WORKSAFE
Mahi Haumaru Aotearoa

HSWA

QUICK GUIDE

January 2021

Keeping workers safe when servicing machinery

This guidance advises small to medium PCBUs[1] how to use lockouts to safely isolate and de-energise the parts of machinery that could cause harm to workers when servicing[2] this machinery.

This guidance provides general advice. It is not possible for WorkSafe New Zealand to address every situation or type of machinery that may require lockout. This means that you will need to think about this guidance and how to apply it to your particular circumstances. Where manufacturer's instructions do not apply, it may be necessary to have a competent person develop or assess the lockout procedures for more complex machinery.

This guidance explains:

- the importance of managing the risks of machinery
- when machinery should be locked out
- individual, multiple and group lockout procedures
- restart procedure
- what to do if machinery must keep operating and cannot be locked out.

What is the machinery lockout process?

Lockout is the process of turning off machinery and applying a physical lockout device to its lockout point (for example, a disconnect switch, isolator switch, or circuit breaker). Types of lockout devices might also include padlocks, chains and hasps. More than one lockout device may be used to lock out machinery.

Lockout prevents energy from being transmitted or released to machinery so it cannot be restarted (or cannot restart by itself) and cause death or serious injury to the person or people servicing the machinery. Machinery must be locked out safely and effectively before being serviced, if it is reasonably practicable to do so and if there is the potential for it to cause harm.

As the PCBU, you must have a safe and effective lockout procedure and you must make sure your workers are trained in the procedure or are supervised when they carry out the procedure.

Why a safe and effective lockout process is important

Workers in New Zealand have been killed or seriously injured when machinery was restarted while they were servicing it. Injuries have included:

- amputated limbs
- trap or crush injuries
- electric shock
- burns or scalds
- entanglement
- pressurised fluid injection injuries.

[1] Person Conducting a Business or Undertaking.

[2] In this guidance, servicing machinery includes, but may not be limited to, doing maintenance, repairing, cleaning, unjamming or unblocking the machinery.

WSNZ_3850_JAN 21

Manage the risks

Risks to health and safety arise from people being exposed to a hazard (a source or cause of harm). The Health and Safety at Work Act (2015) requires the PCBU to eliminate risks to health and safety, so far as is reasonably practicable.

If you cannot eliminate a risk, you must minimise it, so far as is reasonably practicable. Use the **hierarchy of controls** to help choose safe and effective control measures to minimise risk.

You must **involve your workers** in the risk management process, including when choosing control measures. If you need further help deciding on controls, get the advice of a competent person[3] or read the manufacturer's instructions for the machinery.

Isolating machinery from its energy source

For a lockout to be safe and effective, and prevent the machinery making any unplanned movements that could cause harm, it is critical to:

- shut down (isolate) all energy sources to the machinery, and
- release (de-energise) all stored energy within the machinery.

Machinery may use one or more energy sources, including:

- mains electricity
- batteries or capacitor banks
- solar panels
- compressed air
- fuel
- heat
- steam
- fluids or gases under pressure, such as water or hydraulic oil
- stored energy, such as compressed springs or hydraulic rams
- gravity (for example, suspended weights)
- radiation
- chemicals.

If the machinery is powered by electricity, and does not have a lockout point on the power control, you should lock out the circuit breakers. If you are unsure of the safe lockout procedure for the machinery, it is recommended you seek the assistance of a qualified and licensed electrician.

Machinery with just one energy source is generally locked out by attaching a lock to the disconnect switch (the lockout point). The person who locked out the machinery should be the only person who removes the lock.

Lockout for shift changes

Your lockout procedure should take into account when machinery is locked out for more than one day or one shift. For example, at shift changeovers, the worker beginning their shift would attach their personal lock to the lockout point. Then the worker who first locked out the machinery and whose shift has now ended, would remove their personal lock.

Allowing for absences from work

In some cases, the person who locked out the machinery may no longer be at work when it is time for the lockout to be removed. They may have finished their shift, or be ill or on annual leave. Your lockout procedure should include details of how you will safely remove a lockout in this situation.

Tagout

Once machinery is locked out, it should be tagged out. This means a tag is attached to the machinery warning other workers that it is locked out and is not safe to use. Tags are sometimes called danger tags, restricted-use tags, or warning tags.

Emergencies

Your lockout procedure should include instructions for what to do in an emergency, for example, if someone gets stuck in the machinery. Make sure a competent person reviews your emergency plan.

Keep master keys or spare keys locked in a secure place away from where the work is being carried out (for example, an office). These keys should not be accessible to any workers and should only be available to an authorised person, for example, a supervisor or manager.

Master or spare keys should only be used in an emergency and when:

- the person who locked out the machinery has given permission for someone else to remove their lock, and
- the machinery has been checked to make sure it is safe to restart.

[3] In this guidance, a competent person means a person who has the relevant knowledge, experience, and skill to carry out a task and who has a relevant qualification or certificate.

Lockout and tagout process steps

1 Identify the machinery to be locked out and the type of energy to be controlled

- Review your lockout procedure.

2 Assess the risks, including the consequences of locking out the machinery

- For example, make sure that shutting off the machinery will not cause harm to other people.

3 Notify all affected workers that the machinery will be locked out

4 Shut down the machinery following established procedures

- Make sure all moving parts have stopped.
- Where machinery takes some time to stop, workers must not enter the lockout area unless a safe entry system is in place.

5 Identify and de-energise the lockout point for each energy source

For example:

- disconnect electrical power to the pump or compressor
- close the valve feeding the cylinder
- lower or support elevated equipment
- release compressed air or hydraulic pressure
- drain fluids
- check that all hydraulic accumulators, blowdown bottles and receivers are secure
- use effective safety pins or load-holding devices to prevent gravity fall.

6 Each worker should attach their personal lock to the lockout point for each energy source

- Check that the area around the machinery is clear of other people.
- Select your lockout device (for example, chains, locks, adapters, safety stop pins).
- Lock all energy sources in the 'off' position with your lockout device. This should hold the controls in a safe position to achieve a state of zero energy.
- Lock all other controls that could activate or cause the machinery to restart, including backup energy sources such as generators.

Do not use programmable logic controllers (PLCs), key lockable emergency stops or similar selector switches as the only method of isolation and lockout.

7 Tag out the machinery

- Attach a tag to the machinery warning other workers that it is locked out.
- If the machinery is faulty or damaged, attach an 'Out of service' tag to it.
- Tags should have the name of the person who locked out the machinery, the date and time, and the reason for isolation written on them.
- If more than one worker is locking out the machinery, each should attach a tag to their personal lock, and then attach the lock to the lock box.
- Each worker's name and contact details should be written on an isolation register, a permit to work record, an isolation tag or a physical lock.

8 Test the lockout to make sure it works and that each energy source is locked out

- Check that the area around the machinery is clear of other people and that no hazard will be created if the lockout does not work.
- Press all start buttons (the machinery should not start).
- Where applicable, operate all functions to release any stored energy and to check for unknown backup systems.
- Make sure that any pressure sensor, thermostat, switches, PLCs and computer-controlled systems or other automatic systems cannot restart the machinery.

You must also:

- Make sure all workers who lock out and tag out machinery are trained in the correct procedure.
- Supervise workers to make sure they follow correct procedure and use them every time they do a lockout and tagout.

It is good practice to:

- Monitor and review your lockout procedure to make sure it remains effective.
- Write down your lockout procedure and give a copy to your workers, or have a copy on or by the machinery.

Group lockout procedure

Multiple workers, one lockout point

When more than one worker is servicing machinery that has only one lockout point, the supervisor may coordinate the activities of all members of the group. The procedure may contain the following suggested steps:

1. The supervisor attaches a multi-lock device (hasp) to the lockout point.
2. The supervisor then attaches their personal lock to the multi-lock device.
3. Each authorised worker then attaches their personal lock to the multi-lock device.
4. When work is complete, each worker removes their lock.
5. The supervisor removes their lock. They then remove the multi-lock device from the lockout point. The supervisor is responsible for ensuring (by talking to workers) that the work activity is complete and the machinery is safe to be restarted.
6. The machinery is re-energised and restarted.

Multiple workers, multiple lockout points

If the machinery has more than one lockout point and needs to be serviced by more than one worker, and it requires more personal locks than are available, the following procedure could be used:

1. The supervisor obtains a lock box containing locks, tags, and keys.
2. The supervisor attaches the lock box to the machinery.
3. Workers attach locks and tags from the lock box to all of the machinery's lockout points, under the direction of the supervisor.
4. The supervisor collects the keys and places them inside the lock box.
5. The lock box is closed and the supervisor attaches a multi-lock device to it.
6. The supervisor attaches a personal lock to the multi-lock device.
7. Each worker attaches their personal lock to the multi-lock device. Personal locks remain in place while they are servicing the machinery.
8. The last available hole of the multi-lock device should never be used for a lock, but should remain available for another multi-lock device to be added if needed (enabling as many locks as needed to be added to the machinery).
9. The supervisor or other responsible person tests the lockout to make sure it is effective (the machinery should not start).
10. As work progresses, remove all non-essential items from the work site. Workers should remove their personal lock as they finish the job. In all cases, the supervisor should be the last person to remove their lock.

Removing the lockout and restarting the machinery

Only people competent in operating the machinery should restart it.

1. **Check that the area around the machinery is clear of other people**
   - Notify all affected workers that the machinery is going to restart and make sure they are clear of the machinery.
   - Consider the effect of start-up on any connected or attached plant.
   - Check for incomplete work.
2. **Remove all non-essential items from the machinery**
   - For example, safety blocks, spare parts, tools.
3. **Restore all machinery components that may have been removed**
   - Check that all guards, safety devices and interlocks are in place and operating correctly.
   - Repair or replace defective safeguard and safety devices.
4. **Remove tags**
   - The person who attached the tag should be the person to remove it.
5. **Make sure the machinery's operating controls are in the 'off' position**
   - For example, mobile plant.
   - Check that control levers or other engaging devices are in a neutral or safe position.
6. **Inspect the machinery for obstructions**
   - For high-risk complex plant and machinery (for example, a printing press), a team of appropriately trained workers should inspect specifics like the hydraulics and pneumatics.
7. **Remove locks**
   - Each lock should be removed only by the person who attached it following the correct removal sequence.
8. **Do a final check**
   - Restart the machinery at low speed and check it is operating correctly.
   - Turn on each energy source one at a time and check for leaks, unusual vibrations, noises, smells, temperatures or excessive current being drawn by the motors.
   - If the machinery is operating correctly, increase its speed to its usual rate.

If the machinery must keep operating while being set up, adjusted, cleaned, repaired or maintained

If it is essential that the whole or part of the machinery must continue operating (for example, a kiln at a steel mill), you must ensure that:

- only the part of the machinery that is required to keep operating is set in motion, and
- you have a procedure for this to be done safely which includes at least the following:
- only workers who have been adequately trained in the process service the machinery
- this procedure is followed every time the machinery (or part of the machinery) must keep operating while being serviced.

You should check:

- the speed of the machinery is reduced to the slowest practical operating speed with reduced power/force
- where more than one worker is required for the process, there are safe work procedures in place
- an inching control that is in a position to allow the worker full sight of moving parts is used
- the inching control is a two-hand hold-to-run type that ensures the machinery stops immediately when the control is released
- there are emergency stop controls within immediate reach.

More information

WorkSafe

Safe use of machinery

Health and Safety Association of New Zealand (HASANZ)

Video

This 3-minute video Isolating machinery when not in production is from WorkSafe Queensland but is also applicable to the lockout process in New Zealand.

Standards

PCBUs should use the joint or Australian Standard AS/NZS 4024 Safety of Machinery series. This is the standard that gives the current state of knowledge for the safeguarding of machinery and plant. The series includes (but is not limited to):

- AS/NZS 4024.1201 Risk assessment and risk reduction
- AS/NZS 4024.1601 Design of controls, interlocks and guarding
- AS/NZS 4024.1602 Interlocking devices associated with guards
- AS/NZS 4024.1603 Prevention of unexpected start-up.

PCBUs can use other standards but they need to show that they can reach the same level of safety, or better, in the circumstances in which they are used.