

Control of Hazardous Energy Sources (Lockout/Tagout)

Lockout/tagout is a process by which a piece of equipment is secured against accidental energization during repairs or maintenance. Lockout/tagout procedures are designed to ensure energy sources are maintained in a “zero mechanical state” before and during repair or maintenance work on a piece of equipment or machinery. When working on equipment or machinery that is designed to move or has moving parts, it is important to recognize and control all possible energy sources: electrical, pneumatic, hydraulic, mechanical, chemical, thermal and stationary energy sources.

Serious injuries may result from failing to de-energize equipment or machinery prior to working on it. Workers could be shocked or electrocuted from energized electrical circuits; fingers, hands or limbs may be drawn into machine parts when pulleys, belts or shafts are moving; crushing and lacerating injuries may result from pneumatic, hydraulic or stationary (like springs or weights) energy that is not neutralized.

Lockout/Tagout

Although the Occupational Safety and Health Administration (OSHA) addresses lockout/tagout in its General Industry Standards, 29 CFR 1910.147, it does not have a specific subpart for lockout/tagout procedures in the construction industry. The exceptions are the locking and tagging of circuits, addressed in Subpart K, Electricity, and procedures for lockout/tagout in concrete operations under Subpart Q, Concrete and Masonry Construction. Neither standard applies directly to roofing operations unless a company has sheet metal shop operations, in which case 29 CFR 1910.147 applies.

Notwithstanding the lack of a construction-specific standard, adhering to the basic principles and procedures related to lockout/tagout set out in the general industry standards certainly is prudent. Accordingly, there are some general guidelines that should be followed when working or servicing any piece of equipment. These guidelines are:

- *Identify the equipment or machinery that may require energy control.*
- *Identify the forms of energy involved.*
- *List, step by step, the process for shutting down and placing the equipment or machinery in a zero mechanical state and for testing to ensure the effectiveness of the lockout operation.*

- *Choose substantial locking devices and clearly identify them by color-coding and/or personal identification tags; ensure only the employee in control of the lock has the key.*
- *Train and authorize employees to place lockout devices and inform all personnel about the lockout program.*
- *Establish procedures for maintaining the continuity of lockout during shift change.*
- *Make clear the need for each person working on a piece of equipment or machinery to install his or her lock; a multilock hasp should be used if necessary.*
- *Require the following anytime an employee's lock must be removed when he or she is not present: management or supervisor authorization; written documentation of the reason for removing the lock; and documentation of all efforts to contact and notify the employee about the procedure.*

Lockout/tagout is to ensure anyone servicing equipment is protected against energy-source hazards. Controlling energy sources on roofing projects is generally simple because most mechanized roofing equipment consists of power tools with energy sources that can be controlled by unplugging the tool from the wall and making sure it will not get plugged in accidentally. However, some roofing equipment also may have stored energy in the form of compressed air, pressurized hydraulic fluid, spring- or weight-tensioning energy, or heat energy that must be neutralized and locked out on occasion.

With a sheet metal shop, as previously mentioned, OSHA's general industry rules are applicable. This means that the complete set of rules and regulations in the general industry standard applies and a written lockout/tagout program must be established and maintained. A sample written program is included at the end of this chapter to help develop a company program.

The Written Program

The written program must address the following issues:

- *Employee training*
- *Identification and evaluation of energy sources*
- *Types of lockout devices, along with their use and installation*
- *Procedures for verifying the effectiveness of lockout application*
- *Steps for removing lockout devices*
- *Procedures for shift changes*

Training

All employees involved with lockout/tagout must be trained. The standard sets out three training aspects of a lockout/tagout program:

- 1. Training authorized employees to recognize applicable hazardous energy sources. An authorized employee is a person who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment.*
- 2. Training affected employees about the purpose and use of the energy-control procedure. An affected employee is a person whose job requires him or her to operate or use a machine or piece of equipment on which service or maintenance is being performed under lockout/tagout or whose job requires him or her to be in an area where the service or maintenance is being performed.*
- 3. Training of employees whose work operations are or may be in the area where energy control operations are taking place must include the procedure and prohibition on attempting to restart or re-energize equipment or machines that are locked or tagged out.*

Employee retraining is required for authorized and affected employees when there is a change in their job assignments, machines, equipment or processes that present new hazards or when there are new energy-control procedures. Retraining may also be required when an employer has reason to believe there are deviations or deficiencies in an employee's knowledge or use of energy-control devices.

Identifying and Controlling Hazardous Energy Sources

Lists provided at the end of this chapter can be used to complete the following procedures.

The first step in lockout/tagout is to determine and write down the energy source for the specific equipment. Many pieces of equipment have more than one energy source. For example, hydraulic or pneumatic presses have two energy sources: the electricity that runs the hydraulic or pneumatic pump and the stored pressure within the system. Then, the magnitude of power of each energy source must be determined and documented. For example, for a pneumatically driven press powered by electricity, the voltage of the electricity and pounds per square inch (psi) rating of the pneumatic or hydraulic system would be written down.

Controlling the energy sources is the next step in the process. First, how to isolate and remove the equipment from any outside energy source must be determined. For instance, circuit breakers or switches can be used to disconnect the equipment from its source of electricity. Then, pressure that may be built up in the equipment systems must be relieved. Before bleeding down, or relieving pressure from a system, the areas should be cleared of debris, materials and people. The press and all other components that may be in upright positions should be blocked so they won't fall, or they should be brought down to a relaxed position.

It is a good idea to list the steps for shutting down a piece of equipment so it can be referred to each time the machine needs servicing.

Lock vs. Tag

There are three allowable options for lockout/tagout: a lock alone, a tag alone (if it is not possible to install a lock) or, preferably, a lock and tag together. Locks alone create a safe situation but offer no explanation for the lockout. Although tags alone are permitted because some machines cannot be locked out, this is OSHA's least favorite method because it offers less of a guarantee for safety. Locks and tags together provide a visual and written explanation for lockouts while offering fail-safe protection from error.

If a tag is used alone, it must be demonstrated in the program that the tag offers the same level of employee protection as a lock and tag together. Additional training when only a tag is used is required because tags don't offer the same physical restraint as locks and employees must understand this. Although switches still can be activated, it is a safety hazard and a violation of the regulations and company policy to activate switches. Tagout devices must warn against a hazardous condition with a warning such as:

"Do Not Start"

"Do Not Open"

"Do Not Close"

"Do Not Energize"

"Do Not Operate"

Locks

Although the installation of equipment-specific lockout devices is generally a simple matter, the cost can be prohibitive. Fortunately, OSHA doesn't require the purchase of specific lockout devices for each valve, switch or circuit; it requires only that the mechanism that controls the power to the machine be secured. If the power source can be secured with a chain or something as durable and difficult to defeat, it is acceptable to use such means.

Verification

With the lockout devices correctly in place and all power turned off, the equipment should be started by following the normal steps. If the equipment does not start up, the lockout is successfully completed. If the machine does start, the machine should be turned off and the lockout/tagout procedure repeated.

Removing Lockout Devices

The simplest way to unlock and restart equipment once maintenance work is completed is to reverse the steps followed to shut down the equipment. This may not be possible with all machines, however.

The first thing that always should be done is to replace all guards and protective devices that were on the machine originally. Then, all unnecessary objects must be removed and all unessential personnel asked to leave the area. Next, all employees involved should remove their own locks. No employee should remove another person's lock. When an authorized employee who applied a lockout device to a piece of equipment or machinery is not available to remove the device, the employer may remove the device provided that procedures and training for such a removal have been developed, documented and incorporated in the employers' lockout/tagout program.

Shift Changes

When maintenance work on a piece of equipment extends into the next shift, additional steps must be taken to maintain the continuity of the lockout procedure. Keys are not to be passed to employees on the next shift. Each person removes his or her lock while the employees on the next shift install theirs. Communication with incoming shift personnel should include an update about the status of the locked-out equipment. All procedures should be clearly defined.

Outside Contractors or Multiemployer Work Sites

If equipment repair is contracted out, lockout/tagout procedures should be explained to the contractor clearly. Employees should be kept informed of all equipment repair procedures that are taking place.

The same is true for multiemployer work sites. Communication among all groups involved to discuss lockout/tagout when it occurs is important. Employees must be trained about the company's policies and procedures.

Annual Review

A company's written program should be reviewed at least annually to make sure it is accurate and up-to-date. It also should be reviewed when equipment is replaced or other applicable changes are made to the workplace.

Sample Program

Hazardous Energy Source Control Program (Lockout/Tagout)

Purpose

This program establishes the minimum requirements for the control of hazardous energy sources. It should be used to ensure machinery and equipment are isolated from hazardous energy sources before service or maintenance is performed. By implementing the following procedures, the unexpected start-up or release of stored energy will be prevented.

Responsibility

Only authorized employees are permitted to apply the lockout devices and perform procedures for isolating equipment from its power sources. Authorized employees are workers trained to perform the lockout/tagout functions and isolate equipment from its energy sources and apply lockout devices. They must understand a "zero-mechanical state" and how to achieve it for every piece of equipment they control. All employees must be informed of the lockout/tagout of a machine or piece of equipment to prevent anyone from attempting to restart it.

Preparation for Lockout/Tagout

Project managers and shop foremen will be required to locate and identify all pieces of equipment requiring lockout/tagout procedures. Because equipment can have more than one energy source, the person conducting the survey must identify all energy sources and methods to control energy release, including all isolation devices. Examples of energy isolation devices are valves, disconnect switches and pressure relief valves.

Sequence of a Lockout/Tagout Procedure

The following are the steps to lockout/tagout equipment.

- 1. Notify all affected employees that service or maintenance is required on a piece of equipment, and it must be shut down and locked out before performing the service or maintenance. An affected employee is one who normally works on the machine that is being locked or tagged for service.*

This action also applies to employees who are working in the area of the locked/tagged piece of equipment.

- 2. Authorized employees are to refer to the company procedure to identify the type and magnitude of the energy that the machine uses, understand the hazards of the energy and know the methods to control the energy.*
- 3. If the equipment is operating, shut it down by the normal stopping procedure (depress stop button, open switch, close valve, etc.).*
- 4. De-activate the energy-isolating device(s) so the equipment is isolated from the energy source(s).*
- 5. Lockout/tagout the energy-isolating device(s) with assigned individual lock(s).*
- 6. Stored or residual energy (such as springs; elevated or suspended equipment parts; hydraulic systems; air, gas, steam or water pressure; electricity in capacitors; etc.) must be dissipated or restrained by methods such as grounding, repositioning, blocking or bleeding down.*
- 7. Be certain that all unnecessary personnel are removed from the area before the equipment is disconnected from the energy source(s). Verify the isolation of the equipment by attempting to restart the equipment under its normal operations. Remember to return operating control(s) to the neutral or "off" position after attempting to restart the equipment.*
- 8. At this point the equipment should be in locked-out condition.*

Restoring Equipment to Service

The following are procedures for restoring equipment to service:

- 1. Check the equipment and immediate area around the equipment to ensure nonessential items have been removed and equipment components are operationally intact.*
- 2. Check the work area to ensure all employees have been safely positioned or removed from the area.*
- 3. Verify the controls are in neutral.*
- 4. Remove the lockout device(s) and start the equipment. The removal of some forms of blocking may require starting the equipment before safe removal.*
- 5. Notify affected employees that the service or maintenance is completed and the equipment is ready for use.*

Procedure Involving More Than One Person

In the steps outlined in the previous section, one person should place his or her lock on each piece of an energy-isolating device. There may be occasions when more than one person needs to work on a piece of equipment. When this occurs, each person involved in the service or maintenance will be required to place his or her own lock on the energy-isolating device. A multi-hasps lock will be required if the energy-isolating

Lockout/Tagout Information Sheet

Personnel Authorized to Place Lockout/Tagout

<i>Employee Name</i>	<i>Title</i>	<i>Trained? Y/N</i>
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Equipment To Be Locked and Tagged During Maintenance and Service

<i>Equipment Name</i> <i>switch, valve, etc.)</i>	<i>Energy Type and Magnitude</i> <i>(e.g., hydraulic, ____ psi,</i> <i>electrical, ____ volts)</i>	<i>Isolation Device</i> <i>(disconnect</i>
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Note: Make copies of this form for each employee and additional copies for future use.

Certificate of Training

_____ has been trained in
(Employee Name)

accordance with the requirements of 29 CFR 1910.147, Control of Hazardous Energy Sources, Lockout/Tagout. The training was conducted on _____ . Retraining will be
(Date of Training)

provided if one or more of the following conditions arise:

1. A change in equipment, processes or job assignments has been made.
2. It is determined through inspections made by

(Company Name)

that deviations from the established procedures have occurred.

3. The employee's proficiency needs to be re-established or updated.

Employee Signature

Trainer's Signature

Date

Date

Note: Make copies of this form for each employee and additional copies for future use.