Lockout/Tagout: Developing Your Program

Lockout/Tagout

OSHA’s lockout/tagout standard, 29 CFR 1910.147, outlines the concepts of program development, work procedures, and training for employees who are exposed to the risk for injury from the unexpected release of energy during equipment servicing and maintenance. Violations of the lockout/tagout standard can result in serious injuries. All employers must understand the importance of compliance.

Cross-references to other regulations

The lockout/tagout standard makes clear in §1910.147(a)(3)(ii) that it is not intended to replace other existing standard provisions for lockout/tagout, but to supplement and support these provisions by requiring that employers establish an energy control procedure and train employees in the energy control program as detailed in 29 CFR 1910.147. Various OSHA standards impose lockout-related requirements, but do not address lockout/tagout issues or methodology in any detail. For example, some OSHA standards require equipment to have the capability of being locked out, while other OSHA standards mandate the specific use of lockout, tagout, or other energy control devices for certain machines, equipment, or industries. The following examples indicate how lockout/tagout provisions are included in other regulations.

Powered industrial trucks—cross-reference

Under the requirements for maintenance of industrial trucks, 29 CFR 1910.178 requires the battery to be disconnected before repairs are made to the truck’s electrical system. Although the lockout/tagout regulation is not cited, this is a direct correlation between the lockout rules and the industrial truck standard.

Hoisting equipment—cross-reference

The same compliance needs arise under the regulations for hoisting equipment. Under the requirements for overhead and gantry cranes at 29 CFR 1910.179, the power supply to the runway conductors of the hoisting mechanism needs to be controlled by a fixed switch or circuit breaker that is accessible from the floor. The switch is required to be able to be locked in the open position. Cab-operated cranes or hoisting equipment must have the switch or circuit breaker located within easy reach of the operator. The switch or circuit breaker must be enclosed by a cabinet that is capable of shielding the operator from an electrical arc blast in case of a fault. The control must be capable of being locked in the open position.

Also under 29 CFR 1910.179, a maintenance procedure needs to be developed and used before adjustments and repairs are started on a crane. This procedure must indicate lockout/tagout parameters. When servicing and maintaining a crane, the crane will be moved to a location where it will cause the least interference with operations in the area. The standard requires all controllers to be in the “off” position. The main or emergency switch is to be locked in the open position. “Out of order” warning signs must be placed on the crane, on the floor beneath, or on the hook where they are visible from the floor. If other cranes are in operation in the same runway, rail stops or other suitable means are to be in place to prevent interference with the idle crane.

After adjustments and repairs have been made, all guards must be reinstalled, safety devices are to be reactivated, and maintenance equipment is to be removed before the crane can be put back into operation.
The maintenance requirements for derricks, at 29 CFR 1910.181, have similar provisions that are directly related to the lockout/tagout standard.

**Machinery and machine guarding—cross-reference**

Woodworking machinery requirements at 29 CFR 1910.213 also have lockout/tagout provisions. The standard indicates that each power-driven woodworking machine should be provided with a disconnect switch that can be locked in the “off” position. Machines that are operated by electric motors are to have a positive means to render the equipment’s controls inoperable during repairs or adjustments. Lockout/tagout procedures would meet this requirement.

**Mechanical power presses—cross-reference**

Mechanical power press general guarding and construction requirements at 29 CFR 1910.217 require presses to have a main power disconnect switch. The switch must be capable of being locked only in the “off” position. Die-setting procedures require the employer to provide and enforce the use of lockout devices (safety blocks) whenever dies are being adjusted or repaired in the press. The lockout/tagout standard has similar requirements for the use of protective devices and enforcement policies.

**Forging machines—cross-reference**

As indicated under the requirements for forging machines at 29 CFR 1910.218, hammers and presses need a disconnecting power switch that can be locked out, thus rendering cycling controls inoperable. The ram in the equipment must be blocked when dies are being changed or other work is being done on the hammer. This will eliminate the hazards caused by the potential release of energy from mechanical, pneumatic, or gravitational movement. If blocks or wedges are used, they are required to be made of material which has the strength and construction meeting or exceeding the specifications and dimensions shown in TABLE O-11 of 29 CFR 1910.218.

Provisions for power-driven hammers require that steam hammers must be provided with a quick closing emergency valve. This valve is to be closed and locked in the “off” position while the hammer is being adjusted, repaired, serviced, or when the dies are being changed.

This standard has additional lockout-related requirements for gravity hammers. Air-lift hammers must have an air shutoff valve in addition to two drain cocks: one on the main head cylinder, and one on the clamp cylinder. This allows the air-lift hammers to be de-energized to a zero-energy state when service or maintenance work is being performed.

29 CFR 1910.218 contains lockout references in the requirements for mechanical, and hydraulic, forging presses. With mechanical forging presses, the power to the press must be locked out and the flywheel is to be at rest during maintenance or die changes; hydraulic forging presses require the hydraulic pumps and the power supply to be locked out. For both types of forging presses, the ram is required to be blocked with a material that meets the strength specifications shown in the regulation’s TABLE O-11.

Upsetters (forging equipment that applies the main forming energy horizontally to the workpiece) also require lockout. Upsetters need to have a means for locking out the power supply where it enters the machine so that the cycling controls can be made inoperable during service and maintenance. When changing dies, and during any maintenance work, the power to the upsetter must be locked out, and the flywheel is to be at rest. Other forging equipment, including bolt heading, rivet making, and billet shears must also be provided with a positive means to lockout the energy sources during repair or servicing.

**Welding—cross-reference**

The requirements for welding or cutting containers are at 29 CFR 1910.252. The employer is not allowed to do welding, cutting, or other hot work on used drums, barrels, tanks, or other containers until they have been cleaned to eliminate the potential for the generation of flammable or toxic vapors when heated. All pipelines or connections to the drum or vessel must be disconnected or blanked before the work is performed.
Lockout/tagout applies to all forms of hazardous energy, and it applies here because of the potential for chemical and explosive energies to be released during these operations. Cleaning the containers eliminates the risk for fires or explosions, and disconnecting or blanking lines eliminates the potential for the container to be re-filled during the work.

**Pulp and paper—cross-reference**

Like most “special industries,” pulp, paper, and paperboard mills have lockout compliance requirements according to 29 CFR 1910.261. The employer must furnish lockout devices which are to be used at the equipment’s main disconnect switch prior to any service or maintenance work that requires entrance into, or close contact with, the machinery or equipment. This ensures that workers will not be harmed by the unexpected energization of the equipment.

Further lockout compliance requirements are stated for rag and old paper preparation. If an employee needs to enter a rag cooker for cleaning, inspection, or other work, all steam and water valves, or other control devices, must be locked and tagged in the closed or “off” position. Blank flanging is acceptable in place of closing and locking pipeline valves. (Also, an attendant is required to remain outside of the rag cooker to monitor the employee who has entered it.)

Operations during the chemical processes of making pulp also require lockout/tagout. If the paper company has a digester, the valves controlling lines leading into the digester must be locked out during inspection and repair activities. When servicing or maintaining a blowline that leads into one pipe, the cock or valve of the line from the tank must be locked or tagged out.

The paper industry must also follow lockout requirements during stock preparation activities. During beater and pulper service and maintenance work, all control devices must be locked or tagged out if the work being performed exposes an employee to a potential energy source.

The last lockout/tagout reference found in the pulp and paper industry standard is generic in nature. The requirements for machine rooms state that all mechanical drives must be able to be locked out.

**Textiles—cross-reference**

Here again, the special industry standard for textiles, 29 CFR 1910.262, requires the employer to follow lockout/tagout rules. Every textile machine driven by belts and shafting is required to have a locking-type shifter or an equivalent positive device to prevent machines from automatically restarting upon restoration of power. The loom fixer must be able to lockout the loom during service and maintenance work.

When the employer is performing continuous bleaching of cotton and rayon for production cycles, each valve controlling the flow of steam or other energy sources must be equipped with a chain, lock, and key, so the service function can be performed safely when entering the J-box. The same requirements are stated for the kier valves.

**Bakery equipment—cross-reference**

Bakery equipment provisions for flour-handling equipment at 29 CFR 1910.263 require that covers on the openings to storage bins be equipped with hasps and locks so that an employee can lock them open before entering the bin. Each dough mixer must have an individual motor and control, and there must be a conveniently located manual switch to prevent the mixer from being started in the usual manner while the machine is being serviced and cleaned. Oven electrical heating equipment must have a main disconnect switch or circuit breaker that is to be locked in the open position during any work on the electrical equipment or during work inside of the oven.

**Sawmills—cross-reference**

Building facilities, and isolated equipment provisions of the sawmills standard, 29 CFR 1910.265, require lockout on hydraulic systems. Equipment that is normally supported by hydraulic must be blocked, chained, or otherwise secured during maintenance. Also, the main control switches of mechanical stackers and unstackers must be capable of being locked in the open position.

**Electric utilities—cross-reference**

If you read though the special industry standards for electric power generation, transmission, and distribution, 29 CFR 1910.269, you will find similar language to the lockout/tagout standard. Under 29 CFR 1910.147, installations under the exclusive control of electric utilities for the purpose of power generation, transmission, and distribution are excepted from the rule—this is misleading. The utility must comply with lockout requirements, but the sequence of compliance is slightly different. That is, if
the special industry standard, 29 CFR 1910.269, provides adequate direction and protection, it must be followed first. But, in situations where following the special industry standard would fall short of providing full employee protection, the provisions under 29 CFR 1910.147 should be followed.

**Grain handling—cross-reference**
Grain handling facilities find compliance requirements under 29 CFR 1910.272. Employees require annual training, including training in lockout/tagout. During entry into grain storage structures, all mechanical, electrical, hydraulic, and pneumatic equipment that presents a danger to the employees must be disconnected, locked out and tagged, blocked off, or otherwise prevented from being operated. Preventative maintenance procedures require the use of lockout/tagout, and also require established procedures for the removal of locks.

**Electrical wiring methods—cross-reference**
The electrical standard is unique in its relationship to the lockout rules. Rules for wiring methods, components, and equipment for general use, 29 CFR 1910.305, require motors to have disconnecting means—disconnecting switches must be capable of being locked in the open position for some installations. The equipment, unless being worked on by a “qualified employee,” must be locked out while performing any service or maintenance function. Only “qualified persons” can work with live electrical circuits.

The employer can do one of two things to comply with the written lockout program requirements for electrical work. According to 29 CFR 1910.333, Selection and use of work practices, the employer is required to write an electrical lockout program. But, if the employer complies with paragraphs (c) through (f) of 29 CFR 1910.147, and these procedures address the electrical safety hazards covered by the electrical standard, the employer will be deemed to be in compliance with the written electrical lockout program requirements. Simply put, the employer can have two written programs that address each specific standard or one program that addresses both standards.

**Program development**

**Energy sources**
When an employer is assessing the hazards related to service and maintenance work, all potential energy sources must be considered. Energy that could be released during any phase of the task must be addressed. Assess the hazards related to the release of electrical, mechanical, hydraulic, steam, water (or other fluids) under pressure, chemical, gases, gravity, pneumatic, thermal, and any other energy potentials that an employee may be exposed to. An example of a hazardous release of energy potential that an employee may be exposed to would be the discharge of a capacitor. Prior to the work being performed, the employer must assure that all energy potentials are controlled or eliminated.

**Situations where lockout/tagout is impractical**
Sometimes it is impractical to control the energy source and bring it down to a zero energy state. In a situation like this, the employer needs to come up with an equally effective means to provide full employee protection. A quick reference to the General Duty Clause,5(a)(1), of the Occupational Safety and Health Act of 1970 needs to be addressed. That is, as paraphrased from the act, the employer must provide a safe working environment for employees.

An example of an impractical situation would be hot work on the Alaskan Pipeline. Of course, it is impractical to turn off the pipeline during service and maintenance work like welding, but there is a risk of an unexpected energization that an employee is potentially exposed to. In this case, to provide full employee protection, the employer must use specially trained welders, and the welders may need to use special equipment.

**Scope of the lockout/tagout standard**
The scope of the lockout/tagout standard is the control of hazardous energy during service and maintenance activities. When the unexpected energization, start-up, or release of stored energy could cause injury, the employer must establish procedures to control the release of the hazardous energy.

Don’t be misled by the exclusions found in the first section of the standard. For example, the general industry standard at 29 CFR 1910.147 does not apply to construction, agriculture, and maritime employment. But, these industries are covered by their own lockout/tagout standards: The construction standards are found under 29 CFR 1926, the agricultural standards are found under 29 CFR 1915, and
the maritime standards are found under 29 CFR 1917. These industrial standards have lockout/tagout requirements that are identical or significantly similar to the general industry rules.

Also excluded from 29 CFR 1910.147 are installations under the exclusive control of electric utilities for the purpose of power generation, transmission and distribution, including related equipment for communication or metering. However, these utilities are regulated under subpart R of the general industry standards, and they have their own lockout/tagout requirements. As discussed in the cross-reference section, exposure to electrical hazards from work on, near, or with conductors or equipment in electric utilization installations is covered under 29 CFR 1910.269 and 29 CFR 1910.333.

The oil and gas well drilling and servicing industry is also excluded from 29 CFR 1910.147. Typically, the oil and gas industry, regulated under specific industrial rules, is required to come up with lockout requirements and work practices that provide full employee protection.

**Application of the lockout/tagout standard**

The application of the standard excludes normal production operations. That is, servicing and/or maintenance during normal production operations is covered only if:

- An employee is required to remove or bypass a guard or other safety device,
- An employee is required to place any part of his or her body into a point of operation, or
- An associated danger zone exists during a machine operating cycle.

To expand on this, let’s talk about the minor tool changes and adjustments, and other minor servicing activities, which take place during normal production operations. If the minor tool change is routine, repetitive, and integral to the use of the equipment for production, and the machine is properly guarded according to the machine guarding standard, the activity is not regulated by the lockout/tagout standard. An example of a minor tool change would be changing out a drill bit on a drill press. It is important to note, though, that once a machine guard is bypassed, the machine must be locked out or the employee needs to be using an equivalent guarding mechanism, such as an interlocked barrier guard or a handling tool, that removes him from the hazard.

The lockout/tagout standard also does not apply to work on cord-and-plug connected electric equipment when exposure to the hazards of unexpected energization or start up is controlled by unplugging the equipment, and the plug is under the exclusive control of the employee performing the servicing or maintenance. Though this exception might have some application to the real world, the employer must realize that frequently the plug does not remain under the worker’s exclusive control. Often, a maintenance person is called away during a repair job. The plug would no longer be under the employee’s exclusive control. It is easy to see how an unsuspecting employee could be injured by plugging in equipment that was left unattended during the middle of a repair job.

As another example, a maintenance employee may leave the equipment unplugged while going to get another tool. Someone could easily plug in the equipment while the maintenance person is away. The maintenance employee could be injured if he or she resumed work without confirming that the equipment was still unplugged. Lockout devices are available for cord-and-plug operated equipment.

Hot tap operations (welding on a pressurized line) involving transmission and distribution systems for substances such as gas, steam, water or petroleum products may be required. If this is the case, the employer is required to demonstrate that continuity of service is essential and that shutting down the system is impractical. The employer is also required to have documented procedures that will provide proven effective protection for employees. If the employer can demonstrate full employee protection, the work is excluded from 29 CFR 1910.147.

**Purpose**

The lockout/tagout provisions require employers to establish a program and utilize procedures for affixing appropriate lockout or tagout devices to energy isolating devices or to otherwise disable machines or equipment to prevent unexpected energization, start-up or release of stored energy. This is done to prevent injury to employees. What seems to be misunderstood though, is that the employer must have a program on how lockout is going to be accomplished. The program must include equipment-specific written lockout/tagout procedures. The procedures need to be developed prior to the service or maintenance function.
Energy control program
The employer is responsible for developing a lockout/tagout program. Within the program, the employer must outline the equipment-specific energy control procedures. Further, the employer must train employees and must periodically inspect lockout/tagout procedures by observing employees performing the procedures to ensure that protective procedures are being followed.

Stand-alone tagout system
If for some reason, due to equipment age or construction, a lockout device cannot be used, the employer’s energy control program is required to utilize a tagout system. The employer should note that if an energy-isolating device is capable of being locked out, it must be locked out during service and maintenance operations unless the employer can demonstrate that tagout provides full employee protection.

When a tagout system is used instead of lockout, the employer must supplement tagout with additional means to assure full employee protection. These additional means could include the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle to reduce the likelihood of inadvertent energization. Tagout alone does not physically prevent activation of the control, and it may give a false sense of security to the employee. Further training will be required if the employer must use a tagout system.

It is also important for the employer to note that since 1990, whenever replacement or major repair, renovation, or modification of a machine or equipment is performed, and whenever new machines or equipment are installed, energy isolating devices must be designed to accept a lockout device.

Energy control procedure
The employer needs to develop procedures that document the rules and outline the specific isolation mechanisms for each piece of equipment being serviced or maintained. The employer will also need to show how the procedures will be utilized for the control of potentially hazardous energy when employees are engaged in service and maintenance activities. The procedures must:

- Outline the scope and purpose of the procedure.
- Identify who has authorization to perform the procedure.
- Indicate the rules that must be followed while performing the procedure.
- Describe the device application and removal techniques.
- Include provisions for the control of hazardous stored energy.
- Describe the means to enforce compliance.

The employer needs to be able to outline the specific procedural steps for shutting down, isolating, blocking, and securing machines or equipment to control hazardous energy. The procedure will also include steps for the placement, removal, and transfer of lockout or tagout devices, and must identify who has responsibility for using the procedures.

Specific requirements for testing a machine or equipment to verify the effectiveness of the lockout and tagout devices, or other energy control measures, must be outlined in the procedure.

There is an exception from having a written energy control procedure for a particular machine or equipment. (This exception does not exclude the employer from the lockout standard, just the requirement for specific written procedures.) The exception can only be used when all of the following eight elements of the exception apply:

1. The machine or equipment has no potential for stored or residual energy or re-accumulation of stored energy after shut down.
2. The equipment has a single energy source which can be readily identified or isolated.

3. The isolation and locking out of that energy source will completely de-energize and deactivate the machine or equipment.

4. The machine or equipment is isolated from that energy source and locked out during servicing or maintenance.

5. A single lockout device will achieve a locked-out condition.

6. The lockout device is under the exclusive control of the authorized employee performing the servicing or maintenance.

7. The servicing or maintenance does not create hazards for other employees.

8. The employer has had no accidents involving the unexpected activation or re-energization of the machine or equipment during servicing or maintenance.

It is the last element of the exception that seems to get the employer into trouble. This is because an OSHA inspector will interview employees during an audit, and if an employee indicates that an incident has occurred, the employer is out of compliance.

**Protective materials and hardware**

One major problem in many lockout/tagout programs relates to the lockout and tagout devices used to protect the affected and authorized employees. The employer is required to choose and have available locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other devices. These devices must be used to ensure the equipment is isolated, secured, or blocked during the maintenance function.

The lockout/tagout devices need to be standardized by using the same color, shape, or size and print format. This standardization facilitates employee recognition of lockout situations. If the same locks can be found on a toolbox or locker, an employer would be out of compliance. But realistically, non-standardized lockout equipment makes it difficult for employees to know what truly is locked out for servicing versus what is just locked up. Standardization also makes it easier to identify the lockout equipment being used by contractors who are working in your facility.

Energy control devices cannot be used for any other purpose besides lockout/tagout. As an example, lockout locks cannot be used to keep third shift employees from operating certain equipment—they can only be used during servicing and maintenance.

The next requirement for devices and tags is durability. Lockout and tagout equipment must be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected. It would not be a good idea to use a paper tag in a wet environment. Further, lockout devices must be substantial enough to prevent removal without the use of excessive force. For example, a simple little brass luggage lock is not durable or substantial enough to be used as an acceptable lockout device. Even tagout devices, and their means of attachment must be substantial enough to prevent inadvertent or accidental removal. According to OSHA, the means for attaching a tag must have an unlocking strength of 50 pounds of pulling strength and it must be made of a material that is a non-reusable type—such as a nylon cable tie. Many employers mistake this to mean that the tags can not be reused—the tags can be reused, but the attachment mechanism cannot.

Another area of concern associated with the use of lockout/tagout devices is identity. The lockout/tagout devices must indicate the identity of the employee applying the device(s). This identifies the person who is responsible for the lockout, and makes it easy for anyone with questions about the equipment’s lockout status to ask the right person. This also assures that, after the service work is performed, the employer can readily determine what employees are missing if a lock or tag is still in place.
Warning tags attached to a lock’s hasp are often used to indicate the identity of the person who applied a lock. These tags also warn people that the machine or equipment is not to be energized. Another method to identify the person who applied a lock would be to engrave the name on the lock.

**Work procedures**

**Periodic inspection requirements**

The employer must conduct an inspection of the energy control procedures at least annually. It is important to note that the employee performing the inspection must be an authorized employee in order to qualify as the inspector. This does not mean the employee will be required to actually perform a lockout during the year, but the employee must understand how the lockout program works and how to follow the written lockout procedures. The inspector is the person who is going to verify that lockout procedures are being followed and must be someone other than the employee utilizing the energy control procedure being inspected.

OSHA interprets the periodic inspection requirements to mean that each energy control procedure must be separately inspected at least annually. Energy control procedures used less frequently than once a year need be inspected only when used. The inspections may be accomplished through random audits, plant safety tours, or planned visual observations. The inspector, who must be an authorized employee other than the one(s) utilizing the energy control procedure being inspected, must observe the implementation of the energy control procedure and talk with employees implementing the procedure to determine that all the requirements are understood and are being followed. The inspection must also include a review of the procedure with all of the authorized employees who use the procedure, but each of those authorized employees does not need to be observed performing the procedure as part of the inspection.

For inspection purposes, OSHA allows employers to group the lockout/tagout procedures for similar machines and conduct one inspection for the group. The machines or equipment in the group must have the same or similar types of control measures. This approach is acceptable as long as the inspection sampling reasonably reflects plant servicing and/or maintenance operations and hazardous energy control practices for the procedures being inspected.

For purposes of procedure grouping, machines and equipment may be grouped together as one procedure if they all are listed or identified in the scope of the energy control procedure and if they all have the same or similar:

- Procedural steps for shutting down, isolating, blocking, securing, and dissipating stored energy in machines or equipment.
- Procedural steps for the placement, removal, and transfer of the lockout or tagout devices and the responsibility for them.
- Requirements for testing a machine or equipment to determine and verify the effectiveness of lockout/tagout devices and other control measures.

For example, assume that a single procedure is intended to cover a group of machines and that part of the energy control procedure requires the use of a start/stop button for shutdown and energy isolation verification purposes. However, one of the machines does not have a start/stop button because it is wired directly to an electronic on-demand signal. In this scenario, the single procedure will not provide adequate instructions for the machine without a start/stop button because the single procedure will not provide sufficient employee guidance on how to effectively shut down the machine and verify energy isolation. The energy control procedure for this machine may not be included in the group.

OSHA recognizes that some employers choose to develop machine-specific energy control procedures for individual machines or pieces of equipment because this approach provides an optimum level of
detail, enhancing overall employee safety during servicing operations. In order not to discourage this practice, employers who develop energy control procedures for individual machines still may group same or similar individual machine/equipment procedures for periodic inspection purposes.

After the inspection, the authorized inspector must prepare a certification statement that includes the identity of the machine or equipment that was inspected, the date of the inspection, the employees included in the inspection, and the inspector’s name. The periodic inspection must provide for, and ensure, effective correction of identified deficiencies. If any inadequacies or deviations from the procedure are identified, the employee needs to be retrained or disciplined. OSHA excludes energy control procedures that are used less frequently than once a year from the annual inspection requirements.

**Employee review**

The periodic inspection must include a review of the responsibilities of each authorized employee implementing the lockout procedure. Group meetings between the inspector and authorized employees would constitute compliance with this requirement. When a tagout system is used, each affected employee is to be included in the review as well.

**Energy isolation authorization**

The energy control program requires that the authorized employees who perform the energy isolation procedures also perform the servicing or maintenance. This ensures that the people who are responsible for the lockout are the same people who are exposed to the potential hazards that the lockout/tagout procedures protect against.

**Employee notification**

The employer must assure that all affected employees are notified about pending service and maintenance work. The notification must occur before the devices are applied to the energy sources and after the removal of the devices from the machine. This control procedure is used to ensure that all employees are aware that the equipment is “off limits” until service or maintenance is complete. In other words, this mechanism is in place to eliminate the potential for someone to try to bypass the lockout to run equipment that has been shut down for repairs. The notifications also help to ensure that employees are clear of the machine and in a safe position before the equipment is re-energized.

**Application of lockout/tagout**

The employer must establish a procedure for the application of energy isolating devices. The procedure must contain the proper shutdown sequence. Before an authorized employee turns off a machine for maintenance purposes, he or she must know the types of, and the magnitude of, the energy sources. After the authorized employee has shut down the machine and has isolated the equipment from its energy sources by operating disconnect switches, closing valves, etc., he or she needs to follow the proper sequence for the application of lockout/tagout devices.

The energy control procedure documents all energy isolating devices that are needed. Locks must be secured to the energy isolating devices so that the equipment will be maintained in a “safe” or “off” condition while the lock is in place. If a tagout system is being used, the tags must be applied close to the energy isolation devices. After the lockout/tagout devices are in place, the authorized employee will relieve all potentially hazardous stored or residual energy (from capacitors, line pressure, elevated parts, etc.).

Finally, the authorized employee is to verify that the energy isolation is complete and the equipment is rendered safe to service. This can be done by using test equipment, checking gauges, or simply by trying to turn the equipment back on. The authorized employee should always return all controls to the “off” or “stop” position following the verification step to ensure that the machine will not start automatically when power is restored—this can be especially important in computerized equipment that has controls programmed to remember and act on their last commands.
Release from lockout/tagout

Once the maintenance work is complete, the authorized employee must follow written procedures for the re-energization and start-up of the equipment. The authorized employee must inspect the machine or equipment to ensure that it is intact and that all tools or other items have been removed. This can be very important—a tool that is left behind in a piece of equipment can destroy the machine causing injury, downtime, and product loss.

Part of this inspection should include a check of the machine’s control panel to ensure that all controls remain in the “off” or “stop” position. Once the equipment has been checked and the guards have been reinstalled, the authorized employee must ensure that all employees in the area are safely positioned. The authorized employee may now remove the lockout/tagout devices from the energy isolating devices and restore energy to the machine.

As mentioned earlier, after lockout or tagout devices have been removed and before a machine or equipment is started, each affected employee must be notified that the lockout or tagout device(s) have been removed. When the notifications are complete, the authorized employee can start the machine to check that it is functioning properly.

Removal of a lockout device by others

Only the employee who applied the lock may remove it. When the authorized employee who applied a lockout device is unavailable to remove it, the employer can have it removed by another employee if specific procedures are followed. The procedure is to be included in the employer’s lockout/tagout program. The procedure needs to demonstrate that the employer has verified that the authorized employee who applied the device is not at the facility. The procedure must include reasonable efforts to contact the authorized employee to inform him or her that the lockout/tagout device(s) has been removed. The authorized employee must be informed of the removal of the device(s) before resuming work at that facility.

The employer should not remove a lock without actually talking to the employee who applied it. Whenever another person removes a lock, the equipment must be fully inspected by a qualified person to ensure that repairs or maintenance have been completed, and the machine is safe to operate. If the authorized employee had left the lock in place because of negligence, retraining or disciplinary action should be considered.

Working on energized equipment

It may be necessary to energize equipment to perform tests or reposition parts during servicing. The procedures for the testing or positioning of machines, equipment, or components in situations where lockout/tagout devices must be temporarily removed must follow this specific sequence:

1. Clear the machine of tools and materials, and remove all employees in the danger area.
2. Have the authorized employee remove the lockout/tagout devices.
3. Energize the equipment for the test.
4. Test the equipment.
5. De-energize the equipment after testing and re-apply the lockout/tagout devices.

To reiterate, OSHA allows the temporary removal of lockout or tagout devices and the re-energization of the machine or equipment ONLY during the limited time necessary for the testing or positioning of machines, equipment, or components. Note that OSHA does not specifically require the reinstallation of machine guards during these procedures, but it remains very important for employees to be safely positioned while the machine is energized. After the completion of the temporary re-energization, the authorized employees shall again de-energize the equipment and resume lockout/tagout procedures.

Contractors

As with the majority of OSHA regulations, the host employer has specific responsibilities for contractors that come on-site. It is important that the employer assess the contractors’ safety policies to assure contract employees are properly trained and that the contractor has the appropriate written programs in place.
Before the contractor starts work, the host employer and the contractor employer are required to inform each other of their respective lockout/tagout procedures and the hazards involved in the particular task at hand. The host employer then must inform his or her employees about the contractor relationship and how to safely interact with the contractors’ employees. The contractor must also communicate this information with his or her employees.

Both employers must comply with the minimum standards. If the host employer takes a direct supervisory role over the contract employees (telling the contract employees what to do when they are on-site), then the host employer becomes responsible for training the contract employees. Typically temporary employees who are hired through an agency would fall into this category. The employer should also note that he or she could be cited when an on-site contractor is not complying with the OSHA standards.

**Group lockout requirements**

When more than one authorized employee performs servicing or maintenance on a machine, the standard’s provisions for group lockout apply. OSHA requires that “Each authorized employee shall affix a personal lockout or tagout device to the group lockout device, group lockbox, or comparable mechanism when he or she begins work, and shall remove those devices when he or she stops working on the machine or equipment being serviced or maintained.” The procedure must provide for full employee protection that is equivalent to that provided by the implementation of a personal lockout or tagout device.

For example, if a single lockout device or set of lockbox devices (often referred to as “operations locks”) are utilized to isolate the machine or equipment from the energy sources, each authorized employee must be able to use his personal lockout or tagout devices so that no single employee has control of the means to remove the group lockout or tagout devices while employees are still servicing or maintaining the machine or equipment. This can be accomplished by the use of a lockbox or other similar appliance. Once the machine or equipment is locked out, the key to the operations locks that were applied to the machine’s energy isolating devices are placed into the lockbox. Then each authorized employee places his lockout or tagout device on the box. When each individual completes his portion of the work, that person removes his lockout or tagout device from the lockbox. Once all personal lockout or tagout devices have been removed, the keys for the operations locks can be used to remove the locks from the machine. This method provides individual protection for all employees working under the protection of a particular lockout or tagout device.

However group lockout is performed, the employer needs to ensure that employees are protected. Further, the employer should note that when more than one craft is involved in the group lockout, the different crafts must coordinate their work forces to ensure continuity of protection.

**Shift changes**

During shift changes, procedures must allow for the orderly transfer of lockout/tagout devices between leaving and incoming employees. A multiple-lock hasp may be used so the authorized employee for the next shift can apply his or her lock before the employees who are leaving remove their locks. This would ensure continued protection. This procedure should be included in the written lockout/tagout program.

In situations where the off-going employee removes his lockout or tagout device before the oncoming employee arrives (for example a change from second shift to first shift employees), the procedure could allow for the off-going employee to apply a tagout device at the time he removes his device, indicating that the lock had been removed, but that the machine or equipment had not been reenergized. The oncoming employee would verify that the system was still de-energized, and would remove the interim tag and substitute his lockout device. This would assure that the continuous protection is maintained from one shift to another.

**Service/maintenance analysis**

The following analysis is provided to assist employers in teaching authorized employees to document or develop a procedure for energy isolation. For more complex systems, more comprehensive procedures
may need to be developed. This document goes beyond the minimal requirements and can be cut back (OSHA provides a minimal lockout procedure in Appendix A of 29 CFR 1910.147). It is intended as an overview of information that authorized employees need to remember prior to starting a lockout sequence and after the service work is performed.

### Service/Maintenance Analysis Documentation

Name of the machine: ___________________ Date of analysis: ________________

Person performing the analysis: ___________________

#### Device Types:

- **Key Locks**
- **Tags Only**
- **Blanks**
- **Wedges**
- **Blocks**
- **Chains**
- **Cables**
- **Hasps**
- **OTHER** ______________________________________________

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What information was analyzed to make the Qualified/Authorized employee aware of the hazards prior to equipment shutdown: *(check and explain)*

- Blue Print Check
- Maintenance Team Review
- On-the-Job Experience
- Manufacturers Equipment Handbook
- Interviews
- Other

Explain:___________________________________________
___________________________________________
___________________________________________
Normal Shut Down Procedures Outlined:

Outline how verification of energy isolation was performed:

**Release From Lockout**

Were all nonessential items removed from the equipment? **yes or no**
- If no, remove items from the equipment.

Are all employees safely positioned away from the energy source(s)? **yes or no**
- If no, properly position employees.

Have devices been removed by the authorized person who attached them? **yes or no**
- If no, the production manager must verify that the suspected missing employee is not in or around the equipment. Disciplinary action and retraining is to follow.

Is the production manager notified of the pending equipment start up? **yes or no**
- If no, notify the production manager.

Has the production manager notified affected employees of the pending start? **yes or no**
- If no, verify that the production manager has performed his duties.

**When YES TO ALL OF THE ABOVE QUESTIONS - start up the machine**

I have completed this Service/Maintenance Analysis to the best of my ability to meet requirements of the lockout/tagout standard, 29 CFR 1910.147 (c) (4), (d) and (e).

Signature: ________________________________

**Training and communication**

Basically, everyone in the company needs to be trained under lockout/tagout, but the training will be at different levels depending on the employees’ responsibilities. The employer’s training program must cover, at a minimum, a review of the energy control program, elements of energy control procedures relevant to the employees’ duties, and the pertinent requirements of the standard. The employer must provide effective initial training and retraining as needed.

The employer is required to certify that the employee has the knowledge, skills, and understanding to work safely. The certification must contain each employee’s name and the training date. Retraining is required whenever the employee has a change in job assignments and when a new hazard is introduced due to a change in the equipment, process, or energy control procedures. Inspections that reveal inadequacies also trigger retraining.

**Authorized employee training**

Authorized employees are workers who are responsible for performing lockout/tagout procedures. Their training must cover the recognition of hazardous energy sources, the types of energy involved...
(electrical, mechanical, pneumatic, hydraulic, steam, water or other fluids under pressure, thermal, gravity, chemical, and gases), and the magnitude of the energy available in the equipment or machinery. They must know the methods used to apply the lockout/tagout devices, including the sequence for applying and removing lockout devices. They must be trained in what devices are to be used, and where they are to be applied, on the machinery or equipment.

**Affected employee training**

Affected employees are workers who are affected by lockout/tagout operations in their area. Typically, they are the machine operators. The employer must train affected employees about the purpose for the lockout program and how the energy control procedures are used. A key element to this training will be that affected employees must be notified about lockout/tagout activities that take place in their areas. Authorized employees must make sure that affected employees have been notified about the lockout/tagout before they can proceed with the procedure. Affected employees must be notified again after work has been completed. This requirement ensures that employees are aware that they are to stay clear of equipment during a service cycle.

**Other employee training**

The standard requires that employers train anyone whose work may bring them into an area where energy control procedures may be utilized. All employees must be aware of lockout/tagout procedures and the prohibition on tampering with lockout/tagout devices.

Employees who are not authorized to operate machinery need to understand that they must still stay clear of the equipment even when it is locked out for repairs. If an administrative person enters the work process area to bring someone a message, he or she needs to be able to identify lockout devices and know not to touch the device—even if another employee asks for assistance.

This training does not have to be long and drawn out. It must basically cover what lockout/tagout devices look like and that only trained and authorized people can handle them.

**Training for tagout systems**

If a tagout system is the only source of protection, further training is required for employees. The training must assure that all employees understand the limitations of tags. That is, the tags are essentially warning devices, and they do not provide the same level of protection that lockout devices provide.

Further, a tag must only be removed by the authorized person who attached it. The tag should never be bypassed, ignored, or otherwise defeated. The tag must be legible with a warning against the hazardous conditions if the machine or equipment is energized, such as “Do Not Start.”

Employees using the tags must be trained to understand that the tags might evoke a false sense of security.

**Employee retraining**

The employer must retrain all authorized and affected employees whenever there is a change in their job assignments or whenever a change in the equipment or processes could expose them to a new hazard. Further, additional retraining is required for employees that fail to comply with the lockout/tagout policies and procedures. For example, if an inspection reveals that an employee uses a lock other than one identified as a lockout device, the employee needs to be retrained.

The retraining, along with the initial training, must establish employee proficiency and introduce new or revised control methods and procedures, as necessary. It is important to note that the employer is required to certify that employee training has been accomplished and is being kept up to date. This certification must include the employee’s name and the dates of the training.

In addition, the periodic inspection of energy control procedures must include a review of the procedure with the authorized employees who use that procedure. Affected employees are included in the review when a tagout system is used. The periodic inspections must be done at least annually.

**Electrical training requirements**

Employees working with electricity must have training that goes beyond that required under the lockout/tagout standard. These employees must be trained in and familiar with the safety-related work practices of the electrical standard, 29 CFR 1910.331-.335. Training requirements differ for “qualified”
and “unqualified” electrical workers. This classification is specific to the task, and the same person may be considered to be “qualified” for some jobs and “unqualified” for others.

Generally, “qualified” employees are more directly exposed to electrical hazards—they may work on exposed electrical parts. “Qualified” employees must be trained on: how to avoid electrical hazards, how electrical equipment functions, the specific hazards of the job, how to distinguish between exposed “live” parts and other parts of the electrical equipment, how to determine nominal voltages, and the safe clearance distances corresponding to the voltages they are exposed to.

“Unqualified” employees may have only indirect exposure to electricity. They need basic training in the hazards associated with: electric current, high voltages, grounding, arcing, and lack of guarding. Basically, these “unqualified” employees must also be trained in and familiar with any electrically related safety practices not specifically addressed by 1910.331 through 1910.335, but which are necessary for their safety.

**OSHA inspection guidelines**

The employer will need to know what performance requirements OSHA expects when developing lockout/tagout programs. OSHA will look to see that the employer has a site-specific program—canned programs or umbrella policies do not comply with the program requirements. The OSHA inspector will start the inspection by confirming whether or not employees perform servicing and maintenance operations. Typically, OSHA will interview employees to establish an understanding of the compliance level at a company.

The compliance officer will review the OSHA 300 form to determine whether or not injuries related to maintenance and servicing operations have occurred. If evidence of injuries exists, the officer may concentrate his or her time in the area where the injuries occurred.

At a minimum, ask the employer for documentation including: procedures for the control of hazardous energy, certification of employee training, and the certification of periodic inspection. Because the standard focuses on the programmatic approach to hazardous energy control, OSHA inspectors are expected to carefully review the employer’s energy control procedures and the associated documentation (e.g., hazard analyses, if performed, and machine or equipment instructions/diagrams).

As the inspection progresses, the inspector will ask the employer for any hazard analyses associated with service and maintenance functions. This analysis is probably the employer’s basis for the written lockout/tagout program and subsequent employee training. The employer should note that a hazard analysis is not a specific requirement of the standard, but it will help the officer gauge the adequacy of the program.

Next, the inspector will ask the employer for the documentation required by the standard. This will include the procedures that have been prepared for each specific piece of equipment that has had service or maintenance. These procedures need to describe the following:

- Equipment shutdown sequences,
- Energy isolation devices,
- Lockout/tagout application points,
- Procedures for the release of stored energy, and
- Procedures for the verification of energy isolation.

The documented procedure must identify the type and magnitude of the machine’s energy sources. Where a common procedure is to be used for equipment that is uniquely the same, the officer will look for the identification of the equipment and its location. The records review will also include verification that periodic inspections and employee training have been certified.

The compliance officer will evaluate the employee training program. This is typically done through an interview process, or if a procedure is being performed during the inspection, the inspector will observe the authorized employee. The inspector will be looking to verify that authorized employees recognize and understand: all applicable hazardous energy sources, the type and magnitude of energy found in the workplace, and the means and methods of isolating and/or controlling energy. Particular attention will
be paid to the employees’ abilities to verify the effectiveness of the energy isolation. The authorized employees also need to understand the purpose of the lockout program.

The inspector will verify that affected employees have been instructed in the purpose for and use of the energy control procedures. The inspector will also verify that all other employees who work in the area where the energy control procedures are utilized know about the energy control procedures and program and that it is prohibited for them to attempting to restart or reenergize machines or equipment that is locked or tagged out.

The next part of the investigation will consist of evaluating compliance with the requirements for periodic inspection of procedures. Remember that only “authorized” employees can perform the inspections. The inspector will determine if the periodic inspections are adequate to ascertain whether: the steps in the energy control procedure are being followed, the employees involved know their responsibilities under the procedure, and the procedure is adequate to provide the necessary protection and identify what changes, if any, are needed.

The OSHA inspector will evaluate compliance with the need to retrain employees if deficiencies in employee training are noted for a particular periodic inspection. The inspector will also ensure that retraining is done whenever the employer has reason to believe that there are problems with an employee's knowledge of the energy control procedure or with its implementation. Additionally, retraining must be provided for all authorized and affected employees whenever there is a change in their job assignment, a change in the machines, equipment, or processes that presents a new hazard, or when there is a change in the energy control procedure. The inspector will determine whether the retraining has reestablished employee proficiency and whether any necessary new or revised control methods and procedures have been implemented. The inspector will check training certifications to ensure that the training included all of the elements of the energy control procedure which are directly relevant to the duties of the employee.

This will lead to an evaluation of the employer’s compliance with additional lockout/tagout requirements including how the employer meets the requirements: when lockout/tagout is temporarily removed for testing and repositioning purposes, during group lockout/tagout situations, and during shift or personnel changes.

If the inspector comes on-site during a time when outside contractors are being used, the inspector should evaluate both employers’ compliance with the lockout/tagout standard's requirements.

**Classification of violations**

Generally, a violation of the lockout/tagout standard could result in employee exposure to hazardous energy. These exposures may result in death or serious physical harm to employees; such violations shall normally be classified as **serious**.

For simple paperwork deficiencies in lockout/tagout programs where effective lockout/tagout work procedures are in place, the citations will be classified as other-than-serious.

**Electrical standard**

According to 29 CFR 1910.333, the selection and use of work practices associated with electrical equipment, including service and maintenance, is important to be outlined. The electrical standard’s safety-related work practices must be used by the employer to assure employees have protection and training to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts.

When work is performed near or on equipment or circuits which are, or may be, energized, specific safety-related work practices must be implemented—these practices are basically “electrical lockout.” The employer needs to note that conductors (wires or similar conductive materials) and parts of electric equipment that have been de-energized, but have not been locked or tagged out, are to be treated as if they are energized. While any employee is exposed to contact with parts of fixed electric equipment or circuits that have been de-energized, the circuits energizing the parts must be locked out.

Lockout/tagout procedures that comply with paragraphs (c) through (f) of 29 CFR 1910.147, will also be deemed to comply with the electrical standard’s lockout requirements,
provided that the procedures address the electrical safety hazards including the procedures for de-
energizing circuits. Interlocks for electric equipment may not be used as a substitute for lockout and
tagging procedures. The employer must also document the requirements for qualified employees to
release stored electric energy that might endanger personnel during the service or maintenance function.

Capacitors must be discharged and high capacitance elements must be short-circuited and grounded.
Further, the employer must control or eliminate stored non-electrical energy in devices by blocking or
relieving the energy. If a tag is used without a lock, the tag must be supplemented by at least one
additional safety measure that provides a level of safety equivalent to that obtained by the use of a lock.
Additional safety measures include the removal of an isolating circuit element, blocking of a
controlling switch, or opening of an extra disconnecting device.

Like the lockout standard, the employer must verify the electrical part is de-energized. A qualified
person must conduct tests and visual inspections, as necessary, to verify that all tools, electrical
jumpers, shorts, grounds, and other such devices have been removed, so that the circuits and equipment
can be safely energized prior to equipment start-up.

Employees exposed to the hazards associated with re-energizing the circuit or equipment must be
warned to stay clear of circuits and equipment. If the employee must work on exposed live parts, the
employee must be a qualified person. The qualified person must be capable of working safely on
energized circuits and be familiar with the proper use of special precautionary techniques, personal
protective equipment, insulating and shielding materials, and insulated tools.

**Conclusion**

Lockout is the process of blocking the flow of energy from a power source to a piece of equipment, and
keeping it blocked out by installing a lockout device at the power source.

Lockout/tagout devices must be provided by the employer and can be used only for lockout/tagout
purposes. The best protection is provided by using lockout to physically prevent energy isolating
devices from being operated during service, maintenance, or repairs. If tagout is used on equipment that
is capable of being locked out, the employer must take additional precautions to ensure full employee
protection.

The lockout/tagout standard requires that employers develop an energy control program and train
employees on their responsibilities to comply with the program’s requirements. The employer must
identify and differentiate between authorized and affected employees to assure that proper training is
accomplished. Remember, the authorized employees are those who physically lock and tag out
equipment for servicing or maintenance; the affected employees are those who work in the area where
service and maintenance is performed, but they do not perform the service and maintenance work.

The employer must recognize that there are a wide variety of energy sources on which lockout/tagout
must be used. These energy sources include electrical, mechanical, pneumatic (air), fluid and gases
(chemical), hydraulic, thermal (temperature extremes), steam, water and other fluids under pressure,
and gravity.

The employer must initiate a lockout program to address the problems associated with hazardous
energy. Avoiding accidental start-ups, electrical shock, disabling injuries, and death are only a few
good reasons to institute a program. The employer should remember that these accidents are usually the
result of taking a short cut or a misunderstanding of the equipment or responsibilities.

Instituting the use of lockout/tagout procedures can save lives, reduce operating costs, and minimize
product loss and downtime.