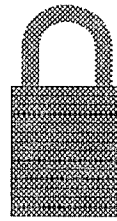




CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

INTRODUCTION

On September 1, 1989, OSHA issued a final rule on the Control of Hazardous Energy (Lockout/Tagout) in Volume 29 of the *Code of Federal Regulations* (29 CFR), Section 1910.147. This standard, which went into effect on January 2, 1990, helps safeguard employees from hazardous energy while they are performing service or maintenance on machines and equipment. The standard



identifies the practices and procedures necessary to shut down and lock out or tag out machines and equipment, requires that employees receive training in their role in the lockout/tagout program, and mandates that periodic inspections be conducted to maintain or enhance the energy control program.

In the early 1970's, OSHA adopted various lockout-related provisions of the then existing national consensus standards and Federal standards that were developed for specific types of equipment or industries. When the existing standards require lockout, the new rule supplements these existing standards¹ by requiring the development and utilization of written procedures, the training

¹ The following OSHA standards currently contain lockout/tagout related requirements: 1910.178 - Powered Industrial Trucks; 1910.179 - Overhead and Gantry Cranes; 1910.181 - Derricks; 1910.213 - Woodworking Machinery; 1910.217-Mechanical Power Presses; 1910.218 - Forging Machines; 1910.252 - Welding, Cutting and Brazing; 1910.262 - Textiles; 1910.263 - Bakery Equipment; 1910.265 - Sawmills; 1910.272 - Grain Handling; and 1910.305 - Electrical.



of employees, and periodic inspections of the use of the procedures. OSHA has determined that lockout is a more reliable means of de-energizing equipment than tagout and that it should always be the preferred method used by employees. The Agency believes that, except for limited situations, the use of lockout devices will provide a more secure and more effective means of protecting employees from the unexpected release of hazardous energy or start-up of machines and equipment.

This new rule requires that, in general, before service or maintenance is performed on machinery or equipment, the machinery or equipment must be turned off and disconnected from the energy source, and the energy-isolating device must be either locked or tagged out. OSHA estimates that adherence to the requirements of this standard can eliminate nearly 2% of all workplace deaths in establishments affected by this rule and can have a significant impact on worker safety and health in the U.S.

Approximately 39 million workers will be protected by this new rule. (The million workers who actually service equipment - i.e., craft workers, machine operators, and laborers - face the greatest risk.) OSHA estimates that compliance with the standard will prevent about 122 fatalities, 28,400 lost workday injuries, and 31,900 non-lost workday injuries each year.

SCOPE AND APPLICATION

The lockout/tagout standard applies to general industry employment and covers the servicing and maintenance of machines and equipment in which the unexpected start-up or the release of stored energy could cause injury to employees. (If employees are performing service or maintenance tasks that do not expose them to the unexpected release of hazardous energy, the standard does not apply.)



The standard establishes minimum performance requirements for the control of hazardous energy.

The standard does not apply in the following situations:

- while servicing or maintaining cord and plug connected electrical equipment. (The hazards must be controlled by unplugging the equipment from the energy source; the plug must be under the exclusive control of the employee performing the service and/or maintenance.)
- during hot tap operations that involve transmission and distribution systems for gas, steam, water, or petroleum products when they are performed on pressurized pipelines; when continuity of service is essential, and shutdown of the system is impractical; and employees are provided with an alternative type of protection that is equally effective.

NORMAL PRODUCTION OPERATIONS

OSHA recognizes that machines and equipment present many hazardous situations during normal production operations - i.e., whenever machines and equipment are used to perform their usual production function. These production hazards are covered by rules in other General Industry Standards, such as the requirements in Subpart O of Part 1910 for general machine guarding and guarding power transmission apparatus (1910.212 and 1910.219). In certain circumstances, however, some hazards encountered during normal production operations may be covered by the lockout/tagout rule. The following paragraphs illustrate some of these instances.



Servicing and/or Maintenance Operations

If a servicing activity - such as lubricating, cleaning, or unjamming the production equipment - takes place during production, the employee performing the servicing may be subjected to hazards that are not encountered as part of the production operation itself. Workers engaged in these operations are covered by lockout/tagout when any of the following conditions occurs:

- The employee must either remove or bypass machine guards or other safety devices, resulting in exposure to hazards at the point of operation;
- The employee is required to place any part of his or her body in contact with the point of operation of the operational machine or piece of equipment; or
- The employee is required to place any part of his or her body into a danger zone associated with a machine operating cycle.

In the above situations, the equipment must be de-energized and locks or tags must be applied to the energy-isolation devices.

In addition, when normal servicing tasks - such as setting equipment up, and/or making significant adjustments to machines - do not occur during normal production operations, employees performing such tasks are required to lock out or tag out if they can be injured by unexpected energization of the equipment.

OSHA also recognizes that some servicing operations must be performed with the power on. Making many types of fine adjustments, such as centering the belt on conveyors, is one example. Certain aspects of troubleshooting, such as identifying the source of the problem as well as checking to ensure that it has



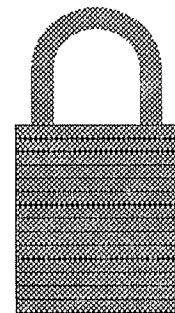
been corrected, is another. OSHA requires the employer to provide effective protection for employees performing such operations. Although, in these cases, a power-on condition is essential either to accomplish the particular type of servicing or to verify that it was performed properly, lockout or tagout procedures are required when servicing or maintenance occurs with the power off.

Minor Servicing Tasks

Employees performing **minor** tool changes and adjustments and/or other **minor** service activities *during normal production operations* that are **routine**, **repetitive**, and **integral** to the use of the production equipment are not covered by the lockout/tagout standard, provided the work is performed using alternative measures that give effective protection.

PROVISIONS OF THE STANDARD

The standard requires employers to establish procedures for isolating machines or equipment from the input of energy and affixing appropriate locks or tags to energy-isolating devices to prevent any unexpected energization, start-up, or release of stored energy that would injure workers. When tags are used on energy-isolating devices capable of being locked out, the employer must provide additional means to assure a level of protection equivalent to that of locks. The standard also requires the training of employees, and periodic inspections of the procedures to maintain or improve their effectiveness.



Energy Control Program

The lockout/tagout rule requires that the employer establish an energy control



program that includes (1) documented energy control procedures, (2) an employee training program, and (3) periodic inspections of the procedures. The standard requires employers to establish a program to ensure that machines and equipment are isolated and inoperative before any employee performs service or maintenance where the unexpected energization, start up, or release of stored energy could occur and cause injury.

The purpose of the energy control program is to ensure that, whenever the possibility of unexpected machine or equipment start-up exists or when the unexpected release of stored energy could occur and cause injury, the equipment is isolated from its energy source(s) and rendered inoperative prior to servicing or maintenance.

Employers have the flexibility to develop a program and procedures that meet the needs of their particular workplace and the particular types of machines and equipment being maintained or serviced.

Energy Control Procedure

This standard requires that energy control procedures be developed, documented, and used to control potentially hazardous energy sources whenever workers perform activities covered by the standard.

The written procedures must identify the information that authorized² employees must know in order to control hazardous energy during service or maintenance. If this information is the same for various machines or equipment or if other means of logical grouping exists, then a single energy control procedure may be sufficient. If there are other conditions - such as multiple energy sources, different connecting means, or a particular sequence that must

² See section on "Employee Training."



be followed to shut down the machine or equipment - then the employer must develop separate energy control procedures to protect employees.

The energy control procedure must outline the scope, purpose, authorization, rules and techniques that will be used to control hazardous energy sources as well as the means that will be used to enforce compliance. At a minimum, it includes, but is not limited to, the following elements:

- a statement on how the procedure will be used;
- the procedural steps needed to shut down, isolate, block, and secure machines or equipment;
- the steps designating the safe placement, removal, and transfer of lockout/tagout devices and who has the responsibility for them; and
- the specific requirements for testing machines or equipment to determine and verify the effectiveness of locks, tags, and other energy control measures.

The procedure must include the following steps: (1) preparing for shutdown, (2) shutting down the machine(s) or equipment, (3) isolating the machine or equipment from the energy source(s), (4) applying the lockout or tagout device(s) to the energy-isolating device(s), (5) safely releasing all potentially hazardous stored or residual energy, and (6) verifying the isolation of the machine(s) or equipment prior to the start of service or maintenance work.

In addition, before lockout or tagout devices are removed and energy is restored to the machines or equipment, certain steps must be taken to re-energize equipment after service is completed, including: (1) assuring that machines or equipment components are operationally intact; (2) notifying affected employees



that lockout or tagout devices are removed from each energy-isolating device by the employee who applied the device. (See sections 6(e) and 6(f) of 29 CFR 1910.147 for specific requirements of the standard.)

Energy-Isolating Devices

The employer's primary tool for providing protection under the standard is the energy-isolating device, which is the mechanism that prevents the transmission or release of energy and to which all locks or tags are attached. (See glossary for a more complete definition.) This device guards against accidental machine or equipment start-up or the unexpected re-energization of equipment during servicing or maintenance. There are two types of energy-isolating devices: those capable of being locked and those that are not. The standard differentiates between the existence of these two conditions and the employer and employee responsibilities in each case.

When the energy-isolating device cannot be locked out, the employer must use tagout. Of course, the employer may choose to modify or replace the device to make it capable of being locked. When using tagout, the employer must comply with all tagout-related provisions of the standard and, in addition to the normal training required for all employees, must train his or her employees in the following limitations of tags:



- Tags are essentially warning devices affixed to energy-isolating devices and do not provide the physical restraint of a lock.
- When a tag is attached to an isolating means, it is not to be removed except by the person who applied it, and it is never to be bypassed, ignored, or otherwise defeated.



- Tags must be legible and understandable by all employees.
- Tags and their means of attachment must be made of materials that will withstand the environmental conditions encountered in the workplace.
- Tags may evoke a false sense of security. They are only one part of an overall energy control program.
- Tags must be securely attached to the energy-isolating devices so that they cannot be detached accidentally during use.

If the energy-isolating device is lockable, the employer shall use locks unless he or she can prove that the use of tags would provide protection at least as effective as locks and would assure "full employee protection."

Full employee protection includes complying with all tagout related provisions plus implementing additional safety measures that can provide the level of safety equivalent to that obtained by using lockout. This might include removing and isolating a circuit element, blocking a controlling switch, opening an extra disconnecting device, or removing a valve handle to reduce the potential for any inadvertent energization.

Although OSHA acknowledges the existence of energy-isolating devices that cannot be locked out, the standard clearly states that whenever major replacement, repair, renovation or modification of machines or equipment is performed and whenever new machines or equipment are installed, the employer must ensure that the energy-isolating devices for such machines or equipment are lockable. Such modifications and/or new purchases are most effectively and efficiently made as part of the normal equipment replacement cycle. All newly purchased equipment must be lockable.



Requirements for Lockout/Tagout Devices

When attached to an energy-isolating device, both lockout and tagout devices are tools that the employer can use in accordance with the requirements of the standard to help protect employees from hazardous energy. The lockout device provides protection by holding the energy-isolating device in the safe position, thus preventing the machine or equipment from becoming energized. The tagout device does so by identifying the energy-isolating device as a source of potential danger; it indicates that the energy-isolating device and the equipment being controlled may not be operated until the tagout device is removed. Whichever devices are used, they must be singularly identified, must be the *only* devices used for controlling hazardous energy, and must meet the following requirements:

- **Durable** - *Lockout* and *tagout* devices must withstand the environment to which they are exposed for the maximum duration of the expected exposure. *Tagout* devices must be constructed and printed so that they do not deteriorate or become illegible, especially when used in corrosive (acid and alkali chemicals) or wet environments.
- **Standardized** - Both *lockout* and *tagout* devices must be standardized according to either **color, shape, or size**. *Tagout* devices must also be standardized according to **print and format**.
- **Substantial** - *Lockout* and *tagout* devices must be substantial enough to minimize early or accidental removal. *Locks* must be substantial to prevent removal except by excessive force of special tools such as bolt cutters or other metal cutting tools. *Tag means of attachment* must be non-reusable, attachable by hand, self-locking and non-releasable, with a minimum unlocking strength of no less than 50 pounds.

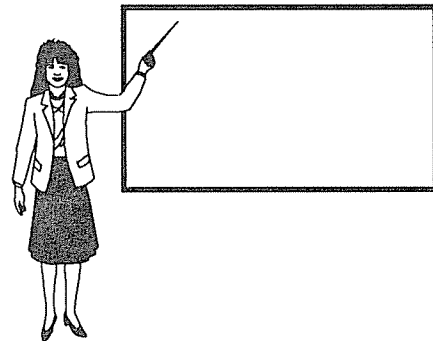


The device for attaching the tag also must have the general design and basic characteristics equivalent to a one-piece nylon cable tie that will withstand all environments and conditions.

- **Identifiable** - *Locks* and *tags* must clearly identify the employee who applies them. *Tags* must also warn against hazardous conditions if the machine or equipment is energized and must include a legend such as the following: **DO NOT START, DO NOT OPEN, DO NOT CLOSE, DO NOT ENERGIZE, DO NOT OPERATE.**

Employee Training

The employer must provide effective initial training and retraining as necessary and must certify that such training has been given to all employees covered by the standard. The certification must contain each employee's name and dates of training.



For the purposes of the standard, there are three types of employees - **authorized**, **affected**, and **other**. The amount and kind of training that each employee receives is based upon (1) the relationship of that employee's job to the machine or equipment being locked or tagged out, and (2) the degree of knowledge relevant to hazardous energy that he or she must possess.

For example, the employer's training program for **authorized** employees (those who are charged with the responsibility for implementing the energy control procedures and performing the service and maintenance) must cover, at minimum, the following areas:



- details about the type and magnitude of the hazardous energy sources present in the workplace, and
- the methods and means necessary to isolate and control those energy sources (i.e., the elements of the energy control procedure(s).)

By contrast, affected employees (usually the machine operators or users) and all other employees need only be able to (1) recognize when the control procedure is being implemented, and (2) understand the purpose of the procedure and the importance of not attempting to start up or use the equipment that has been locked or tagged out.

Because an "affected" employee is not one who is performing the service of maintenance, that employee's responsibilities under the energy control program are simple: Whenever there is a lockout or tagout device in place on an energy-isolating device, the affected employee leaves it alone and does not attempt to operate the equipment.

Every training program must ensure that all employees understand the purpose, function and restrictions of the energy control program and that authorized employees possess the knowledge and skills necessary for the safe application, use, and removal of energy controls.

Training programs used for compliance with this standard, which is performance-oriented, should deal with the equipment, type(s) of energy, and hazard(s) specific to the workplace being covered.

Retraining must be provided, as required, whenever there is a change in job assignments, a change in machines, equipment or processes that present a new hazard, or a change in energy control procedures. Additional retraining must be conducted whenever a periodic inspection reveals, or whenever the employer



has reason to believe, that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedure.

Periodic Inspections

Periodic inspections must be performed at least annually to assure that the energy control procedures (locks and tags) continue to be implemented properly and that the employees are familiar with their responsibilities under those procedures. In addition, the employer must certify that the periodic inspections have been performed. The certification must identify the machine or equipment on which the energy control procedure was used, the date of the inspection, the employees included in the inspection, and the name of the person performing the inspection. For lockout procedures, the periodic inspection must include a review, between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected. When a tagout procedure is inspected, a review on the limitation of tags, in addition to the above requirements, must also be included with each affected and authorized employee.

Application of Controls and Lockout/Tagout Devices

The established procedure of applying energy controls includes the specific elements and actions that must be implemented in sequence.³ These are briefly identified as follows:

- (1) Prepare for shut down.
- (2) Shut down the machine or equipment.

³See 29 CFR 1910.147(d) for the detailed requirements and language of the OSHA standard.



- (3) Apply the lockout or tagout device.
- (4) Render safe all stored or residual energy.
- (5) Verify the isolation and de-energization of the machine or equipment.

Removal of Locks and Tags

Before lockout or tagout devices are removed and energy is restored to the machine or equipment, the authorized employee(s) must take the following actions or observe the following procedures:

- (1) Inspect the work area to ensure that non-essential items have been removed and that machine or equipment components are intact and capable of operating properly;
- (2) Check the area around the machine or equipment to ensure that all employees have been safely positioned or removed;
- (3) Notify affected employees immediately *after* removing locks or tags and before starting equipment or machines; and
- (4) Make sure that locks or tags are removed **ONLY** by those employees who attached them. (In the very few instances when this is not possible, the device may be removed under the direction of the employer, provided that he or she strictly adheres to the specific procedures outlined in the standard.)

Additional Safety Requirements

Special circumstances exist when (1) machines need to be tested or repositioned

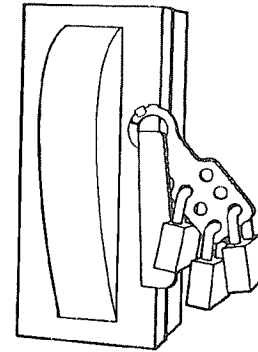


during servicing, (2) outside (contractor) personnel are at the worksite, (3) servicing or maintenance is performed by a group (rather than one specific person), and (4) shifts or personnel changes occur.

- **Testing or positioning of machines.** OSHA allows the temporary removal of locks or tags and the re-energization of the machine or equipment ONLY when necessary under special conditions - for example, when power is needed for the testing or positioning of machines, equipment, or components. The re-energization must be conducted in accordance with the sequence of steps listed below:
 - (1) Clear the machines or equipment of tools and materials.
 - (2) Remove employees from the machines or equipment area.
 - (3) Remove the lockout or tagout devices as specified in the standard.
 - (4) Energize and proceed with testing or positioning.
 - (5) De-energize all systems, isolate the machine or equipment from the energy source, and reapply lockout or tagout devices as specified.
- **Outside personnel (contractors, etc.)** The onsite employer and the outside employer must inform each other of their respective lockout or tagout procedures. Each employer must ensure that his or her personnel must understand and comply with all restrictions and/or prohibitions of the other employer's energy control program.



- **Group lockout or tagout.** During all group lockout/tagout operations where the release of hazardous energy is possible, each authorized employee performing service or maintenance shall be protected by his/her personal lockout or tagout device or comparable mechanism that affords equivalent protection.



- **Shift or personnel changes.** Specific procedures must ensure the continuity of lockout or tagout protection during shift or personnel changes.



GLOSSARY

Affected employee - An employee who performs the duties of his or her job in an area in which the energy control procedure is implemented and servicing or maintenance operations are performed. An affected employee does *not* perform servicing or maintenance on machines or equipment and, consequently, is not responsible for implementing the energy control procedure. An affected employee becomes an "authorized" employee whenever he or she performs servicing or maintenance functions on machines or equipment that must be locked or tagged.

Authorized employee - An employee who performs servicing or maintenance on machines and equipment. Lockout or tagout is used by these employees for their own protection.

Capable of being locked out - An energy-isolating device is considered capable of being locked out if it meets one of the following requirements:

- It is designed with a hasp to which a lock can be attached;
- It is designed with any other integral part through which a lock can be affixed;
- It has a locking mechanism built into it; or
- It can be locked without dismantling, rebuilding, or replacing the energy isolating device or permanently altering its energy control capability.

Energized - Machines and equipment are energized when (1) they are connected



to an energy source or (2) they contain residual or stored energy.

Energy-isolating device - Any mechanical device that physically prevents the transmission or release of energy. These include, but are not limited to, manually-operated electrical circuit breakers, disconnect switches, line valves, and blocks.

Energy source - Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

Energy control procedure - A written document that contains those items of information an authorized employee needs to know in order to safely control hazardous energy during servicing or maintenance of machines or equipment. (A more comprehensive explanation is given beginning on page 6.)

Energy control program - A program intended to prevent the unexpected energizing or the release of stored energy in machines or equipment on which servicing and maintenance is being performed by employees. The program consists of energy control procedure(s), an employee training program, and periodic inspections.

Lockout - The placement of a lockout device on an energy - isolating device, in accordance with an established procedure, ensuring that the energy - isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lockout device - Any device that uses positive means such as a lock, either key or combination type, to hold an energy - isolating device in a safe position, thereby preventing the energizing of machinery or equipment. When properly installed, a blank flange or bolted slip blind are considered equivalent to lockout devices.



Tagout - The placement of a tagout device on an energy - isolating device, in accordance with an established procedure, to indicate that the energy - isolating device and the equipment being controlled may *not* be operated until the tagout device is removed.

Tagout device - Any prominent warning device, such as a tag and a means of attachment, that can be securely fastened to an energy - isolating device in accordance with an established procedure. The tag indicates that the machine or equipment to which it is attached is not to be operated until the tagout device is removed in accordance with the energy control procedure.

()

()

()