONE CRUSHER	SYMONDS CRUSHER	SCREEN 2 MOTORS 1&2	CONVEYOR 5
Conveyor 5a	CONVEYOR 5	CONVEYOR 5a			
Symonds Crusher	CONVEYOR 5a	SYMONDS CRUSHER	SYMONDS HYD PUMP	SYMONDS LUBE PUMP	SCREEN 2 MOTORS 1&2
Screen 2	CONVEYOR 5a	SCREEN 2 MOTORS 1&2	CONVEYOR 8		
Conveyor 6	SCREEN 2 MOTORS 1&2	CONVEYOR 6	CONVEYOR 7		
Conveyor 7	CONVEYOR 6	CONVEYOR 7			
Conveyor 8	SCREEN 2 MOTORS 1&2	CONVEYOR 8	BARMAC MOTORS 1&2		
Barmac Crusher	CONVEYOR 8	BARMAC MOTORS 1&2	CONVEYOR 9		
Conveyor 9	BARMAC MOTORS 1&2	CONVEYOR 9	SCREEN 3		
Screen 3	CONVEYOR 9	SCREEN 3	CONVEYOR 10,11,12,13		
Conveyor 10	SCREEN 3	CONVEYOR 10			
Conveyor 11	SCREEN 3	CONVEYOR 11			
Conveyor 12	SCREEN 3	CONVEYOR 12			
Conveyor 13	SCREEN 3	CONVEYOR 13	CONVEYOR 14		
Conveyor 14	CONVEYOR 13	CONVEYOR 14			

As you can see in the first box on the left area of plant this details the item of plant (within the crushing plant) that is going to be the item worked on.

The item of plant needs to be isolated and then additional items to the right that will also need to be positively isolated. These are generally items that may feed into or onto and away from the item which is to be worked on.

Isolation plan, matrixes or registers

ABC - Quarry - Isolation Plan

Date: 2/08/2023

Isolation coordinater responsible	

Equipment to be isolated during task:

Select / Insert Name of equipment	Points required to isolate	Type of Energy to be isolated	How to Verify Isolation	# of locks per person
Boot bin	ot bin	Gravity	Prove nil movement of equipment	1
Additional Equipment required to be isolated	Bollards	Mechanical	Prove nil movement of equipment	
Additional Equipment required to be isolated	Red light	Visual	#N/A	
Additional Equipment required to be isolated	Chain feeder	Electrical	Prove nil Electrical energy or attempt start-up	
Additional Equipment required to be isolated	0	0	0	
Other Equipment required to be isolated (manually complete)				

In this slide, a more advanced system has been developed by a local quarry in the form of an interactive spreadsheet which allows you to enter in the item of plant, that then assists you to identify the other items that subsequently require positive isolation.

Note that this also describes other energies to be isolated, which may also be a secondary energy source.

Isolation plan, matrixes or registers

See the demonstration of how the isolate spreadsheet on the previous slide works.

Open separate Excel spreadsheet with this PowerPoint presentation named – **Isolation ABC Quarry**

What are most other operations doing?
(personal locks)

Most operations in the small mines sector are now using and issuing their personnel with RED personal isolation locks, these have the individuals name and contact details engraved on a traffolyte label which is placed on the lock.

If personnel, such as visitors or contractors, do not have a lock and need to work on the item of plant or equipment, then the operation should keep some Personal Danger Tags and these can be fitted to a set of spare RED locks that do not have an individuals name engraved.

What are some other operations doing?
(scissor clips or hasps)

6 places to put locks

Many operations in the small mines sector are now using scissor clips/hasps, rather than personnel locking directly with their lock or tag onto the isolation point, this allows others to also lock onto the same isolation if needed.

These come in a variety of shapes and sizes, and they will only allow 6 people onto any one isolation at any one time. If the task requires more than 6 people and there are multiple isolation points, for example in a plant shutdown with many work tasks taking place at the same time, then you would need to go to a group isolation process (Group Lockout Stations or Lock Boxes).

What are some other operations doing?
(group lockout stations or lock boxes)

These are used where there are multiple isolation points and multiple personnel.

Recall the Main Feed Bin in the crushing plant – Isolate each point (VF1, Jaw, Conveyor 1, barrier) with a separate coloured isolation lock eg yellow lock.

The key from each of these yellow locks goes inside the box and then personnel apply their personal RED lock onto the box.

The yellow locks can then only be removed once everyone has removed their RED personal lock.

Crushing Plant Isolation Register				
Area of Plant	Isolate	Isolate	Isolate	Isolate
Main Feed Bin	VF1	JAW	CONVEYOR 1	BARRIER LIGHT TO RED

What are some other operations doing?
(information tags)

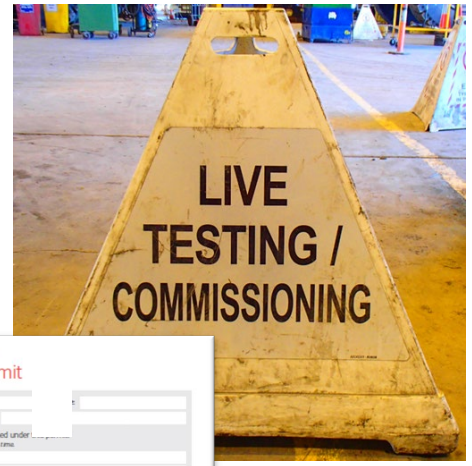
These are for the general transfer of information for the current status of an item of plant.

These should never be used as an personal isolation device for people to work on an item of fixed or mobile plant. They are also not to be used in place of an out of service tag.

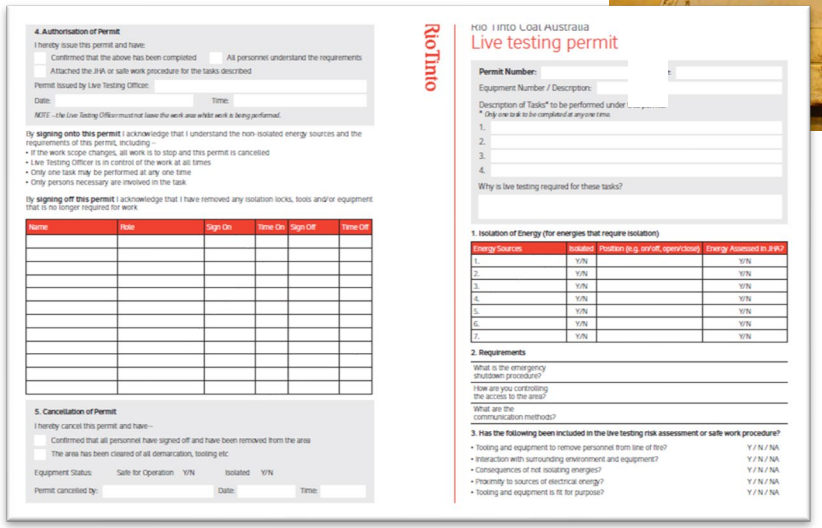
What are some other operations doing?
(Live test/commissioning process)

Prefer positive verified isolation

Rather than live testing / commissioning



Conveyor pulley tracking bolts external to the guards



AVOID LIVE TESTING WHERE POSSIBLE

What are some other operations doing?
(out of service tags)

An out of service tag indicates an item of machinery or plant is not to be used until the item of plant has been repaired. Out of service tags should never be used in place of a personal isolation lock or personal danger tag.

These should be attached securely to the isolation point of the specific item of fixed plant or mobile equipment to prevent inadvertent operation of the damaged or item of plant that is either under repair or awaiting repair.

These should only be removed by a competent person or ie: mechanical fitter, electrician or supervisor.

Isolation examples

Visible break isolator

Isolation examples

Excavator

Grader

Isolation examples

Truck – starter and battery isolators

Caution tag applied - bad oil samples

Summary

Remember that emergency stops, lanyards or pullwires are **NOT** primary isolation devices and **CANNOT** be used to positively isolate an item of plant.

These are emergency stop devices only.

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Summary

All operations are different, whether you have mains power to a fixed plant, genset power to a fixed plant, field/local control stations to isolate within the plant itself, mobile crushing and screening equipment and various types of HME/mobile plant.

It is your responsibility as a mine operator to ensure there are safe and practical systems including training in place for personnel and contractors to identify and positively isolate and verify the isolation or test for dead both primary and secondary energy sources before carrying out any tasks on any fixed or mobile plant within your operation.

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Thank you

Any question?