

Energy Control Program (Lockout/Tagout)



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OSHAcademy Course 710 Study Guide

Energy Control Program (Lockout/Tagout)

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Contact OSHAcademy to arrange for use as a training document.

This study guide is designed to be reviewed off-line as a tool for preparation to successfully complete OSHAcademy Course 710.

Read each module, answer the quiz questions, and submit the quiz questions online through the course webpage. You can print the post-quiz response screen which will contain the correct answers to the questions.

The final exam will consist of questions developed from the course content and module quizzes.

We hope you enjoy the course and if you have any questions, feel free to email or call:

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Course Introduction

Control of Hazardous Energy (Lockout/Tagout)

This course presents OSHA's general requirements for controlling hazardous energy during service or maintenance of machines or equipment as detailed in 29 CFR 1910.147, Control of Hazardous Energy. It is not intended to replace or to supplement OSHA standards regarding the control of hazardous energy.

After completing this course, you should also review the OSHA standards on the control of hazardous energy to gain a complete understanding of the requirements regarding the control of hazardous energy. These standards, as well as other relevant resources, are identified throughout this course.

Why do I need to be concerned about lockout/tagout?

It's important that you be familiar with [OSHA's Lockout/Tagout standards](#) to help save lives and avoid OSHA citations. Take a look at OSHA's top 10 most cited violations for 2015 and you will see that Lockout/Tagout ranks as the fifth most commonly cited violation!

1. Fall Protection in Construction (1926.501)
2. Hazard Communication (1910.1200)
3. Scaffolding in Construction (1926.451)
4. Respiratory Protection (1910.134)
5. **Lockout/Tagout (1910.147)**
6. Powered Industrial Trucks (1910.178)
7. Electrical – Wiring Methods (1910.305)
8. Ladders in Construction (1926.1053)
9. Machine Guarding (1910.212)
10. Electrical – General Requirements (1910.303)

Employees can be seriously or fatally injured if machinery they service or maintain unexpectedly energizes, starts up, or releases stored energy. OSHA's standard on the Control of Hazardous Energy

(Lockout/Tagout), found in Title 29 of the Code of Federal Regulations (CFR) Part 1910.147, spells out the steps employers must take to prevent accidents associated with hazardous energy. The standard addresses practices and procedures necessary to disable machinery and prevent the release of potentially hazardous energy while maintenance or servicing activities are performed.

Two other OSHA standards also contain energy control provisions: 29 CFR 1910.269 and 1910.333. In addition, some standards relating to specific types of machinery contain de-energization requirements - such as 29 CFR 1910.179(l)(2)(i)(c) (requiring the switches to be "open and locked in the open position" before performing preventive maintenance on overhead and gantry cranes). The provisions of Part 1910.147 apply in conjunction with these machine-specific standards to assure that employees will be adequately protected against hazardous energy.

Lockout/Tagout will most likely be required where you work because, after all, just about every workplace includes hazardous energy sources that could injure or kill workers.

So, let's find out more about LOTO!

Module 1: Purpose, Scope, and Application

What is the purpose of the Energy Control Program (ECP)?

Information about the Energy Control Program (ECP) is contained in [29 CFR 1910.147, Control of Hazardous Energy \(Lockout/Tagout\)](#). The purpose of the ECP is to provide written policies and rules within your safety management system that helps prevent injury to workers due to the unexpected startup of machines and equipment, or release of stored energy.

What is the scope of the Lockout/Tagout rule?

Employers must establish an energy control program, consisting of three core components: [energy control procedures](#); employee training; and periodic inspections to ensure that before service and maintenance is performed, machines and equipment that could unexpectedly startup, become energized, or release stored energy, are isolated from their energy source(s) and rendered safe.

1. [Energy control procedures](#) detail and document the specific information that an authorized employee must know to accomplish lockout/tagout, i.e., the scope, purpose, authorization rules and techniques to be utilized for the control of hazardous energy.
2. [Periodic inspections](#) of the energy control procedures ensure that the procedures are effective and the requirements of the standard are being followed.
3. [Employee training and retraining](#), along with additional training under a tagout system, ensure that the purpose and function of the energy control programs are understood by the authorized, affected and other employees.

What is "lockout/tagout"?

"Lockout/tagout" (LOTO) refers to specific practices and procedures to safeguard employees from the unexpected energization or startup of machinery and equipment, or the release of hazardous energy during service or maintenance activities.

The standard requires, in part, that a designated individual turns off and disconnects the machinery or equipment from its energy source(s) before performing service or maintenance. It also requires that an authorized employee(s) either lock or tag the energy-isolating device(s) to prevent the release of hazardous energy and take steps to verify that the energy has been isolated effectively.

If the potential exists for the release of hazardous stored energy or for the re-accumulation of stored energy to a hazardous level, the employer must ensure that the employee(s) take steps to prevent injury that may result from the release of the stored energy.

Lockout devices hold energy-isolation devices in a safe or "off" position. They provide protection by preventing machines or equipment from becoming energized because they are positive restraints that no one can remove without a key or other unlocking mechanism, or through extraordinary means, such as bolt cutters. Tagout devices, by contrast, are prominent warning devices that an authorized employee fastens to energy-isolating devices to warn employees not to re-energize the machine while he or she services or maintains it. Tagout devices are easier to remove and, by themselves, provide employees with less protection than do lockout devices.

When must a worker perform LOTO procedures?

Whenever your employees perform servicing and/or maintenance on machines or equipment, they can be exposed to the unexpected energization, startup, or release of hazardous energy. Hazardous energy sources include electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other forms of harmful energy.

Servicing or maintenance refers to constructing, installing, setting up, adjusting, inspecting, modifying, maintaining and/or servicing machines or equipment, including lubrication, cleaning or unjamming of machines or equipment, and making adjustments or tool changes, where workers could be exposed to the unexpected energization or startup of the equipment or release of hazardous energy.

The term "unexpected" also covers situations in which the servicing and/or maintenance is performed during ongoing normal production operations if:

-) A worker is required to remove or bypass machine guards or other safety devices; or
-) A worker is required to place any part of his or her body into a point of operation or into an area on a machine or piece of equipment where work is performed, or into the danger zone associated with the machine's operation.

What is Hazardous Energy?

Energy in any form becomes hazardous when it builds to a dangerous level or is released in a quantity that could injure a worker. Workers servicing or maintaining machines or equipment may be seriously injured or killed if hazardous energy is not properly controlled. Injuries resulting from the failure to control hazardous energy during maintenance activities can be serious or fatal! Injuries may include electrocution, burns, crushing, cutting, lacerating, amputating, or fracturing body parts, and others.

- J A steam valve is automatically turned on burning workers who are repairing a downstream connection in the piping.
- J A jammed conveyor system suddenly releases, crushing a worker who is trying to clear the jam.
- J Internal wiring on a piece of factory equipment electrically shorts, shocking worker who is repairing the equipment.

Forms of Energy - Electricity is not the only hazard!

Energy is the power for doing work. Energy exists in different types, but all are associated with motion. Regardless of the type, energy exists in two basic states: potential energy and kinetic energy. Tensioned objects such as suspended loads have potential energy – energy that has the opportunity for motion.

Releasing the load converts potential energy to kinetic energy, causing the load to drop.

Types of Energy

It's important to understand that electricity is not the only form of hazardous energy employees may encounter during lockout/tagout. Main energy sources that supply power to the entire machine or equipment may be electrical, but secondary energy sources such as pneumatic or mechanical energy may still be stored with the potential to cause injury. One or more of the following types of energy may require de-energization to completely isolate the equipment.

- J **Chemical.** Liquids, such as gasoline, diesel, benzene, acids, and caustics. Gases, such as propane, natural gas, and methane. Solids, such as fertilizer, wet and dry cell batteries, and combustible dust.
- J **Electrical.** Alternating (AC) and direct (DC) currents. Includes equipment and conductors at both household and industrial-voltages, photovoltaic systems, circuit breakers, transformers, capacitors, inverters, motors, and hybrid vehicles.

-) **Gravitational.** Objects such as hoisted vehicles, raised dumpster lids, objects supported by a crane, and elevated dump truck beds.
-) **Hydraulic.** Pressurized hydraulic systems, including hoses, pumps, valves, actuators, and reservoirs such as those on a forklift, in an automotive vehicle hoist, power press equipment, or an injection molding machine.
-) **Mechanical.** Sources such as a breeze rotating a wind turbine, water moving a paddle wheel, vehicle/mobile equipment movement, and a spring under compression. Extreme sound is also a hazardous mechanical energy.
-) **Pneumatic.** Pressurized air or gas systems, including pipes, pumps, valves, actuators, and pressure vessels such as those found in coating or pesticide sprayers, air compressors, and tank and pipe purging systems.
-) **Radiant.** Energy that travels by waves or particles, particularly electromagnetic radiation such as heat or x-rays. Ionizing radiation includes alpha and beta particles, computed tomography (CT) and X-rays. Non-ionizing radiation includes lasers, radio frequency (RF), and microwave (MW).
-) **Thermal.** Hot water, heated oil, steam, and equipment need time to cool, while liquefied gases, such as nitrogen, need time to warm to safe thermal levels.
-) **Explosive.** The rapid increase in the volume of energy with the generation of high temperatures and the release of gases. Supersonic explosions are called detonations. Subsonic explosions are called deflagration. A boiling liquid vapor expanding explosion is called (BLEVE).

Module 1 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. The purpose of Lockout/Tagout is to prevent injury due to the _____ startup of machines and equipment, or release of stored energy.**
 - a. unusual
 - b. regulated
 - c. unexpected
 - d. scheduled

- 2. Which of the following is not one of the three components of an Energy Control Program (ECP)?**
 - a. Energy control procedures
 - b. No-notice audits
 - c. Employee training
 - d. Periodic inspections

- 3. Which of the following is not considered as a form of energy addressed in the Energy Control Program?**
 - a. Potential
 - b. Electrical
 - c. Chemical
 - d. Psychic

- 4. Remember, hazardous energy is _____ those who need to service or maintain powered equipment.**
 - a. never far from
 - b. is a friend to
 - c. always touching
 - d. usually unknown

5. Which of the following is an example of "servicing or maintenance"?

- a. Constructing
- b. Adjusting
- c. Installing
- d. Any of the above

Module 2: Energy Control Program Components

What is management's obligation in establishing energy control procedures?

Management must develop, document, and make sure employees use specific written LOTO procedures to control potentially hazardous energy.

Are there any situations in which a worker need not develop and use a written LOTO procedure?

Yes, the employer need not develop and use a written LOTO procedure for servicing or maintenance on a particular machine or equipment, but only when all of the following elements exist:

1. The machine or equipment has no potential for stored or residual energy or re-accumulation of stored energy after shut down which could endanger employees;
2. The machine or equipment has a single energy source which can be readily identified and isolated;
3. The isolation and locking out of the energy source will completely de-energize and deactivate the machine or equipment;
4. The machine or equipment is isolated from the energy source and locked out during servicing or maintenance;
5. A single lockout device will achieve a lock-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; and
8. The employer has had no accidents involving the unexpected activation or re-energization of the machine or equipment during servicing or maintenance.

What specific elements must be documented in the LOTO procedures?

If the employer can't meet the above exception criteria, written LOTO procedures must be developed and used. The procedures for equipment with one or more sources of energy must outline the scope, purpose, authorization, rules and techniques that the employer will use to control hazardous energy. The scope might be limited to a single or group of similar pieces of equipment or machinery. The purpose of the procedures is to ensure the unexpected energization/startup or shutdown does not occur during servicing or maintenance activities. The responsible manager authorizes the procedures and ensures specific rules/techniques are listed within the procedures.

The procedures must state the means to be used to enforce compliance. Typically, this requirement is met by stating the procedure is mandatory and may result in disciplinary action if not followed.

At a minimum, the procedures must include the points listed below.

-) A specific statement of the intended use of the procedure.
-) Specific procedural steps for shutting down, isolating, blocking, and securing machines or equipment to control hazardous energy.
-) Specific procedural steps for the placement, removal, and transfer of lockout devices or tagout devices, and a description of who has responsibility for them.
-) Specific requirements for testing a machine or piece of equipment to determine and verify the effectiveness of lockout devices, tagout devices, and other energy control measures.

If an energy isolating device is not capable of being locked out, can the employer use a tagout system?

Yes, and this is very important to remember: if an energy isolating device is not capable of being locked out, the employer's energy control program must use a tagout system.

If an energy isolating device is capable of being locked out, must the employer use a lock out system?

Yes. Unless the employer can demonstrate that the tagout system will provide full employee protection. The employer may choose to use a tagout system as long as the requirements for additional training and periodic inspections are met. You'll read more about "full employee protection" in a later module.

What are the requirements for the use of tagout devices when lockout devices are NOT capable of being used?

1. The tags must be attached where the lockout devices would be.
2. The employer must demonstrate (prove) that the tagout system will provide protection at least as effective as locks and will assure full employee protection.

How does an employer demonstrate that the protection achieved using the tagout program is equivalent to the level of safety obtained by using a lockout program?

The employer must comply with all tagout-related provisions and also use additional safety measures that provide a level of safety equivalent to that obtained by using lockout. Examples include:

-) Removing and isolating a circuit element;
-) Blocking a controlling switch;
-) Opening an extra disconnecting device; and
-) Removing a valve handle to reduce the potential for any inadvertent energization while the tags are attached.

What about new or modified equipment?

All new machines and equipment, or all machines and equipment that undergo major repair, renovations or modification, must be equipped with energy-isolating devices capable of accepting a lockout device.

After January 2, 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 for such machine(s) or equipment must be designed to accept a lockout device.

Last Words

That's about it for a discussion of the basic components of the ECP. Remember, make sure all three components have been developed and deployed. If OSHA comes inspecting, they will not cut you any slack when it comes to the LOTO program because if something goes wrong, a serious injury or fatality is likely to result. Okay... time for the quiz.

Module 2 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. Written LOTO procedures are not required when _____ of the seven exception conditions listed in the text is/are met.**
 - a. Any
 - b. All

- 2. Which of the following does not need to be included in specific LOTO procedures for equipment with one or more hazardous-energy sources?**
 - a. Steps for servicing or maintenance equipment
 - b. Steps for shutting down, isolating, blocking, and securing equipment
 - c. Steps for placing, removing, and transferring LOTO devices
 - d. Equipment-testing requirements to verify effectiveness of procedures

- 3. Lockout/Tagout procedures must state the means to be used to enforce compliance.**
 - a. True
 - b. False

- 4. According to the text, what must the employer do if an energy isolating device is not capable of being locked out?**
 - a. The employer must use plastic ties instead of locks
 - b. The employer must install fail-safe controls
 - c. The employer must use a tagout system
 - d. The employer must redesign the energy isolation device

- 5. Which of the following is not considered an additional safety measure that provides a level of safety equivalent to that obtained by using lockout?**
 - a. Removing an additional circuit element
 - b. Blocking a control switch
 - c. Opening a valve
 - d. Removing a valve handle

Module 3: Training and Communication

Employee Training and Communication

The employer is required to provide effective training for all employees covered by the lockout/tagout standard and ensure that all employees understand the purpose, function, and restrictions of the energy control program. Authorized employees must possess the knowledge and skills necessary for the safe application, use, and removal of energy controls. This training also must make employees aware that disregarding or violating the energy control program could endanger their own lives or the lives of co-workers.



Training Importance

It is important to train employees so they understand the purpose and function of the energy control program and get the knowledge and skills necessary to safely apply, use and remove the energy controls. The LOTO standard requires different levels of training for the three categories of workers: authorized, affected, and other employees.

Real Life Event

A recent news report shows the importance of lockout/tagout training within a company:

Man Survives Going through a Wood Chipper

An employee at a wood chip company in Washington State, USA went through a wood chipper and survives. According to a recent television news story, Frank Arce works at a company that shreds up bark into wood chips.

In January 2014, something got stuck inside the machine and Arce went into the wood chipper to get the object. He thought everything was turned off. However, a fellow employee turned on the machine while Arce was inside.

Arce spent some time in the hospital with a broken pelvis, shattered ankle, bruised liver, broken leg and a cut that runs the length of his body on the backside. The cut was so deep, it crushed his knee. He said he received the right care quickly because of the training and help from his co-

workers at the Swanson Bark and Wood Products Company in Longview, Washington. The company paid 100% of Arce's medical bills.

The Washington State Bureau of Labor and Industries investigated the accident.

Source: KATU-TV, Portland, Oregon, January 2014.

What are the differences in the training required for the three categories?

There are three types of employees which must receive training: authorized, affected, and other. The amount and type of training that each employee receives is based upon the relationship of that employee's job to the machine or equipment being locked or tagged out and upon the degree of knowledge relevant to hazardous energy that the employee must possess.

In addition, employers are required to certify that effective training and retraining has been provided to all employees covered by the standard. The certification must contain each employee's name and dates of training.

Authorized employees lock out or tag out equipment and service or maintain the equipment. Required training for authorized employees includes:

-) How to find and recognize hazardous energy sources;
-) The types and magnitudes of energy used in the workplace; and
-) How to isolate energy sources.

Affected employees operate equipment serviced under lockout or tagout procedures or work in an area affected by the procedures. An affected employee becomes an authorized employee when the employee performs service or maintenance work on the equipment. Required training for affected employees includes:

-) The purpose of energy-control procedures.
-) How energy-control procedures are applied.
-) How energy-control procedures will protect them.

Other employees: Other employees, who work around or otherwise might be in the vicinity of equipment that is under lockout/tagout, need to receive awareness-level training about the Energy Control Program. They need to understand that if they see LOTO devices, they are not to touch them.

What are the requirements for keeping LOTO training records?

Don't make recordkeeping too complicated. Keep current training records for each authorized and affected employee. Document the employee's name and the training date.

When must your employees receive LOTO retraining?

Retrain employees when work conditions change. Authorized and affected employees must be retrained whenever:

-) their job assignments change;
-) energy-control procedures change;
-) equipment or work processes present new hazards; or
-) when they don't follow energy-control procedures.

Other triggers that indicate training may be necessary include:

-) periodic inspections reveal that there are deviations in the energy control procedure; or
-) the employer believes that there are deviations from, or inadequacies in, the employee's knowledge or use of the energy control procedures.

What is the object of the retraining?

-) To introduce new or revised control methods and procedures as necessary.
-) To re-establish employee proficiency.

Is training required annually?

No.

However, if your employees do not actually use LOTO procedures often, it's a good idea to practice the procedures at least annually.

What additional training is required when tagout systems are used?

Employers must train workers in the following limitations of tags listed below.

- J Tags are essentially warning devices attached to energy isolating devices and do not provide the physical restraint on those devices that is provided by a lock.
- J When a tag is attached to an energy isolating means, it is not to be removed without authorization and it is never to be bypassed, ignored, or otherwise defeated.
- J Tags must be legible and understandable by all workers.
- J Tags and their means of attachment must be made of materials which will withstand the environmental conditions encountered in the workplace.
- J Tags may evoke a false sense of security and their meaning needs to be understood as part of the overall energy control program.
- J Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.

Does training require certification?

Yes. The employer must certify that training or retraining took place and that the employee is kept up to date. However, if your training program aspires to conform to [ANSI Z490.1](#), Criteria for Accepted Practices in Safety, Health, and Environmental Training, you will need to certify that each employee has demonstrated proficiency in the learning environment immediately after training. After training, you will be required to certify the employee has successfully applied what they have learned in the workplace.

What information must appear on the certificate?

To meet basic Federal OSHA requirements in the USA, certification need only contain the information listed below.

-) Each employee's name.
-) The dates of training and/or retraining.

However, you are encouraged to also include a statement of proficiency as well as the employee's identification number or a unique certificate number for training. It should also contain the signature of the trainer who conducted the training.

Module 3 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. All workers must be trained to know basic hazardous-energy _____ and the purpose of the devices used to _____ hazardous energy.**
 - a. concepts, control
 - b. principles, prevent
 - c. objectives, observe
 - d. goals, monitor

- 2. Under the Energy Control Program, training is conducted for _____, _____, and _____ employees.**
 - a. management, authorized, labor
 - b. management, labor, contractors
 - c. authorized, affected, other
 - d. certified, authorized, affected

- 3. Which category of employee must know how to find and recognize hazardous energy sources, the types and magnitudes of energy used, and how to isolate energy sources?**
 - a. Other employees
 - b. Affected employees
 - c. Certified employees
 - d. Authorized employees

- 4. Which of the choices below is not a situation in which authorized and affected employees must be retrained?**
 - a. When their job assignments change.
 - b. When energy control procedures change.
 - c. When it has been one year since they were last trained.
 - d. When they do not follow LOTO procedures.

5. Which statement below is true concerning the use of tagout devices?

- a. Tags are only warning devices.
- b. Tags may be removed by affected employees once LOTO is complete.
- c. Tags only need a red diamond to indicate removal is prohibited.
- d. Tags provide equivalent security to using a lock.

Module 4: Periodic Inspections

Evaluating Written Energy-Control Procedures

An evaluation of lockout/tagout procedures is required annually and must be conducted by an authorized employee other than the person who performs the procedures. If your authorized employee(s) perform all of the lockout/tagout procedures, you might have to have a supervisor designated as an authorized employee. The supervisor can then conduct the evaluation of lockout/tagout procedures.

The purpose of the inspection is to determine that workers are following the written procedure and that the procedure is correct. Either the employer or the inspector must document each inspection with the following information:

1. The equipment on which the procedure is used.
2. The date of the inspection.
3. The workers included in the inspection.
4. The person who did the inspection.

If an inspector finds that workers are not following an energy-control procedure or that the procedure is not protecting them, those workers must be retrained and the procedural deficiencies corrected.

The authorized employee who does the inspection must understand the procedure and must not be among those following the procedure at the time of the inspection. Each procedure must be verified for its accuracy, completeness and effectiveness in energy control.

The Purpose of Periodic Inspections

The purpose of periodic inspections is to ensure that the energy control procedures continue to be implemented properly, workers are familiar with their responsibilities and any deviations or procedural inadequacies that are observed are corrected.

Reviewing a Lockout/Tagout Procedure

If the inspection covers a procedure for equipment with an energy-isolating device that can be locked out, the inspector should review the procedure with the workers who use it to service the equipment and affected employees who operate the equipment. The inspector can review the procedure with the

workers individually or in a group. An employee who is not involved in the energy control procedure should inspect the area on an annual basis.

What does the periodic inspection entail?

The employer must identify any deficiencies or deviations and correct them.

Where lockout is used, the inspector must review each authorized employee's responsibilities under the procedure with that employee (group meetings are acceptable).

Where tagout is used, the inspector must review both the authorized and affected employee's responsibilities with those workers for the energy control procedure being inspected, and the additional training responsibilities.

Hazardous energy in the workplace: a recent accident

The son of the owner of a commercial drywall construction company, an employee of the company, was preparing an aerial lift for a job and had replaced two battery terminals. He had raised the aerial boom and was reaching toward the battery compartment across the metal enclosure that houses the lift's toggle controls when the boom dropped and pinned him to the control panel. His father discovered him and summoned emergency responders but he died at the site.

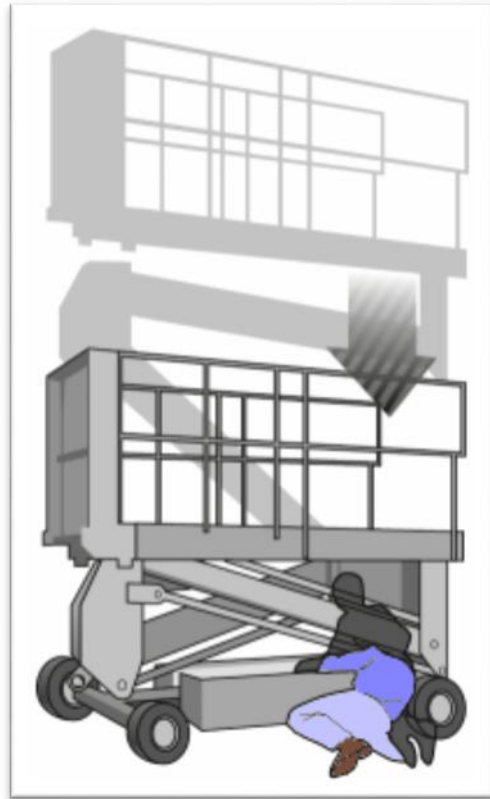
Investigation findings

1. The lift's emergency valve, hydraulic hoses and fittings, and electrical wiring were inspected after the accident and were not defective; however, the on/off key switch had been bypassed so that the operator could use the toggle switches without using the key.
 2. The battery charging system was missing a fuse that would stop the system from charging and the spring-loaded toggle switches that controlled the boom did not have guards to prevent accidental contact.
 3. The employee did not use lockout procedures while he was working on the lift and did not block the boom to prevent it from dropping.
 4. The owner had not reviewed the lift's instruction manual with the victim or other company employees.
-

5. Although the company had more than 10 employees, it did not have a safety committee.

The accident resulted in the OSHA violations listed below.

1. The employer failed to ensure that employees did not remove or tamper with required safety devices.
2. The employer did not develop, document, and require employees to use lockout procedures to control hazardous energy during maintenance work.
3. The employer had more than 10 employees but did not have a safety committee. (Oregon requirement)



Source: Oregon OSHA

Module 4 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. According to the text, the purpose of the lockout/tagout procedure inspection is to determine that: _____.**
 - a. procedures are correct
 - b. workers are following procedures
 - c. policies are communicated
 - d. a and b above

- 2. Which of the following need not be documented on the lockout/tagout procedure inspection?**
 - a. The equipment on which the procedure is used
 - b. Intent to comply with the inspection
 - c. Workers included in the inspection
 - d. Date of the inspection

- 3. As part of the inspection, each procedure must be verified for which of the following?**
 - a. Accuracy
 - b. Completeness
 - c. Effectiveness in energy control
 - d. All of the above

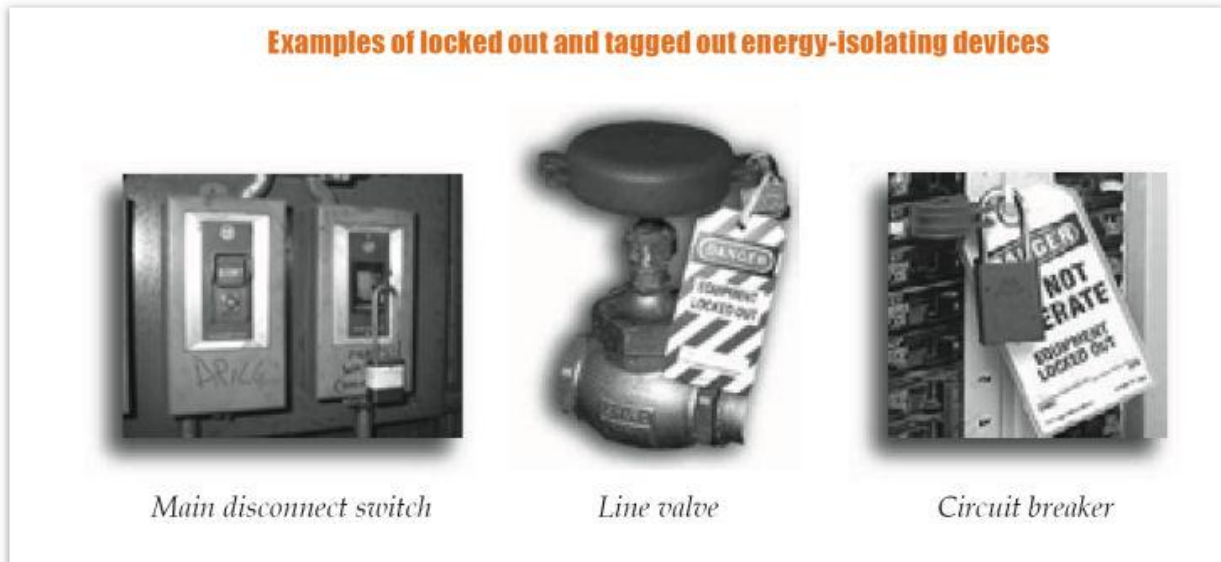
- 4. The inspector must be an authorized employee not involved in the energy control procedure being inspected.**
 - a. True
 - b. False

- 5. In the inspection, the employer must identify any deficiencies or deviations and _____ them.**
- a. correct
 - b. report
 - c. list
 - d. note

Module 5: Materials and Hardware

Lockout/Tagout (LOTO) Devices

An employer must provide locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware for isolating, securing or blocking equipment from its energy sources.



LOTO Device Requirements

Requirements for lockout/tagout devices:

- Ñ LOTO devices must be durable, so that they are capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected. Lockout devices must work under the environmental conditions in which they are used. Warnings on tagout devices must be legible even in wet, damp, or corrosive conditions.
- Ñ Must be singularly identified.
- Ñ Must be the only devices used for controlling energy.
- Ñ Must not be used for other purposes.
- Ñ Must be standardized within the facility in at least one of the following criteria: color, shape, or size. Additionally, tagout devices must be standardized as to print and format.

- Ñ Must be identifiable, in that it indicates the identity of the employee applying the devices.



Other Requirements for Lock-out

LOTO devices must be substantial enough to prevent removal without the use of excessive force or unusual techniques such as with the use of bolt cutters or other metal cutting tools.

LOTO Device Criteria

Lockout and tagout devices must meet the four criteria listed below to ensure that they're effective and not removed inadvertently.

1. **Durable:** Lockout devices must work under the environmental conditions in which they are used. Warnings on tagout devices must be legible even in wet, damp, or corrosive conditions.
2. **Standardized:** Lockout and tagout devices must be designated by color, shape, or size. Tagout devices must have a standardized print and warning format.
3. **Substantial:** Lockout devices and tagout devices must be strong enough that they can't be removed inadvertently. Tagout devices must be attached with a single-use, self-locking material such as a nylon cable tie.
4. **Identifiable:** Any employee who sees a lockout or tagout device must recognize who attached it and understand its purpose. Each lock must have a unique key or combination; this means that only the employee who uses the lock has the key or the combination to that lock.

Additional Tagout Device Criteria

- Ñ Must be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.

- Ñ Must not deteriorate when used in corrosive environments such as areas where acid and alkali chemicals are handled and stored.
- Ñ Must be standardized in print and format.
- Ñ Must be substantial to prevent inadvertent or accidental removal.
- Ñ Must have an attachment means of a non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds and having the general design and basic characteristics of being at least equivalent to a one-piece all-environment-tolerant nylon cable tie.
- Ñ Must warn against hazardous conditions if the machine or equipment is energized.
- Ñ Must include a legend such as: Do Not Start, Do Not Open, Do Not Close, Do Not Energize, Do Not Operate.

Module 5 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. LOTO devices must be _____, so that they are capable of withstanding the environment to which they are exposed.**
 - a. useable
 - b. painted
 - c. durable
 - d. rust-proof

- 2. Warnings on tagout devices must be legible even when wet, damp, or corroded.**
 - a. True
 - b. False

- 3. Which of the following is not one of the requirements for suitable lockout and tagout devices?**
 - a. Must be singularly identified
 - b. Must be used for other purposes
 - c. Must be used only for controlling energy
 - d. Must be standardized

- 4. Which of the following is true about LOTO devices?**
 - a. Must be easily removed in an emergency
 - b. May be used for any purpose if necessary for the procedure
 - c. May be applied without being locked if approved
 - d. Must be substantial to prevent removal without excessive force

- 5. Tagout devices must have a minimum unlocking strength of no less than ___ pounds.**
 - a. 30
 - b. 40
 - c. 50
 - d. 60

Module 6: Application of Energy Control Devices

Basic Steps in Controlling Energy

To control hazardous energy, you have to prevent it from being transmitted from its source to the equipment that it powers. You can accomplish this by doing the following:

- Ñ identify energy sources;
- Ñ de-energize equipment by isolating or blocking the energy sources;
- Ñ dissipate potential (stored) energy that could affect the equipment;
- Ñ lock out the equipment's energy-isolating device; and/or
- Ñ tag out the energy-isolating device only if you can't lock it out.

To safely apply energy controls to machines or equipment (using either lockout or tagout devices), authorized workers must perform certain procedures, in a specific order.

Preparing for Shutdown

The first step in controlling energy is to identify equipment in your workplace that needs service or maintenance. Determine the form of energy that powers the equipment, including potential energy that may remain when the energy source is disconnected. Label the energy sources so that workers will know what equipment is powered by each energy source.

Before an authorized or affected employee turns off a machine or equipment, the authorized employee must have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.

Shutting Down Machinery or Equipment

The machine or equipment must be turned off or shut down using the procedures established for it to avoid any additional or increased hazards to workers as a result of the unexpected machine or equipment startup or stoppage.

Machine or equipment isolation: All energy-isolating devices that are needed to control the machine's energy source must be located. These devices must then be used to isolate the machine or equipment from its energy source(s).

De-energizing equipment means isolating it from its energy source and controlling potential energy so that no energy can flow to the equipment. The method you use to de-energize equipment depends on the form of energy and the means available to control it.

Below is a list of safe practices for de-energizing equipment.

- Ñ Disconnecting motors from the equipment
- Ñ Isolating electrical circuits
- Ñ Disconnecting equipment from energy sources
- Ñ Blocking the fluid flow in hydraulic, pneumatic, or steam systems with control valves or by capping or blanking the lines.
- Ñ Blocking equipment parts that could be moved by gravity

Stored energy must be released after equipment has been de-energized. Below is a list of possible sources of stored energy.

- Ñ Capacitors
- Ñ Coiled springs
- Ñ Elevated machine members
- Ñ Rotating fly wheels
- Ñ Air, gas, steam, chemical, and water systems

If the energy could return to a hazardous level, make sure that it remains isolated from the equipment until all service work is finished. Below is a list of safe practices for dissipating potential energy.

- Ñ Vent pressurized fluids until internal pressure levels reach atmospheric levels.

- Ñ Discharge capacitors by grounding them.
- Ñ Release or block tensioned springs.
- Ñ Ensure that all moving parts have stopped completely.

Energy-Isolating Devices

Energy-isolating devices prevent energy from being transmitted from an energy source to equipment. Energy-isolating devices are the primary means for protecting those who service equipment. Examples of energy-isolation devices include:

- Ñ manually operated electrical circuit breakers;
- Ñ main disconnect switches;
- Ñ line valves; and
- Ñ blocks.



Applying Lockout/Tagout Devices

An energy-isolating device is effective only when no one can accidentally restart the equipment. Locking out is a procedure for securing an energy-isolating device in an off, closed, or neutral position. When an energy-isolating device is locked out, a worker can safely service hazardous equipment. A lockout device — typically a lock with a unique key or combination — secures the energy-isolating device in a safe position. When an energy-isolating device is locked out, the equipment it controls will not work until the lockout device is removed.

Similarly, tagging out is a procedure for placing a warning tag or sign — a tagout device — on an energy-isolating device. Remember, tagout devices must control hazardous energy at least as

effectively as lockout devices. Since tagout devices do not provide the same physical barrier to hazardous energy as lockout devices, it is harder to ensure (or prove to OSHA) that tagout devices are as effective as lockout devices. Bottom line: If you can lock it out, do not use tags.

Key Criteria When Applying Lockout/Tagout Devices

- Ñ Lockout or tagout devices must be attached to each energy-isolating device by authorized workers.
- Ñ Lockout devices, where used, must be attached in a manner that will hold the energy isolating devices in a "safe" or "off" position.
- Ñ Where tagout devices are used, it must be attached in a manner that will clearly indicate that the operation or movement of energy isolating devices from the "safe" or "off" position is prohibited.
- Ñ If the tag cannot be attached directly to the energy isolating device, the tag must be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.
- Ñ A tagout device must be securely fastened to the energy-isolating device and must state that the equipment being serviced can't be operated until it is removed.

Lockout or tagout? How do you decide?

If you can lock out an energy-isolating device, then you must lock it out before you service the equipment that it controls. If you can't lock out an energy-isolating device, then you must tag it out. Remember that you must ensure that the hazardous energy is controlled just as effectively with the tagout device as it would be with a lockout device.

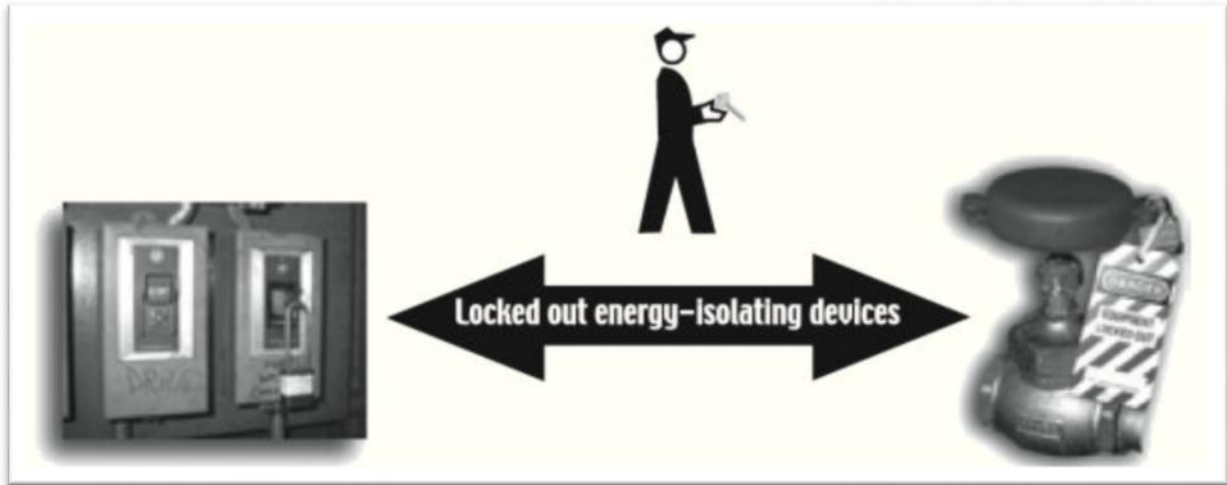
Releasing Stored Energy

After the energy-isolating device has been locked out or tagged out, all potentially hazardous stored or residual energy must be relieved, disconnected, restrained, and otherwise rendered safe.

Verifying Machinery or Equipment Isolation

Each authorized employee must place his or her personal lock on each energy-isolating device before beginning service work. Service work involving many workers and many energy-isolating devices can make traditional lockout complicated.

Before any work begins on machines or equipment that have been locked out or tagged out, an authorized employee must verify that the machine or equipment has been properly isolated and de-energized.



Module 6 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. To control hazardous energy, you have to prevent it from being transmitted from its _____ to the _____.**
 - a. machinery, equipment
 - b. equipment, source
 - c. source, equipment
 - d. input, output

- 2. What is the first step in controlling energy on equipment that needs maintenance in your workplace?**
 - a. Identify equipment
 - b. Energize equipment
 - c. Apply LOTO devices
 - d. Dissipate potential energy

- 3. During shutdown, what must be located to control the equipment or machine's energy source?**
 - a. All LOTO devices
 - b. All energy-isolating devices
 - c. Electrical energy-isolating devices
 - d. Primary LOTO devices

- 4. A lockout device is typically a: _____.**
 - a. circuit breaker
 - b. tag with plastic tie
 - c. disconnect switch
 - d. lock with unique key or combination.

- 5. After the energy-isolating device has been locked out or tagged out, only known hazardous stored or residual energy must be relieved, disconnected, restrained, and otherwise rendered safe.**
- a. True
 - b. False

Module 7: Release from Lockout/Tagout

Basic Steps for Release from Lockout/Tagout

OSHA's Lockout/Tagout standard includes requirements for releasing machines or equipment that have been locked out or tagged out prior to restoring energy to the equipment and using it.

Before lockout or tagout devices are removed, and energy is restored, there are some procedures the authorized employee must follow:

1. The work area must first be inspected to ensure that nonessential items (e.g., tools, spare parts) have been removed and that all of the machine or equipment components are operationally intact.
2. The work area must then be checked to ensure all workers have been safely positioned or have cleared the area. In addition, all affected workers must be notified that the lockout or tagout devices have been removed before the equipment is started.
3. Each lockout or tagout device must be removed from the energy-isolating device by the employee who applied the device.

Your employer can authorize another employee to remove the device if that employee is trained to do so and follows a documented alternative energy-control procedure.

Alternative Steps for Release from Lockout/Tagout

There are some things an employer must do if a worker who didn't apply the lockout/tagout device actually removes the device.

The person in charge must accomplish the three actions listed below.

1. Verify that the authorized employee who applied the device is not at the facility.
2. Make all reasonable efforts to contact the authorized employee to inform him/her that his/her lockout or tagout device has been removed.
3. Ensure that the authorized employee knows that the lockout device has been removed before he/she resumes work at the facility.

Testing Machinery or Equipment

In some circumstances, workers need to temporarily restore energy to a machine or piece of equipment during servicing or maintenance to test and /or reposition the machine or piece of equipment. Lockout or tagout devices may be removed temporarily in order to perform these tasks. However, it is important to know that you may not use an abbreviated procedure during the release - test - restore sequence. You must use full lockout/tagout procedures anytime you release from lockout/tagout or restore equipment after testing and positioning.

What sequence of action must occur in the temporary removal of the lockout/tagout devices?

1. The machine or equipment must be cleared of tools and materials.
2. Workers must be removed from the machine or equipment area.
3. All lockout or tagout devices may then be removed.
4. Authorized workers may then proceed to energize and test or position the equipment or machinery.
5. Following testing or positioning, all systems must be de-energized and energy control measures reapplied to continue the servicing and /or maintenance.

Release after Long-Term Shutdown

You should have an additional energy-control procedure to protect workers if they must restart equipment after long-term shutdowns. Determine who will be responsible for monitoring any lockout and tagout devices that control energy to the equipment. Include steps in the procedure for protecting workers if they need to remove or change parts while the equipment is shut down. Do not restart equipment until you are absolutely certain that it is working properly.

Module 7 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. Before lockout or tagout devices are removed, and energy restored, what must the authorized employee do first?**
 - a. Clear the area of all non-essential workers.
 - b. Inspect and clear the area of non-essential items.
 - c. Remove warning signs.
 - d. Install energy-isolating devices.

- 2. Prior to release from lockout/tagout, who must be notified that lockout or tagout devices have been removed?**
 - a. Immediate supervisor
 - b. All employees
 - c. All other employees
 - d. All affected employees

- 3. Which of the following is not required before a worker (other than the one who applied the lockout/tagout device) can remove the device?**
 - a. The other employee must be trained.
 - b. The authorized employee is not available.
 - c. The authorized employee cannot be contacted.
 - d. The authorized employee must first give permission.

- 4. Lockout or tagout devices may be removed temporarily in order to perform equipment tests or repositioning.**
 - a. True
 - b. False

5. According to the text, for long-term shutdowns, the employer should also include procedures for protecting workers who perform which of the following tasks?

- a. Removing or changing parts while equipment is shut down
- b. Cleaning equipment and machinery during the night shift
- c. Conducting training using equipment on weekends
- d. Performing quarterly equipment inspections

Module 8: Sub-Contractors, Group Lockout/Tagout, and Shift Changes

Working with Contractors

Whenever contractors and other outside servicing personnel perform tasks covered by the Lockout/Tagout standard, they must adhere to all the OSHA standard's requirements. The host employer and the contractor or outside employer must inform each other of the other's respective lockout or tagout procedures.

The host employer and the contractor must understand one another's lockout and tagout procedures. Make sure you review the contractor's energy-control program before the contractor does any on-site work. The host employer's workers must also understand and comply with the contractor's energy-control program.

Note: If you hire a one-person "independent contractor," he or she may claim they do not have to comply with State or Federal OSHA standards. They may be right, if they are not required to participate in a workers' compensation system. However, that does not relieve you, as the general or host employer, from legal liability. Make sure you require all contractors, no matter what their business status is, to adhere, at a minimum, to OSHA standards. If the contractor puts up a fuss, I personally would not do business with the contractor.

If the sub-contractor is using their own LOTO procedures, the on-site general contractor or host employer must ensure that his or her workers understand and comply with the restrictions and prohibitions of the contractor or outside employer's energy control program.

Group lockout

In many workplaces a group of authorized workers may need to service equipment that has several energy sources and several energy-isolating devices. In these instances, group lockout may be used. Under group lockout, protection must be used which affords the employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device.

The primary responsibility for a set number of employees working under the protection of a group lockout or tagout device must be vested in a single authorized employee. In other words, under group lockout, just one designated person in the group assumes responsibility for securing each energy-isolating device. However, each authorized employee should be assured of his or her right to personally verify that the hazardous energy has been isolated and/or de-energized.

Variations in Group Lockout

There are a number of variations of group lockout; the group lockbox variation reduces the number of locks and makes it easier for workers to coordinate their activities.

If there will be more than one crew, department, or group involved in the activity, a single authorized employee must be designated to coordinate affected workforces and to ensure continuity of protection. For these more complicated energy-control systems, group lockout can reduce the number of lockout devices that workers must use. Here's an example: Ten workers do maintenance on a machine that has five energy sources that need to be isolated.

- Ñ Traditional lockout requires 50 locks. (Each employee places a lock on each energy-isolating device.)
- Ñ Group lockout requires 15 locks. (A designated person in the group places a lock on each energy-isolating device. Each authorized employee places a lock on the group lockbox.)

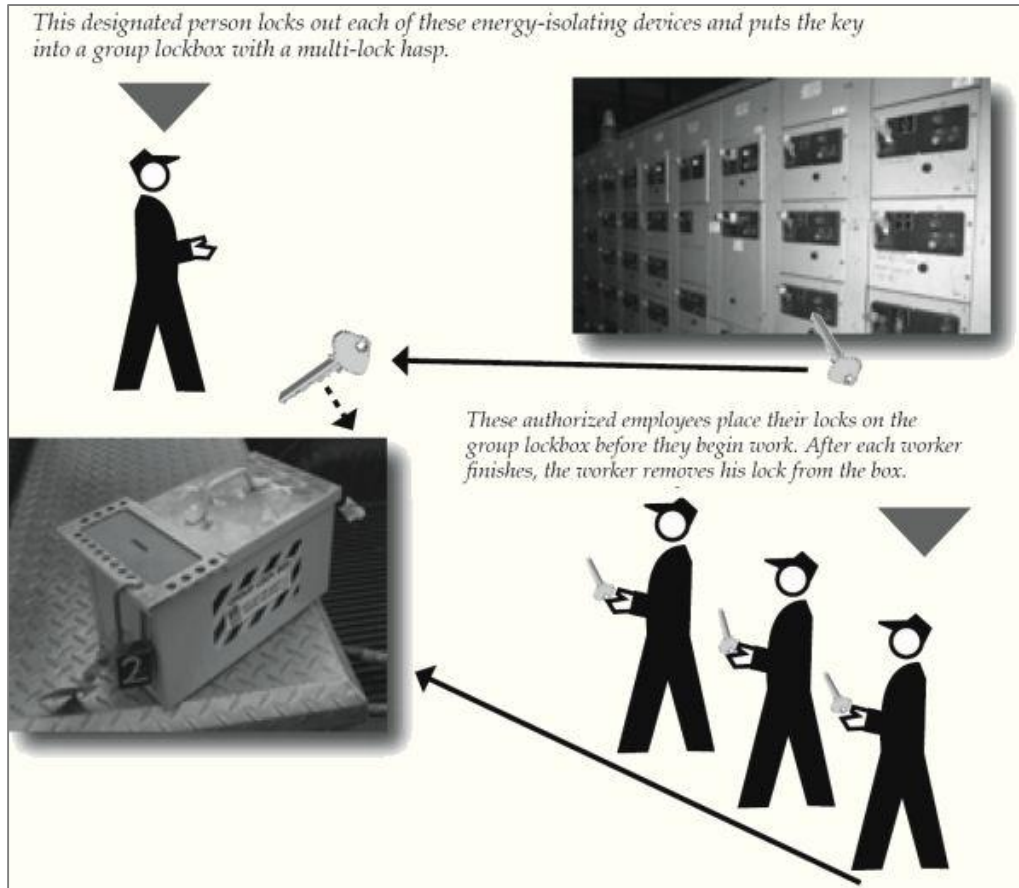
Group lockout can also reduce the risk of injury for service and maintenance workers, contractors, and other affected workers who don't regularly work with complicated energy-control systems.

Master Lockbox: The lockbox into which all keys and tabs from the lockout or tagout devices securing the machine or equipment are inserted and which would be secured by a “job-lock” during multi-shift operations.

Example of a Group Lockout Procedure - the Group Lockbox Variation

1. A designated, authorized employee in the group secures each energy-isolating device with a personal lock.
2. The same authorized employee places the key that fits each lock in a group lockbox with a multi-lock hasp.
3. The other authorized workers in the group secure the lockbox — they attach their personal locks to the box — before beginning their service work.
4. After each employee finishes service work on the equipment, that employee removes his personal lock from the lockbox.

5. After all the workers have finished their service work and removed their personal locks from the lockbox, the authorized employee who placed the key in the box removes it.
6. The authorized employee uses the key to remove the lock on each energy-isolating device.



Shift Change Procedures

A high percentage of accidents occur shortly after a shift change and are often due to a lack of communication. Therefore, employers must make sure that there is a continuity of lockout or tagout protection. This includes the orderly transfer of lockout or tagout device protection between outgoing and incoming shifts to control hazardous energy.

-)] When lockout or tagout devices remain on energy-isolation devices from a previous shift, the incoming shift members must verify for themselves that the machinery is effectively isolated and de-energized.
-)] The off-going shift personnel should meet oncoming personnel at the lockout/tagout device.

-)] The oncoming authorized employee should place his/her lock or tag on the energy isolating device before the exiting authorized employee removes his /her lock or tag. If this is not possible, the oncoming authorized employee should place his/her lock or tag on the energy isolating device immediately after the exiting authorized employee removes his/her lock or tag.
-)] The exiting employees should inform oncoming employees of any problems or concerns regarding the service and maintenance of machinery or equipment.

Module 8 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. Whenever contractors and other outside servicing personnel perform tasks covered by the Lockout/Tagout standard, they must adhere to all the OSHA standard's requirements.**
 - a. True
 - b. False

- 2. Under group lockout, _____ in the group assumes responsibility for securing each energy-isolating device.**
 - a. just one designated person
 - b. one or more designated persons
 - c. one designated and one other person
 - d. all persons

- 3. _____ should be assured of the right to verify that the hazardous energy has been isolated and/or de-energized.**
 - a. the primary authorized employee
 - b. the lockout/tagout supervisor
 - c. each authorized employee
 - d. each affected employee

- 4. A high percentage of accidents occur _____ a shift change and are often due to a lack of communication.**
 - a. shortly before
 - b. before and after
 - c. during
 - d. shortly after

- 5. During a shift change, the oncoming authorized employee should place his or her lock on the energy isolating device before the exiting authorized employee removes his or her lock.**
- a. True
 - b. False