

Mineral Products Association

# Guide to Energy Isolation and LOTOTO

(Lock-out - Tag-out - Try-out)

# Introduction

The industry operates equipment that has the potential to cause harm if not operated or isolated correctly.

We have seen from incidents within the industry, that giving employees and contractors as much information and guidance on the risks involved when operating heavy machinery and the types of energy to be protected against is critical.

This document will describe LOTOTO ( Lock-Out – Tag-Out – Try-Out) which is the way to isolate equipment to ensure maintenance and cleaning can be undertaken safely.

This document has been prepared by the MPA and Reece Safety to Share Best Practice and to raise awareness of the subject ‘LOTOTO’ to help guide the industry to a safer working environment. In this document you will also find also find product information to safe guard the workforce.



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# What is LOTO and how it has evolved to LOTOTO?

The term lockout tagout (LOTO) refers to a safety procedure that ensures that dangerous machines and energy sources are properly shut off and not unexpectedly started up before the completion of maintenance or servicing work. These energy sources could include electrical, mechanical, hydraulic, pneumatic, chemical, radiation, and thermal hazards. It is important to remember the effects of overloading conveyors as this can distort the belt and release energy as the load is removed. The point of a LOTO procedure is to identify a hazard that may injure or even kill employees if such an incident occurs due to the startup or release of stored energy during the maintenance of machines and equipment.

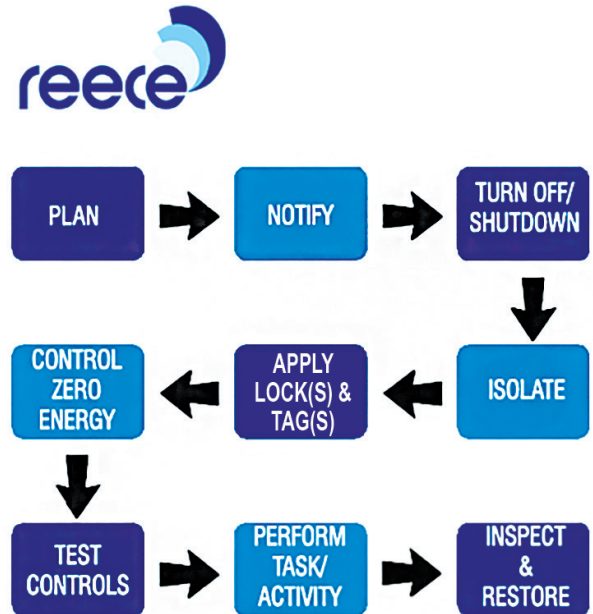
Lockout tagout (LOTO) procedures ensure that the hazardous power sources are isolated and rendered inoperative before any maintenance work is started. Usually, a lock is used that prevents the power source from being switched on. A tag affixed to the locked device cautions that it should not be turned on.

LOTO describes a safe work procedure and identifies tasks and equipment that may expose employees to hazardous energy. It also identifies hazardous energy sources and adjacent equipment. It prevents accidental energizing and unauthorized reactivation of machines, equipment or energy sources. A maintenance employee must ensure the LOTO procedure is followed before beginning work and on completion he or she must verify that all personnel are clear of danger before re-energizing the system.

LOTOTO increasingly is being used by our industry but is being recognised as best practice in many other industries including Waste and Renewables due to the additional documented steps in the process.

LOTOTO is known as “Lock-Out, Tag-Out, Try-Out” with the focus on testing controls before completing any tasks and equipment. This simple addition to the process would identify if there are any faults with the Isolation Point(s) and if there are any work wouldn’t be carried out until the investigation into the fault has been diagnosed and safe to continue.

Below is a map of the 9 Safe Steps to Isolation:



# LOTOTO – Lock-Out, Tag-out and Try-Out

- Required when guarding or safety devices need to be removed or bypassed, or you are exposed to hazardous energy.
- Performed by authorized and responsible individuals.
- The nine steps of LOTOTO: -

- 1 Prepare
- 2 Notify
- 3 Turnoff / Shutdown
- 4 Isolation
- 5 Apply Locks and Tags
- 6 Zero Energy State
- 7 Tryout
- 8 Perform Task
- 9 Make safe, inspect and restore



# LOTOTO Step 1 - Prepare

**Responsible individual in charge:**

- Reviews the Work Order.
- Performs a pre-job briefing if required.
- Reviews the machinery, equipment and process together with any associated risk assessment and Safe Working Practice.
- Complete associated paperwork or a permit/schedule of isolation for the work.



## LOTOTO Step 2 - Notify

### Responsible individual notifies ALL affected individuals:

- Via control room, radio, physical entry to the area or other appropriate method.
- Notifies people that the equipment will be isolated.
- Advises them to stay clear.
- Instructs them not to operate the equipment or process.



## LOTOTO Step 3 - Turn Off / Shutdown

### The responsible individual for LOTOTO:

- Turns off, shuts-down and de-energizes the equipment by referring to the specific procedure.
- The machine or equipment shall be shut down in an orderly manner to avoid additional hazards due to stoppage.

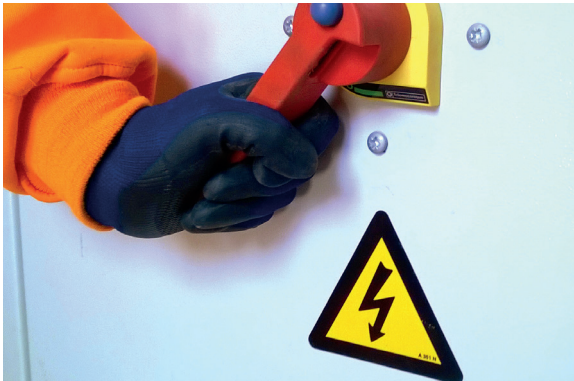




## LOTOTO Step 4 - Isolation

### All Personnel:

- Where safe to do so, starting and running the equipment, prior to isolation identifies if the machine has other electrical defects which could compromise the isolation process.
- The machine or equipment shall be isolated by using its energy isolating devices and not its operating controls.
- Don't use the STOP button or EMERGENCY STOP for isolation.
- Physical barriers are to be equipped with a locking device.
- Consider and isolate all other sources of energy, e.g. Hydraulic and Pneumatic
- If panels have a window where physical disconnect can be viewed, confirm the contactors have parted.



## LOTOTO Step 5 - Apply Locks

### One Lock, One Person, One Energy Source:

- Locks should be applied to each energy isolation device.
- A personal lock plus a tag to be fitted to each isolation point.
- Additional persons on the same equipment must apply their own lock and tag.
- Check isolation cannot be defeated (multi-hasp and padlocks secure).



## LOTOTO Step 5 - Apply Tags

**If any energy source is unable to be locked out, an alternative method and information tag must be applied as a means of protection. For example:**

Plus further measures:

- Pull fuses (lock them in a lock box for instance) or take air pipes off
- Blocking or controlling of a switch
- Bleeding lines, valves and tanks
- Securing valve handles
- Locking rooms
- Other effective means
- Action plan raised to address issue
- Procedures for locking out and applying tags to non standard equipment must always be assessed and discussed with a supervisor/manager
- Ensure distribution board is locked
- Tag removed only by responsible authorised person
- Tag never bypassed, ignored or defeated.

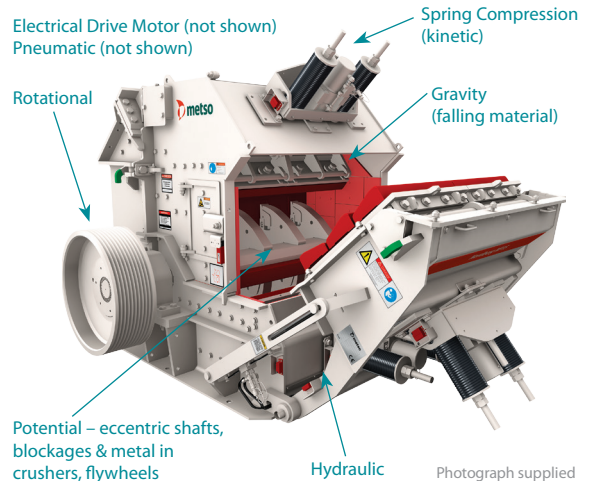


## LOTOTO Step 6 - Zero Energy State

- Is where all hazardous energy has been relieved, and rendered safe.
- Where stored energy still presents a hazard, additional procedures shall be developed to dissipate it or restrain it (e.g. chains).
- Make sure they work (try out).
- Ensure energy can not re-accumulate (air systems).
- Remember – conveyors for instance roll back if no backstop is fitted.

### Typical Types of Energy

Electrical Drive Motor (not shown)  
Pneumatic (not shown)



Photograph supplied courtesy of Metso

## LOTOTO Step 7 - Tryout

**Attempt to operate the equipment by its normal operating controls (either from the control room or from the local start), to ensure the correct equipment or process:**

- Has been de-energized
- Will not operate

Where equipment can be started from more than one source confirm try start process with site electrical support if in any doubt.

Pay particular attention to, and care with automated equipment operated via sensors, timers, etc. which may start unexpectedly. e.g. Packers, Palletisers

If the equipment or process operates:

- Equipment shall be shut down
- Supervisor shall be notified
- Near Hit raised
- Investigation to be completed

## ALWAYS TEST BEFORE YOU TOUCH

Prove the integrity and effectiveness of isolations before beginning work. All isolations must be secured, monitored and maintained throughout the work task.



## LOTOTO Step 8 - Perform Task

**Complete the task as per the risk assessment and safe working practice requirements.**

If at any point it is suspected that stored or other energy has not been isolated or rendered safe, immediately:

- Stop the task
- Withdraw all personnel
- Implement control measures
- Report Near Hit
- Investigate





## LOTOTO Step 9 - Inspect and Restore

### Responsible individual to:

- Visually inspect the area
- Guarding **MUST** be in place and secure
- Notify all affected individuals that power will be restored and ensure everyone is clear of the equipment
- Remove all lock-out devices and tags. Never remove another individual's personal locks or tags
- Restore all devices to the operating position and verify it is operating properly
- Notify the supervisor or production that the equipment or process is back in service
- Complete associated paperwork including Isolation Registers, and permits where required
- Have a procedure for test running if required
- Transfer ownership back to production
- Refix locks if it doesn't restart



## More Complex LOTOTO Methods – Where?

### Likely to be cement and large quarries

Where a large number of energy isolation devices or authorized individuals are involved a schedule of isolation is required and it should cover:

- Extended energy isolation period (e.g. more than one shift)
- Complicated energy isolation
- Highly sequenced equipment or high risk activities (confined spaces)

### Mandatory LOTOTO sequence guidance:

- An authorised individual must be identified
  - Who has the overall responsibility and authority
  - Who applies a controlling lock and key to the lockbox or board
- A Lockbox or complex isolation board system is used:
  - Into which all keys of assigned equipment placed
  - To which all individuals attach their personal locks
  - For which the controlling key is not a master key



# Safety Padlocks

## Brass safety padlocks

- Our range of British made brass padlocks are ideal for use in lockout/tagout systems.
- **Padlocks to Differ** - each padlock is keyed differently, supplied with 1 key per lock. 40,000 individual padlocks available.
- Bodies & keys numbered as standard



## Reece aluminium body safety padlocks with steel shackles

- These Aluminium bodied safety padlocks are unique in the lockout safety market in having lock numbers engraved on the body and key as standard to ensure safe padlock control



# Safety Lockout Hasps and Tags

## Stainless steel lockout hasp (mlh1)

- Manufactured from 316 stainless steel with a bright, durable nickel plated finish. Ideal for use in all industrial environments



# LOTOTO Tags

Using tags is a visual method of identifying details for an isolation which can often include; name, date, type of isolation, permit number and usually is room for some notes regarding the situation if required. These are available in various options which can be standard or tailored to reflect yourn procedure or safety rules.

- Easy to identify
- Can include individual pictures
- Various shapes and sizes
- Tailored options
- Visual indicator



## Area Isolation

Area isolation is a great way of defining a specific area or zone by prescriptive isolation station which reflects the safe working document which enable you to be able to perform and train individuals on the machine specific requirements.

- Ideal for complex isolations
- Defines requirement
- Promotes ownership
- Prescriptive process
- Easy to identify if a stage/isolation has been missed



## Plant Labelling

### Designated isolation points shall be clearly labeled:

- Permanent and weather resistant
- Standardised and consistent format

### Label information:

- Isolation device name and function
- Energy type and magnitude (eg hydraulics and air line)
- The standard of colour coding should be to BSEN 1710
- Located as close as practicable to the activity
- Sites should have a schematic of the electrical system

### Protecting from:

- Contact with energized electrical component
- Arc flash hazard
- Capable of being securely locked out
- Items should be easily identifiable



## Signs

 <b>Danger</b> High voltage test area	 <b>Keep away</b>	 <b>Danger Electricity</b>	 <b>Danger Isolator</b>	 <b>Danger</b> Overcurrent test area
1mm PVC Flexible self-adhesive vinyl	400 x 300 RIGID RPW12AR	400 x 300 RIGID RPW184AR S/A RW164AS	200 X 150 S/A RW631AS	400 X 300 RIGID RY688R
Made from durable 1mm PVC or flexible self-adhesive vinyl.				
 <b>Danger</b> 240 volts	 <b>Danger</b> 415 volts	 <b>Danger of death</b> if interfered with	 <b>Danger of death</b>	 Switch off electrical supply before working on this equipment
200 X 150 RIGID RFW68R 200 X 150 S/A RW606S	200 X 150 RIGID RFW68R 200 X 150 S/A RFW64S 400 X 300 RIGID RFW64SAR 400 X 300 S/A RFW64SAS	200 X 150 S/A RS10AS	400 X 300 RIGID RMC13AR S/A RW658S	150 X 225 RIGID RMC13AR S/A RMC13AS
 <b>Danger of death</b> High voltage	 <b>Keep away</b>	 <b>Danger</b> Restricted power before equipment is isolated	 <b>Danger</b> Keep away	 <b>Danger</b> Keep locked
300 X 400 RIGID RWM63AR 300 X 400 S/A RWM63AS	300 X 400 RIGID RY14AR	150 X 225 RIGID RWM43AR 150 X 225 S/A RWM43AS	150 X 225 RIGID RWM43AR 150 X 225 S/A RWM43AS	150 X 225 RIGID RWM43AR 150 X 225 S/A RWM43AS
 <b>Danger</b> High voltage	 <b>Keep away</b>	 <b>Danger</b> Lock it out	 <b>Danger</b> No storage	 <b>Danger</b> No unauthorised access
300 X 400 RIGID RWM63AR 300 X 400 S/A RWM63AS	400 X 600 RIGID RMC24R	150 X 225 RIGID RWM57AR 150 X 225 S/A RWM57AS	150 X 225 RIGID RWM57AR 150 X 225 S/A RWM57AS	150 X 225 RIGID RWM63AR 150 X 225 S/A RWM63AS 300 X 400 RIGID RWM63AR 300 X 400 S/A RWM63AS
 <b>Danger</b> Isolate for safe working	 <b>Isolate for safe working</b>	 <b>Danger</b> Isolate for safe working	 <b>Isolate for safe working</b>	150 X 225 RIGID RWM63AR 150 X 225 S/A RWM63AS 300 X 400 RIGID RWM63AR 300 X 400 S/A RWM63AS
300 X 450 RIGID RWM21AR 300 X 450 S/A RWM21AS	75 X 110 RIGID RVM15AR 75 X 110 S/A RVM15AS			

# Designing Captive Key Systems

**Captive key interlocking follows a process which cannot be circumvented or short cut. A key is used to start the process and remains trapped whilst the machine is running. The only way to remove the key is to isolate the hazard.**

There are three simple steps in designing a captive key system:

### 1. Establish what is being isolated

- a) Is there more than one system that needs to be isolated to make access safe?
- b) What are the energy sources present?
- c) What is the operating environment?
- d) What is the operational flow to start and stop equipment?
- e) What is the nature of the hazards?
- f) What is the possibility of avoiding the hazard?
- g) Severity of the possible injuries?

### 2. Work out how many access points there are

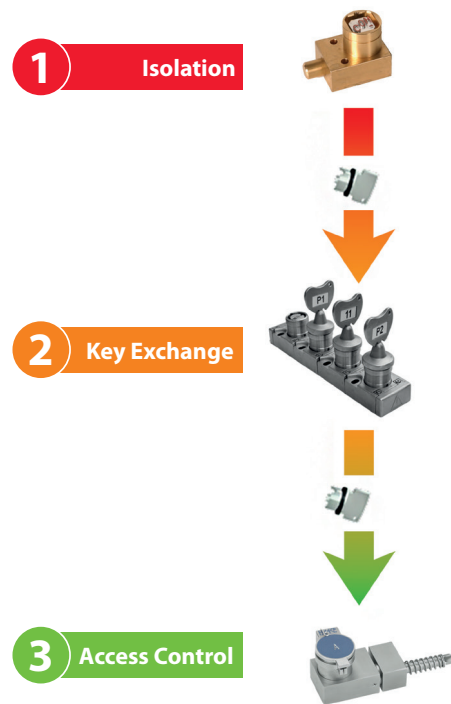
- a) What is the type of each access? Full body or part body?

### 3. Confirm what type of access is required

- a) Is there a time delay required for safe access?
- b) Severity of the possible injuries?
- c) What is the possibility of avoiding the hazard?
- d) What is the nature of the hazards?

**NO MASTER KEYS TO BE USED**

## The three points of trapped key interlocking





## LOTOTO Safety Conversations

- Do you have your own personal locks and do you only have one key?
- Are there any duplicate keys in a cabinet or manager's office somewhere?
- Do you use tags to show who is working on equipment?
- Have you had a tool box talk on LOTOTO (Lock Out, Tag Out, Try Out)?
- How have you locked off the equipment you are working on and if so where?
- Can you show me the lock off point and is it convenient to lockout here?
- How do you try out this piece of equipment?
- When is it necessary to have a Permit to Work on your site?
- Have you ever had to cut a lock off? If so, what is the correct procedure for this site?
- When was this electrical panel last inspected?
- Have you identified all the hazardous energies that might allow this equipment to move?
- Is there an isolation procedure for the task you are undertaking?
- If there is no isolation point for this equipment how do you prevent someone starting it?
- Do you need to have Arc Flash protection PPE?



## Isolation of Mobile Plant

While the isolation of mobile plant is generally less complex than isolations on 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.

All mobile plant should be fitted with the capability to switch off the battery or supply to the starter with the capability of being locked in the off position using a unique lock and key.

### 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.

### Isolation

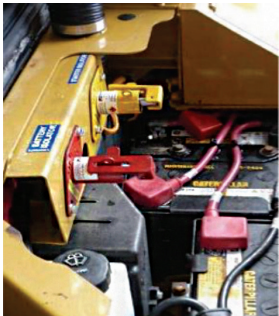
The isolation needs to be conducted by a competent person, who confirms that all energies have been identified, deactivated, dissipated and isolated before work commences.

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 to the isolator and danger tag as a minimum.



## Why Reece Safety

We at Reece have partnered with the MPA to put this guide together as we pride ourselves on giving the very best advice and understanding of the industry when it comes to safe isolation.

We have over 15 years' experience in the field and have a range of products that complement the industry's requirement for all energy sources and control of lockout, tagout, tryout (LOTOTO).

MPA have chosen to work closely with Reece because we manufacture all our own products in house which gives flexibility when it comes to the safe working practice of both simple and complex isolations.

We hope that you found this guide useful. For further information please refer to the references.

### References

Mineral Products Association  
[www.mineralproducts.org](http://www.mineralproducts.org)

Reece Safety  
[www.reecesafety.co.uk](http://www.reecesafety.co.uk)

[www.safequarry.com](http://www.safequarry.com)

[www.safeprecast.com](http://www.safeprecast.com)

[www.metso.com](http://www.metso.com)



## Please ensure that you report all Incidents or incidents.

If you see anything on your sites or customer sites that you think is unsafe, it is okay to Stop and Report it as a Near Miss.



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