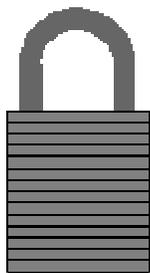




# Best Practices Guide For Lockout Programs

## “Hazardous Energy Control”



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## Who Needs a Lockout Program

One very important, but often overlooked, component of a municipal safety and health program are procedures to protect employees from being injured, or worse, by the accidental startup or movement of machinery and equipment that they are working on. While officially known as “hazardous energy control procedures”, most people refer to them as “lockout procedures”. Lockout/Tagout is an older term. “Tagout” or using tags without locks to protect employees is a nearly obsolete practice since most valves, switches, and breakers can now be locked out with devices that are readily available on the safety equipment market.

You must have a lockout program if any of your employees perform maintenance work on machinery or equipment that either:

- exposes them to injury if the equipment were to accidentally be started, or
- exposes them to injury if an unexpected release of hazardous energy were to occur, such as a blast of steam, corrosive chemical, or an electrical arc flash.

Some examples of tasks commonly performed by municipal, school, and utility district employees that would *usually* require lockout are:

- Replacing belts on compressors, ventilation equipment, shop machinery, and vehicle engines;
- Disassembling pump couplings to replace/repair the motor or pump;
- Maintenance on electric/hydraulic recycle balers and trash compactors;
- Confined space entry;
- Boiler repairs;
- Working on engines and drive trains of vehicles/mobile equipment;
- Working under elevated buckets, booms, or dump bodies of vehicles and mobile equipment;
- Changing saw or chipper blades;
- Electrical work where employees are exposed to conductors under the assumption that they are “off”, like replacing light ballasts;
- Repair work or jam clearing on conveyors;
- Repair work or jam clearing on wastewater treatment equipment such as screw conveyors, sludge dewatering equipment, rake arms, and blowers;
- Unusual tasks by fire and rescue departments, such as elevator rescue and industrial firefighting, which should be covered by specific SOP/SOGs.

A good lockout program should be *specific* to your operations and equipment. It is not something that you can buy or “borrow” word for word from another entity. It should include a statement of policy, a program coordinator, equipment specific lockout procedures, lockout equipment, employee training, and periodic program evaluation.

Lockout accidents are not as common as other mishaps in municipal service, but when they do occur, they may result in serious injury or death. You cannot wait for an accident to tell you that you need a lockout program!

## Standards

The standard, on which all lockout programs are based is OSHA Standard 29 CFR 1910.147 “The Control of Hazardous Energy”. It is adopted by the State of Maine as ME 1910.147 and enforced by the Bureau of Labor Standards over public sector employers. Maine also applies this standard to work on mobile equipment, such as vehicles and earth moving machines. See page 10 “Sources of Additional Help” for a link to the standard and a sample written policy.

Most equipment also will have recommended energy isolation procedures in the operation or owner’s manuals. This is a good place to start when developing equipment specific procedures. Be aware, however, that some older equipment manuals, and those for equipment made outside the U.S., may have recommended procedures that are not in compliance with current standards.

## Basic Principles of Hazardous Energy Control

**Hazardous Energy** is any type of energy that, if released unexpectedly, can injure or kill. It has two major forms:

- **Kinetic Energy** from *movement*, such as turning shafts, belts, pulleys, flowing liquids/gases, and electrical current.
- **Potential Energy**, which is *stored* energy that can be dangerous if unexpectedly released and turned into kinetic energy. Examples would include elevated dump bodies on trucks, hydraulic/pneumatic/steam pressure in pipes or tanks, elevated loader buckets, or electrical energy stored in batteries or capacitors.

Hazardous energy comes in many forms. Examples are:

	Kinetic	Potential
<b>Electrical</b>	Current	Batteries, capacitors
<b>Mechanical</b>	Turning shafts, gears, belts, chains, fans etc.	Elevated parts, tensed springs
<b>Hydraulic</b>	Moving cylinders/motors	Pressure in accumulators, lines
<b>Pneumatic</b>	Moving cylinders/motors	Pressure in tanks/lines
<b>Steam</b>	Flowing steam	Trapped pressure
<b>Hazardous Chemicals</b>	Flows	Trapped gas/liquids

## Common Terms

**Authorized Employees** are employees who perform work that exposes them to accidental startup or release of hazardous energy. They must be thoroughly trained in all aspects of lockout.

**Affected Employees** work around or operate equipment that is placed under lockout, but do not do any work requiring lockout. They must be trained not to attempt to operate equipment that they have been notified is under lockout and to recognize the locks and tags used in your program as safety devices.

**Other Employees** do not lockout or normally work around locked out equipment. They include office staff and vendors/visitors. Since these employees are usually few in number in a municipal government and may occasionally travel through areas where equipment is under lockout, you may consider just training them as “Affected”.

**Energy Isolation Devices** are switches, breakers, and valves etc. used to actually shut off and isolate hazardous energy.

“**One-Person One Lock**” is the basic principle under which lockout works. Each employee working in the “hazard zone” places his/her own lock, with identification, on each energy isolation device and holds the key. This way, nobody can operate the switch/breaker/valve until they are clear and have removed their lock.

“**Systems Lockout**” or “**Lock Box**” **System** - when large numbers of employees work on complex equipment, a systems lockout or “lock box” system is used so that each employee has to place only one lock. If you need such complex procedures, review ME 1910.147.

**Written Lockout Procedures**, specific to each piece of equipment are generally required. They should identify the types of hazardous energy present and contain specific procedures for proper shut down, isolation, and testing. There is a specific exception to being required to have a written lockout procedure for equipment that has a single readily identifiable energy source and isolating it is the only step required for lockout. If you intend to use this exception, then you should review ME 1910.147 *carefully*.

## Steps to Equipment Lockout

1. **Notify Affected Employees** that the equipment is being locked out for maintenance.
2. **Shut Down** the equipment safely, if not already down.
3. **Isolate Hazardous Energy Sources** by placing switches, breakers, and valves in the proper position and applying locks/tags.
4. **Block/Jack/Pin** raised components and other potential mechanical energy sources.
5. **Release Stored Energy** by draining, bleeding down, and applying grounds.
6. **Test for “Zero Energy”** by trying to start the equipment; Be sure it will not start.

## Steps to Removing Lockout

1. **Search** the equipment for personnel, tools, and loose parts; Remove them if necessary.
2. **Replace** safety guards.
3. **Remove Locks.**
4. **Notify “Affected Employees”** that lockout has been removed.

## Steps to Test or Reposition Equipment Under Lockout

1. **Follow “Steps to Removing Lockout”.**
2. **Keep personnel clear; Perform test or repositioning.**
3. **Follow “Steps to Equipment Lockout”.**

**Exceptions to requiring lockout** - Exceptions exist and apply to certain tasks commonly performed by employees. These include:

- **Work on cord and plug equipped equipment** where the plug can remain under the control of the employee performing the work and unplugging the cord completely isolates all hazardous energy. EXAMPLE: Changing the bit in a portable drill.
- **Normal operating procedures** that are “routine, repetitive, and integral to the use of the equipment”. For instance, lockout is not required each time material is added to a baler. Guards or interlocks should adequately protect the employees during such operations.
- **Electrical work** can be performed “hot” by qualified electricians under certain circumstances if they follow certain safety work practices.

**Relationship between lockout and machine guarding.** Machine guards and safety interlocks protect employees during normal operation. Lockout is intended to protect employees during maintenance and jam clearing when safety guards often have to be removed or be overridden. If a safety guard is being removed from a piece of equipment, it is a powerful clue that lockout may be necessary!

## Essential Elements of a Lockout Program

1. **A written Hazardous Energy Control Policy** should be adopted to form the basis for the program. This should include:
  - A statement of policy that all covered work will be done under lockout according to 1910.147 and how this will be enforced;
  - Identification of an individual to act as the “**Lockout Coordinator**” to make sure that procedures are up to date, training is done, adequate lockout equipment is available, and that an annual program evaluation is done.
  - Identification of employees by job title who must be trained as “authorized” and “affected”;
  - A description of how initial and periodic review training will be conducted;
  - A procedure for conducting an annual review of the program by inspecting work in progress under lockout;
  - A procedure for removal of locks in unusual situations where they have been inadvertently left on and the employee who placed them is not available to remove them. At a minimum, this should include a documented procedure of:
    - Attempting to contact the employee,
    - Searching of the area to ensure that the employee is, in fact, not there,
    - Notifying (as soon as possible and preferably in writing) the employee whose lock(s) were removed.
2. **Equipment Specific Lockout Procedures** for all equipment needing them. These should be posted near equipment and readily available to employees who need them and include:
  - Affected employees who must be notified,
  - Shut down procedures,
  - Hazardous energy present, by type and magnitude (i.e. 110v electrical, 30 PSI compressed air),
  - Energy isolation points (energy isolating devices such as switches and valves) that need to be locked out,
  - Any blocking, jacking, pinning, chocking, or other procedures needed to control raised equipment or other potential mechanical energy,
  - Bleed down procedures for other types of stored energy, such as hydraulic and pneumatic,

- Testing procedures to ensure that the equipment is really at “zero energy” and safe to work on.

**ATTACHMENT A** is an example of a form that could be used for written lockout procedures.

**ATTACHMENT B** contains 3 examples of lockout procedures for “fictitious” equipment.

### 3. Lockout Equipment

- **Padlocks.** Each employer **MUST** standardize their safety locks by brand, color, shape, or label etc. so that they are readily recognizable as safety lockouts. No other type of lock can be used for lockout, and lockout locks may not be used for any other purpose, such as toolbox security. Locks should be individually keyed.
- **Lockout Tags** must be provided, or all “tag” information must be affixed to each lock using a label. If separate tags are chosen, then the grommets must be large enough for a lock shackle to pass through. Tags and labels must be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible. As with locks, tags or labels must be standardized for your workplace. The minimum information that should be on a tag or lock label is:
  - The word “**DANGER**”,
  - Wording that indicates that someone’s safety is in jeopardy if it is overridden- such as “**DO NOT START**” or “**LOCKED OUT**”,
  - The employee’s name that it represents and protects.
- **Multiple Lockout Hasps** are attached to lockout points to allow multiple employees to lock out. They are available in many styles.
- **Valve Lockout Equipment** suitable for the valves your employees must lock out. For larger valves, this includes sections of sturdy chain. For smaller hand wheel valves, plastic “clamshell” devices are available. Several different devices are available to lock out quarter turn valves, if yours are not already lockout compatible.
- **Circuit Breaker and Switch Lockout Devices** suitable for the types of devices in your workplace.
- **Plug Cups** if electrical plugs or hydraulic/pneumatic hoses must be disconnected and locked out on any of your equipment.
- **Lock Boxes** for locking up vehicle/heavy equipment keys, or for “systems lockout” if you have complex equipment.

- **A Supply of Blocking, Cribbing, Pins, Mechanical Jacks, Wheel Chocks, etc.** to block machinery components and elevated parts against hazardous movement.

#### 4. **Employee Training** must be provided:

- Initially
- If new equipment or energy sources are added to the workplace
- If annual program evaluations, accidents, near misses, or employee feedback indicate that the lockout program is not working effectively
- If the employer feels the written program needs to be reviewed

Since lockout is a “complex” work behavior, that requires a great deal of attention and commitment by each employee not to cut corners, it is a good practice to provide some motivational “review” training in the “why”, “when”, and “how” of lockout.

- **Authorized Employees** who must lock out equipment must be trained in:
  - The hazards associated with uncontrolled energy
  - Your written lockout program
  - Proper techniques for applying lockout
- **Affected Employees** who don’t lock out, but work around equipment that is locked out, must be trained in:
  - Recognition of lockout equipment used in your program
  - The dangers of overriding lockout
  - Prohibitions against attempting to operate any equipment that they have been notified is locked out, or appears to be locked out

#### 5. **Contractors and other Outside Employers** (such as vendors)

- You must always inform other employers working on your machinery/equipment, on-site, about your lockout procedures.
- You must either:
  - Require them to use your lockout procedures and equipment, or
  - Allow them to use their own lockout procedures and equipment, if they provide equivalent protection and you train your employees about their lockout procedures.

6. **Periodic Program Evaluation.** At least annually, an authorized employee who is not directly involved in the maintenance task being performed must conduct a documented evaluation, to ensure that the lockout program is working properly. This should include:

- Interviews with authorized and affected employees,
- An inspection to ensure that the equipment has been properly locked out,
- An inspection to ensure that all equipment used in lockout is appropriate for your written lockout program.

**APPENDIX C** is an example of a checklist that could be incorporated into your program and used for this purpose.

7. **Record Keeping.** The following records, related to your lockout program should be maintained on file for at least 3 years:

- Employee training records/attendance sheets and course outlines
- Periodic Program Evaluations and follow-up documents
- Accident and near miss reports
- Documentation of employee lock removal by others (when inadvertently left on).

## Sources of Additional Help

MMA, Risk Management Services - Please call Loss Control Services @ (800) 590-5583 or visit our website @ [www.memun.org/RMS/LC/default.htm](http://www.memun.org/RMS/LC/default.htm).

Maine Safety Works! Sample Lockout Program (29 CFR 1910.147) @ [http://www.safetyworksmaine.com/safe\\_workplace/sample\\_programs/loto.html](http://www.safetyworksmaine.com/safe_workplace/sample_programs/loto.html)

USDOL OSHA's Lockout Page, Including the 1910.147 Standard @ <http://www.osha.gov/SLTC/controlhazardousenergy/index.html>

NIOSH Machine Safety Page- *Includes alerts for several municipal type machinery hazards* @ <http://www.cdc.gov/niosh/injury/traumamc.html>

OSHA Lockout Fact Sheet located on OSHA's Website @ [http://www.osha.gov/OshDoc/data\\_General\\_Facts/factsheet-lockout-tagout.pdf](http://www.osha.gov/OshDoc/data_General_Facts/factsheet-lockout-tagout.pdf)

This information is intended to assist you in your loss control efforts. "Best Practices" are developed from available current information but may not address every possible cause of loss. We do not assume responsibility for the elimination of all hazards that could possibly cause accidents or losses. Adherence to these recommendations does not guarantee the fulfillment of your obligation under local, state, or federal laws.

## ATTACHMENT A

### Equipment Specific Lockout Procedure Form

Machine or Equipment \_\_\_\_\_

Location \_\_\_\_\_ I.D.# \_\_\_\_\_

Date Implemented \_\_\_\_/\_\_\_\_/\_\_\_\_

1. Affected employees to be notified:
2. Shutdown Procedure:
3. Isolation:

Energy Type/ Magnitude	Isolating Device	Location	Procedure

4. Blocking of Potential Mechanical Energy:

Hazard	Equipment Needed	Placement

5. Bleed Down of Potential Energy:

Energy	Bleed Down Point	Procedure

6. Verification/Zero Energy Test

Control(s) to try	Procedure to verify isolation

**RETURN ALL CONTROLS TO “STOP” OR “OFF” POSITION AFTER TESTING!**

**ATTACHMENT B (Page 1 of 3)**  
**Equipment Specific Lockout Procedure**

**Example #1 Waste Water Treatment Pump**

Machine or Equipment: #3 Effluent Pump

Location: Basement I.D.# \_\_\_\_\_

Date Implemented 3 / 01 / 05

1. Affected employees to be notified:  
Plant Operator and any other personnel working in area.
2. Shutdown Procedure:  
Push "STOP" button on Control Room Panel.
3. Isolation:

Energy Type/ Magnitude	Isolating Device	Location	Procedure
440 volt electrical	Breaker C-5	MCC 1 <sup>st</sup> floor	Turn "Off" and lock.
Effluent Flow 8 PSI	Inlet Valve	Right of pump	Close, chain, and lock.
Effluent Flow 14 PSI	Discharge valve	Left of pump	Close, chain, and lock.

4. Blocking of Potential Mechanical Energy:

Hazard	Equipment Needed	Placement
None.		

5. Bleed Down of Potential Energy:

Energy	Bleed Down Point	Procedure
Effluent	Drain cock on volute.	Open and drain.

6. Verification/Zero Energy Test

Control(s) to try	Procedure to verify isolation
Local Start/Stop Control	Push "Start".

**RETURN ALL CONTROLS TO "STOP" OR "OFF" POSITION AFTER TESTING!**

**ATTACHMENT B (Page 2 of 3)**  
**Equipment Specific Lockout Procedure**

**Example #2 Maintenance Work on Dump Truck**

Machine or Equipment: All Fleet Dump Trucks

Location: Any I.D.# \_\_\_\_\_

Date Implemented 3 / 01 / 05

1. Affected employees to be notified:  
Any in area. Hang "Out of Service" tag on driver door.
2. Shutdown Procedure:  
Pull engine stop, key "Off".
4. Isolation:

Energy Type/ Magnitude	Isolating Device	Location	Procedure
Mechanical (Startup)	Ignition key	Cab	Remove key, place in a lockbox and apply personal locks/tags to lockbox. Place "Out of Service" tag.

4. Blocking of Potential Mechanical Energy:

Hazard	Equipment Needed	Placement
Roll away	Wheel chocks	Set maxi brake and/or chock wheels.
Falling body	Jacking gear or jack stands	If body is raised, then securely block it with the attached jacking gear or 2 heavy-duty jack stands.

5. Bleed Down of Potential Energy:

Energy	Bleed Down Point	Procedure
Electrical	Positive battery terminal	If working on the electrical system, then remove the positive terminal and place in plug cup and apply personal lock(s)/tag(s).
Hydraulic	Bleed valves.	Bleed hydraulic lines before disconnecting.

6. Verification/Zero Energy Test

Control(s) to try	Procedure to verify isolation
None.	

**RETURN ALL CONTROLS TO "STOP" OR "OFF" POSITION AFTER TESTING!**

**ATTACHMENT B (Page 3 of 3)**  
**Equipment Specific Lockout Procedure**

**Example #3 Maintenance Work on Loaders**

Machine or Equipment: All Fleet Loaders

Location: Any I.D.# \_\_\_\_\_

Date Implemented 3 / 01 / 05

1. Affected employees to be notified:  
     Any in area. Hang "Out of Service" tag on cab door.
2. Shutdown Procedure:  
     Pull engine stop, key "Off".

3. Isolation:

Energy Type/ Magnitude	Isolating Device	Location	Procedure
Mechanical (Startup)	Ignition key	Cab	Remove key, place in a lockbox, and apply personal locks/tags to lockbox.

4. Blocking of Potential Mechanical Energy:

Hazard	Equipment Needed	Placement
Roll away	None.	Set maxi brake.
Falling bucket/ attachments		Lower to floor.
		If boom/bucket must be raised for maintenance, hydraulic locking valves must be engaged AND boom supported by jack stands, cribbing, or blocking sleeves.

5. Bleed Down of Potential Energy:

Energy	Bleed Down Point	Procedure
Hydraulic	Bleed valves.	Bleed hydraulic lines before disconnecting.
Electrical	Positive battery terminal	If working on the electrical system, remove the positive terminal, place the plug cup and apply personal lock(s)/tag(s).

6. Verification/Zero Energy Test

Control(s) to try	Procedure to verify isolation
None.	

**RETURN ALL CONTROLS TO "STOP" OR "OFF" POSITION AFTER TESTING!**

ATTACHMENT C (Page 1 of 2)  
Example Program Evaluation Form

Date \_\_\_\_/\_\_\_\_/\_\_\_\_ Machine/Equipment \_\_\_\_\_

Work Being Performed \_\_\_\_\_

Authorized Employees Conducting Work \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Authorized Employees Inspecting \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**(Explain all "N" and "N/A" answers)**

1. Are all employees conducting work on the equipment trained as "Authorized Employees" under the lockout program?  Y  N  N/A  
Notes:
2. Were all Affected Employees effectively notified before lockout?  Y  N  N/A  
Notes:
3. Can the Authorized Employees identify all hazardous energy sources for the equipment?  Y  N  N/A  
Notes:
4. Was the written lockout procedure used and followed?  Y  N  N/A  
Notes:
5. Were all energy isolation points locked out by all employees working on the equipment?  Y  N  N/A  
Notes:
6. Were all blocking and bleed down steps completed?  Y  N  N/A  
Notes:
7. Was a "zero energy test" conducted to ensure isolation?  Y  N  N/A  
Notes:
8. Are all locks, tags and other lockout devices of types approved by the lockout program?  Y  N  N/A  
Notes:

ATTACHMENT C (Page 2 of 2)  
Example Program Evaluation Form

Recommendations:	
Action:	Person Responsible
Action:	Person Responsible:
Action:	Person Responsible
Distribution:	