

Protect workers from hazardous energy during servicing and maintenance

Lockout/Tagout helps protect workers from serious accidents that can result in injury.



Energy sources including electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other sources in machines and equipment can cause serious injury and death to workers if not controlled during servicing and maintenance. In fact, according to the Occupational Safety and Health Administration (OSHA), failure to control hazardous energy accounts for nearly 10 percent of the serious accidents in many industries¹—injuries that may include electrocution, burns, crushing, cuts, amputations and more.

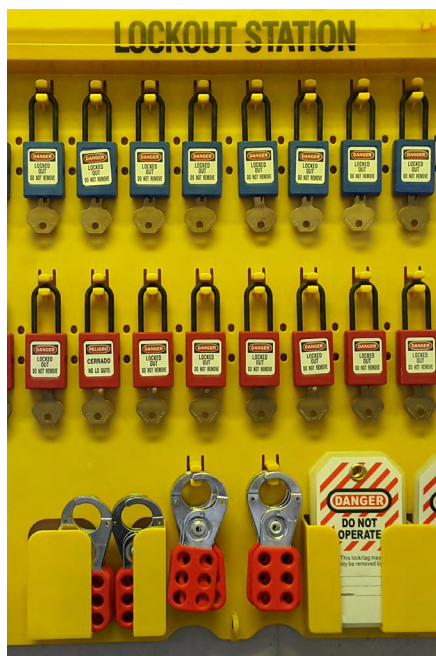
OSHA developed standard 1910.147 *The Control of Hazardous Energy (Lockout/Tagout)* to protect workers during servicing and maintenance operations, which prevents an estimated 120 fatalities and 50,000 workplace injuries each year.² Although certain workers such as maintenance personnel and equipment operators have the greatest risk, many workers—even those who only work in an area where lockout/tagout is being performed—should know of the hazards of energy and methods of ensuring their safety.

For Industry specific workplace controls associated with construction, agriculture, maritime industry, oil and gas well drilling or service, and others research the appropriate standards.



¹ "Control of Hazardous Energy (Lockout/Tagout)," U.S. Department of Labor, osha.gov/SLTC/controlhazardousenergy/ (downloaded Mar. 15, 2019).

² "Lockout/Tagout OSHA Fact Sheet," U.S. Department of Labor, osha.gov/OshDoc/data_General_Facts/factsheet-lockout-tagout.pdf



Employers should always use lockout devices when possible.

What is lockout/tagout?

As the name indicates, lockout/tagout (LOTO) is a two-step process:

1. **Lockout**— The securing of an energy isolating device (such as a switch, valve, blank or block) by a lock that is controlled by the exposed worker to physically prevent the flow of energy from the power source to the noted piece of equipment for the duration of service. For example, a lock may be placed on an electrical disconnect switch to keep a machine from being electrically energized.
2. **Tagout**— The placement of a tag on the lockout device that communicates the lockout status and warns others not to re-energize the equipment. For example, in the case above, a tag may be placed on the disconnect indicating the nature of the shutdown, who is involved, and not to remove the lock.

Why LOTO is a critical safety process.

Although OSHA provisions allow for the use of a tagout-only system under certain conditions, employers should always use lockout devices when possible, as these afford a greater level of protection. Further, any new equipment that is purchased or existing equipment that is modified or renovated should be equipped with energy isolating devices that are compatible with lockout devices.

The LOTO standard works closely with OSHA's machine safeguarding requirements for normal production operations. OSHA requires that workers doing service or maintenance activities during normal production operations must follow LOTO procedures whenever an employee is required to:

- Remove or bypass a guard or other safety device
- Place any part of his or her body in the point of operation or where an associated danger exists during the machine's operating cycle

However, the hazardous results of failing to properly use LOTO go beyond when guards must be removed. Consider the injuries that may occur if energy is not properly controlled in a system:

- A compressed air valve is automatically turned on, creating an air blast that causes an employee to fall from a stepladder

- A jammed conveyor suddenly releases, crushing a worker who is trying to clear the jam
- Internal wiring on a piece of factory equipment electrically shorts, shocking a worker who is repairing a mechanical component on the equipment

It is important to remember that separate LOTO and testing procedures are required for electrical work that may expose an employee to electrical shock from work on, near or with electrical conductors or circuits within equipment. This type of work is covered by OSHA’s Electrical Safety-Related Work Practices (ESRWP) standard at 1910.333. The major difference between the two standards is the methods for verifying a de-energized state.

Create a written energy control program.

Each business where hazardous energy sources are present should develop an energy control program that matches the hazards of the workplace and the types of machines and equipment being maintained or serviced. Although each energy control program may be slightly different, common components of written programs include: company policies regarding when LOTO is required; responsibilities of management, supervisors, and other personnel; employee training; and procedures for periodic evaluations of the program.

Equipment-specific procedures are essential to worker safety.

While providing a written energy control procedure with the general steps for LOTO may be allowed under certain conditions in the OSHA standard, developing an equipment-specific energy control procedure for each piece of equipment is a best practice recommendation. To do so, visit each machine or equipment in the facility and document the following:

- **Name of machine or equipment**— Use the name assigned by the manufacturer or how it is known within the facility, such as “Power Press #4.”
- **Method for machine shutdown**— Record the normal shutdown procedure for the machine, such as turning the switch to the OFF position.

Tools to assist your program.

Nationwide Loss Control Services also offers an LOTO Equipment Assessment form (CMO-00944AO.1). Use it to visit each piece of machinery or equipment in your facility and document the energy control procedure.





Develop a specific energy control procedure for each piece of equipment to ensure employee safety.

- **Energy sources present** — Determine the energy sources present. While electricity is a common energy source, don't forget to consider pneumatic, hydraulic, water/gas/steam, gravity, thermal (hot or cold), chemicals and other types, including stored energy.
- **Magnitude of energy** — Document the magnitude of the energy for each source identified, such as 240-volt electricity and 100-psi air pressure. Repeat for all energy sources.
- **Method for releasing stored energy** — Decide the proper method to dissipate the energy before work begins, to ensure the machine has reached a zero-energy state if the machine has the potential for stored energy. For example, before working on an air compressor, stored energy is often dissipated by opening a valve until the pressure gauge reads 0 psi.
- **Procedure to isolate each energy source** — Choose how you will isolate each energy source so it does not become re-energized during maintenance. For example, an electrically-powered machine may require turning the disconnect switch to the OFF position and applying a lock that will prevent it from being turned back on. A machine with steam under pressure may require closing of upstream/downstream valves and restraining the valves with chains and locks. Many different lockout devices are available from a variety of manufacturers. When documenting the energy isolation procedure, take photos to assist users in completing the lockout process.
- **Method to determine if energy isolation was successful** — Test equipment prior to beginning service to ensure that it will remain at a zero-energy state for the duration of the work. Determine how the equipment should be tested to ensure that lockout was successful, such as pressing the START button and ensuring the machine does not operate. Also document in the procedure that the equipment should be turned back off following the test so that the machine does not start up following the removal of the lockout device and restoration of energy.

Review an example of written procedures.

Following the energy source assessment, photos and information should be assembled into a written procedure, such as the example on these two pages. When complete, the energy control procedure should be readily available for use when needed. It is common to laminate the procedure and place it directly on the machine/equipment, ensuring it is available at the point of use.

General Manufacturing Co. Lockout Procedure

Approved by: **Michelle Jones, Safety Office**

Equipment: **Air Compressor**

Revision Date: **8/31/2018**

1 Compressor



2 On/Off Switch



3 Electrical Disconnect



4 Air Valves



Required Energy Control Procedure

1. The following hazardous energy sources are present:
 - a. Electrical: 480 volts
 - b. Air: 117 psi (max)
2. Notify foreman and other employees that may work on/near the machine that it is being shut down and locked out.
3. Shut down the machine by pressing the OFF button (see photo 2).
4. Isolate all energy sources:
 - a. Electrical: move disconnect single throw safety switch to OFF position (see photo 3). Apply lock and tag to switch.
 - b. Air: turn air valves 001 and 003 (see photo 4) off (90 degrees to pipe) to isolate the compressor from the overflow tank. Apply valve device covers with lock and tag.
5. Verify that the machine is locked out by pulling out the ON button and verify there is no unwanted compressed air. The machine should not start. If it does, return to Step 4 and verify proper disconnect switch was moved to OFF. After verifying, return button to OFF position and that the equipment is now de-energized prior to beginning work on equipment.
6. The machine is now locked out and work can begin.

Restoring Machine to Use

1. Check the machine to make sure it has been restored to its pre-service condition, all tools are removed, guards replaced, etc.
2. Ensure that all workers are safely positioned away from the machine.
3. Notify foreman and other employees that work is complete, and the machine is about to be placed back into service.
4. Verify that the compressor is in the OFF position.
5. Restore energy to the machine:
 - a. Electrical: remove lock(s) and tag(s) from disconnect and move the single throw safety switch to ON position.
 - b. Air: remove valve covers and return valves to desired flow position.

Train workers on your program accordingly.

The written energy control program forms the basis of employee training and communication. Training should be designed so that employees obtain the knowledge and skills required for the safe application, use and removal of energy control devices. LOTO training should be completed at three different levels, based on the extent of involvement in the process:

1. **Authorized employees** are those who lock out and tag out machines or equipment to perform servicing or maintenance. Often, authorized employees are maintenance personnel or machine operators. Each authorized employee should receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control. Reviewing the energy control program and several machine-specific procedures is often part of training for authorized employees.
2. **Affected employees** are those who operate, use or work in an area with machinery or equipment that is subject to service or maintenance being performed under lockout or tagout. An affected employee is often a machine operator that runs a machine but does not perform any setup or maintenance on that machine. Affected employee training typically includes being instructed on the purpose of LOTO, its importance and not to attempt to work on equipment that is locked and tagged out.
3. **All other employees** whose work operations may be in an area where energy control procedures are used should be trained similarly to affected employees, such as a brief instruction about the procedure and to keep away from machines and equipment which are locked or tagged out.

Holding LOTO refresher training annually can help ensure its importance is understood by all employees. It should also occur when:

- There is a change in job assignments (e.g., an affected employee transitions into an authorized employee), a change in machines, equipment or processes that present a new hazard, or when there is a change in the energy control procedures.
- A periodic program inspection reveals, or the employer believes, that employees are not following the established energy control procedures.

All training should be documented and include employee names, trainer names, dates of training and material covered. The documentation should be retained indefinitely.



Authorized employees are often maintenance personnel or machine operators.

Perform annual program audits.

The development of an LOTO program and machine-specific procedures is certainly a significant, but important, undertaking. To ensure the continued success of the program, OSHA requires that it be audited annually. This audit should:

- Be performed by an authorized employee who is knowledgeable in the required procedures but not involved while it is being audited.
- Aim to correct any deviations between desired and actual performance. Included in this step is typically a review of machine-specific procedures for a variety of machines with different energy sources, to ensure that the procedures are accurate and followed by employees using them.

Annual program inspections should be documented and include the machines or equipment audited, the date of the inspection, the employees included in the inspection and the person performing the inspection.

Apply LOTO in special circumstances.

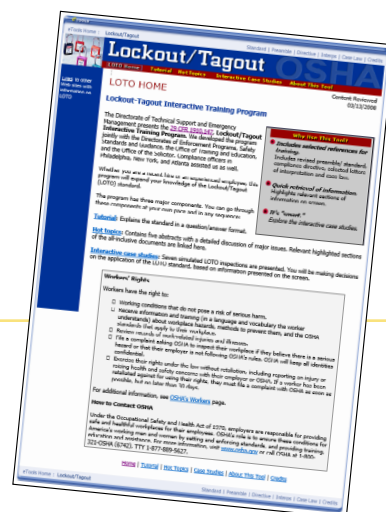
Several instances require special attention regarding LOTO, including:

- **Outside personnel**—If outside servicing personnel, such as hired contractors, will be involved in servicing and maintenance activities, the on-site employer and the contractor should discuss their respective LOTO procedures before work begins. Both parties should agree to follow the procedures that ensure safety for all those involved in the project.
- **Group lockout or tagout**—When servicing and/or maintenance is performed by more than one person, a crew leader should be assigned who is responsible for the project. A key component of group LOTO is that each employee involved should place his/her own lock on a hasp or similar device to ensure that the lockout remains intact until all employees have removed their individual locks.
- **Shift or personnel changes**—Often, machine/equipment maintenance extends beyond a single shift. If the work is handed off to a different crew, locks should be removed and replaced immediately between the incoming and outgoing workers to ensure continuous protection. If work will restart at the next shift by the same outgoing crew, lockout should be maintained during the crew's time away from the facility.

Look to OSHA for additional resources.

To review OSHA guidelines and access additional materials on hazardous energy control, go to [osha.gov/SLTC/controlhazardousenergy/](https://www.osha-slc.com/) where a variety of fact sheets, training materials and other resources are available.

Sample written programs can be found at [osha.gov/SLTC/controlhazardousenergy/program.html](https://www.osha-slc.com/program.html).



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