

Hazardous Energies Control and Lockout/Tagout Program

Responsible Administrator: EHS Safety Specialist
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1. Program Description

It is our goal at the University of California at Irvine (UC Irvine) to control hazardous energies in the workplace to the greatest extent feasible. UC Irvine has developed a Hazardous Energies Control and Lockout/Tagout Program to ensure that their employees' health is protected from hazardous energies in the work environment. UC Irvine is required by Cal/OSHA regulations to provide and maintain a Hazardous Energies Control and Lockout/Tagout Program for all operations where employees may be potentially exposed. This written program is available, upon request, to any UC Irvine employee.

2. Scope

This program applies to the installation, service, maintenance, or removal of any type of machinery, equipment, or components, in which the unexpected start-up or release of stored energy could cause injury.

This program is applicable to all employees at UC Irvine. The purpose of this program is to prevent injuries and accidents from occurring while:

- Servicing or maintaining machinery or equipment that is capable of sudden energy releases; and
- Working with machinery or equipment that is capable of storing hazardous energy.

Note: Stored energy may be in the form of electricity (capacitors), air pressure (pneumatic), liquid pressure (hydraulic), springs, or potential energy of position, but is not limited to the above.

This program requires a systematic approach to servicing and maintaining equipment and machinery and strives to ensure the safety of all UC Irvine personnel and contractors, and compliance with the applicable regulations. This approach involves: following approved and written equipment-specific procedures to shut down and lock out equipment and machinery, dissipating all hazardous energy, blocking parts where necessary, and verifying that the energy has been controlled before all work is initiated.

Persons who fail to follow established written procedures for lockout of equipment and machinery, or who fail to take appropriate steps to protect the safety of all persons who are performing work under locked out conditions are subject to disciplinary action. This includes persons performing lockout that are not previously trained and authorized, working on the UC Irvine campus, who do not follow established policies and procedures.

No employee shall install, service, remove, or perform electrical or mechanical maintenance on any electrical equipment or machinery until that equipment is turned off or de-energized, all stored hazardous energy has been bled down, dissipated, or blocked off, and the machinery has been locked out and blocked as provided in the section below.

Such work may be performed on circuits and systems operating at a sustained voltage of less than 30 volts or where there is no risk of exposure to electric arcs or burns without locking out the electrical energy source.

Lockout is required for mechanical service and maintenance operations if the procedures to be performed could involve employee exposure to energized electrical parts, to machinery that could unexpectedly start up, or to a stored energy source on the equipment or machinery.

Servicing or maintenance on equipment that is powered through an electrical cord and plug shall be worked on with the cord unplugged. The person performing the work must have exclusive control of the plug at all times. If necessary, this can be accomplished by applying some form of a plug lock or cord cap lock-over device that is secured with the worker's personal lock and tag.

3. Definitions

Affected and Other Employee – Any employee in an office or industrial setting who works around outlets, electrical panels, or electrical switches, and whose job requires them to be near or around the hazard zone (but not within the hazard zone) when equipment is being serviced or maintained under a locked-out or tagged-out condition. For example, a machine operator that cannot use a machine that is being serviced under lockout/tagout is considered an “affected” employee because the machine cannot be used. Office staff that may be working on computers in an area where equipment is being serviced or maintained during a lockout/tagout are considered Other Employees. Affected and Other Employees must be instructed never to attempt to re-start or re-activate equipment that is locked out or tagged out.

See also the definition for “Authorized Lockout/Tagout Employee”.

Assigned Individual Lock - A padlock or combination lock issued to an employee for which no other person has the key, combination, or means of opening without using destructive force. The lock shall be uniquely identified and shall not be used for any other purpose.

Authorized Lockout/Tagout Employee - A person who has completed the required Lockout/Tagout (Control of Hazardous Energy) training and is authorized to lockout or tagout a specific machine or equipment to perform service or maintenance. They must also receive training on equipment specific procedures for their work unit.

"Capable of Being Locked Out" - An energy isolating device will be considered capable of being locked out if it is designed with a hasp or other means of attachment to which, a lock can be affixed, or if it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy-isolating device or permanently alter its energy control capability. An appropriate lockout attachment, designed for such an application, is available through a supplier.

Energy Forms:

Electrical – Low voltage is when the potential is greater than 30 volts RMS or direct current, but less than 600 volts; high voltage is when the potential is greater than 600 volts; high current is when 25 amperes or greater exists at any voltage

Chemical – Explosion, pressure, extreme heat, fire, corrosive, reactive, oxidizer, toxic

Pressure – greater than one atmosphere, can be in the form of pneumatic pressure, hydraulic pressure, or liquid pressure Vacuum – less than one atmosphere

Ionizing Radiation – greater than 2 milliRem per hour

Non-Ionizing Radiation – Ultraviolet greater than the ACGIH TLV, Infrared, RF/Microwave, Laser, Magnetic Fields Potential – Flywheels, springs, differences in elevation, elevated parts that could drop, capacitors, batteries.

Energy Isolating Device - A mechanical device located at an energy control point that positively blocks the flow of energy and can be locked in the “safe” position. Push buttons, selector switches, software controls, interlocks, and other control circuit devices are not considered energy isolating devices.

Hazardous Energy - Energy, if not controlled, of such a magnitude that it is capable of causing harm to a person, death, or loss of resources.

Hazardous Energy Control - The process of systematically implementing mechanical means to prevent hazardous energy from flowing to a person. This includes using mechanical means to achieve the following conditions:

Isolated - A condition where all sources of hazardous energy have been controlled by breaking the energy path so that the energy cannot flow to workers. The term “isolated” is commonly used with electrical circuits and fluid lines.

Dissipated - A condition where all stored energy has been reduced to a non-hazardous level. Most commonly used with energy storing devices such as capacitors, pressure receivers, or springs.

Blocked - A condition where a mechanical device is inserted into the energy path to physically prevent movement. Most commonly used with mechanical machinery or fluid filled lines.

Hazard Zone - The space around a source of hazardous energy where a person could be harmed if the hazardous energy was suddenly or unexpectedly released, such as the unexpected release of stored pressure, the unexpected movement of a machine, or the spray from a hazardous chemical that was unexpectedly released.

High Voltage System - Associated electrical conductors and equipment operating at or intended to operate at a sustained voltage of more than 600 volts.

Lockout - The method of applying a mechanical lockout device and a tag on an energy-isolating device by an authorized employee in accordance with established written procedures, to control hazardous energies.

Lockout Device - Padlocks, combination locks, or other methods (such as disconnecting conductors or removing fuses), which will effectively prevent unexpected or inadvertent energizing of a designated circuit or release of equipment or machinery. These devices shall not be used for other purposes and shall include a means to indicate the identity of the employee applying the device.

Low Voltage System - Associated electrical conductors and equipment operating at or intended to operate at a sustained voltage of 600 volts or less.

Normal Production, Normal Production Operation - Using a machine or piece of equipment for its intended or designed production function. If a machine or piece of equipment is not actively producing its product, it is not considered to be in production.

Qualified High Voltage Electrical Worker - A person who has a minimum of two years of training and experience with high voltage circuits (> 600 volts) and equipment and who has demonstrated he/she is familiar with the work to be performed and the hazards involved. A Qualified High Voltage Electrical Worker will actually be performing the electrical work and must also complete EHS High Voltage Safety Awareness training and receive training on equipment specific procedures for their work units.

Also refer to [UC Irvine's High Voltage Safety Program](#).

Tagout - The placement of a tagout device on an energy-isolating device in accordance with established written procedures to control hazardous energy. Using tagout as a form of hazardous energy control is not a positive means of controlling hazardous energy and shall not be used whenever lockout is possible.

Tagout Device - A prominent warning tag capable of being securely attached that provides a warning not to use the equipment. The tag should include: reason for tag, name of person placing the tag and how that person may be contacted, and date the tag was placed. Tags must be durable and able to withstand the environment to which they are exposed for the maximum time exposure is expected. These tags shall not be used for other purposes.

Stored Energy Source - Any device that is capable of holding energy after equipment shutdown. This includes, but is not limited to, capacitors, tanks, pipes, springs, and flywheels.

4. Responsibilities

Supervisor responsibilities in Facilities Management and in other departments that perform Lockout/tagout procedures

- Supervisors are responsible for ensuring that all Affected Employees (including new and transferred employees) are trained in the safety significance, purpose, and use of these lockout/tagout procedures.
- Supervisors are responsible for ensuring all Authorized Lockout/Tagout Employees receive the appropriate level of training and that these employees are provided with the proper equipment and personal protective equipment (PPE) to perform the job safely.
- Supervisors are responsible for ensuring that only Qualified High Voltage Electrical Workers work on high voltage systems (>600 volts), and only Authorized Lockout/Tagout Employees work on systems that contain hazardous voltages equal to or below 600 volts.

SOS Representatives (SR's) Responsibilities

The SOS Representative in Facilities Management and in other Departments who are performing lockout/tagout work, in partnership with EH&S and their supervisor, are responsible for assigning a Lockout/Tagout Coordinator in their Department. In some cases, the SOS Representative may also share the role of supervisor and Lockout/Tagout Coordinator.

Lockout/Tagout Coordinator is responsible for:

- Writing equipment specific lockout/tagout procedures and completing annual reviews;
- Ensuring that only Authorized Lockout/Tagout Employees perform lockout/tagout operations on necessary equipment;
- Maintaining an inventory of all equipment in their department that requires equipment specific lockout/tagout procedures;
- Receiving the appropriate training to become an Authorized Lockout/Tagout Employee and perform lockout/tagout procedures on equipment; and

- Purchasing or installing equipment and machinery to ensure that this equipment or machinery has the capability to accept a lockout device on all energy isolating devices. This will include, but is not limited to, electric power disconnect devices that can be locked only in the open (OFF) position, fluid control components (e.g., valves) that can be locked in the safe position, or fluid lines that have the capability to place a mechanical barrier between a hazardous fluid and the point where work must be performed. Whenever major replacement, repair, renovation, or modification of machines or equipment is to be performed, energy isolating devices for such machinery or equipment shall be installed and be designed to accept a locking device so they are capable of being locked out.

Environmental Health and Safety (EH&S) Responsibilities

EH&S is responsible for:

- Assisting Facilities Management and other departments on campus who perform electrical work, to interpret the standards and regulations as they apply to the work being performed;
- Assisting Facilities Management and other departments in writing equipment specific lockout/tagout procedures;
- Assisting in the coordination of appropriate training for Authorized Lockout/Tagout Employees and providing training for the assigned Lockout/Tagout Coordinator;
- Overseeing and managing the implementation of the intent of this program and resolving any situations not directly addressed by this program; and
- Providing needed support to complete annual review of all electrical work, including lockout/tagout procedures for specific equipment and high voltage switching procedures written by UC Irvine Facilities Management and other departments.

5. Program Components

Sequence of Hazardous Energies Control Procedure

1. The Authorized Lockout/Tagout Employees performing the work, as well as their supervisor, must create the work plan, written lockout procedures, and physically locate and identify all isolating devices to be sure which switches, valves, or other energy isolating devices apply to the equipment to be locked out.
2. Employees authorized to lockout/tagout equipment must be certain which switch or other energy isolating devices apply to the

equipment to be locked out.

- All energy isolating devices must have labels identifying the equipment supplied and the type and magnitude of energy isolated.
 - CAUTION: Any questionable identification of electrical energy sources must be cleared by the employees with their supervisor before proceeding.
3. Notify all Affected and Other Employees as necessary that a lockout is to be performed. These persons must be informed that they are not to disturb the lockout device or attempt to re-start the equipment until they are informed that the lockout has been cleared and it is safe to resume normal operations.
 4. If the equipment is in operation, shut it down using the normal shutdown procedure. Turn the equipment off if there is an off/on switch.
 5. Open the circuit breaker, disconnect switch or other energy-isolating device (i.e., turn it to the "OFF" position). Toggle switches, push buttons, and other types of control switches are not energy isolating devices.
 6. All energy-isolating devices must be locked out. Lockout the circuit breaker, disconnect switch, or other isolating device in the open ("OFF") position with an assigned individual lock, and attach an identifying tag to the lock. If it is impossible to use a lock, refer to the "Procedure When Physical Locking Is Impossible" section.
 7. For electrical equipment which has capacitors that must be manually discharged to assure safe work, open access panels and discharge these capacitors with an appropriate discharge tool and follow directions in the equipment manual or maintenance procedures. This must only be accomplished by a Authorized Lockout/Tagout Employee or Qualified High Voltage Electrical Worker who is authorized to perform such work.
 8. All forms of stored energy must then be dissipated (except for batteries which can be disconnected). This may include relaxing any springs, relieving any pressure or vacuum, allowing flywheels to come to rest, or neutralizing or adequately removing any chemicals.
 9. Any parts that could inadvertently move during the procedure must be blocked in place to prevent this movement. Blocking must be secured in place so that it cannot be inadvertently removed or fall out.

10. At this point it must be verified that all forms of hazardous energy have been reduced to zero potential. If the work to be performed involves de-energized electrical equipment, this equipment must be tested with some form of test equipment to verify that there is no electrical energy present. Other forms of energy also require verification of zero potential. Examples of such means of verification include: observing a pressure gauge for zero pressure (gauge) or vacuum, observing a multi-meter showing zero volts, observing a spring in a relaxed state, observing that a flywheel is not spinning, or using litmus paper or a measuring device to verify that a chemical is no longer present or hazardous.

- The final step is to attempt to re-start or re-energize the equipment or machinery to verify an isolated condition. If the equipment does not re-start, then work can proceed. If the equipment re-starts or it appears that energy has been allowed to flow into the system, there could be a serious flaw in the procedure, and no work should proceed until the problem is identified and appropriate steps are included in the procedure to control this energy.
- The equipment is now locked out. Work may now begin.

Situations Involving More Than One Person Locking Out

Employees and/or contractors must engage in a group lockout situation. If more than one employee works on the equipment, a lockout adaptor suitable for the installation of several locks must be used, enabling all workers to lock out the machine with their individual locks.

Procedure Involving Personnel Changes During the Job

Persons being replaced or exchanged on a job during a shift or at the end of a shift must ensure that the lock(s) and tag(s) of his/her replacement are substituted for his/her own before leaving the job.

If a lockout procedure is to continue through the following work shift, the oncoming work crews must place their locks and tags on the energy isolating devices before the departing crew removes their locks and tags. Before work begins on the subsequent work shift, the oncoming crew must re-verify that all safety devices, such as blocking, are in place, that there is still zero energy in the system, and they should attempt to restart or re-energize the system before anyone enters the hazard zone.

Procedure When Work Is Left Unfinished

Locks, tags, and all other safety warning devices must be left in place during all short absences such as breaks or trips to pick up parts.

When work is incomplete and temporarily suspended overnight or over a weekend, all locks, tags, and other safety warning devices must be left in place.

When work is suspended for more than a weekend, the equipment or machinery must be tagged as out of service, permanently disconnected from all energy sources, and must have its cover and access panels reinstalled. All locks and other tags must be removed.

Procedure When One Employee Leaves the Area Without Removing Lock

When an employee leaves the facility site and does not remove his/her lock(s) from the energy isolating device(s) (for example, if the employee became sick and left the site) then the responsible supervisor must attempt to contact that employee to determine if he/she will be able to return to remove the lock. If it is verified that the equipment is ready to be returned to service, and the employee is unavailable or cannot return, the supervisor must complete the [Abandoned Lock Removal Authorization Form \(Appendix A\)](#), then cut the lock(s) off the energy isolating device(s).

Once the employee returns to the work site, that person must be informed that their lock was removed and the status of the equipment that was locked out (e.g., returned to service, still under lockout, etc.).

Procedure When Physical Locking Is Impossible

When it is impossible to use a lock, a tagout device must be used in lieu of a lockout along with another positive means of disconnecting the circuit, equipment, or machinery. This can include unplugging the equipment (or locking out the plug), disconnecting the conductors, or removing fuses.

All other steps of the process are the same as those listed above for lockout. A tagout device must be placed on the plug, conductors, disconnect switch, fuse brackets, or other positive means employed.

Procedure When Machine Testing Is Required During a Lockout

On some machines, it may be necessary to energize or start up machinery or equipment during a lockout procedure to tune, adjust, or make measurements before the machine is fully restored to service. In those instances, all persons must clear the hazard zone of all tools and equipment, leave the hazard zone, verify that all persons are clear of any hazards, remove the necessary locks, and then the equipment can be energized. A qualified person must then make the necessary measurements or adjustments and the equipment shut down. The locked-out condition must then be re-established by repeating the exact same work steps specified on the written procedure for fully locking out the equipment.

Lock Out Requirements for Specific Situations

Work on pressure or vacuum systems:

- For pneumatic systems, (e.g., generally where compressed air is used to perform some mechanical function).
- Pneumatic systems are generally used to provide some force for mechanical movement. For isolating such a system, it may be more logical and convenient to isolate (block) and lockout the mechanical portion of the energy path. If servicing or maintenance is to be performed on the pneumatic system itself, the compressor pump must be turned off and locked out and the air receiver or system depressurized before work can begin.

Work on Electrical Power Systems or Equipment:

Work on de-energized electrical equipment or systems must be accomplished by person(s) who are Authorized Lockout/Tagout Employees. Electrical energy must be locked out at a disconnect switch that positively interrupts the circuit supplying the electricity or the equipment is physically disconnected from the source of electricity. Interlocks, software controls, relays, or other control circuit devices are prohibited for use to control hazardous electrical energy for servicing or maintenance. The equipment or circuits must be verified to be de-energized with a test meter or other type of testing device before work is to begin.

Restoring Equipment to Service:

The restoration procedure is specified in the written lockout procedure below, and must perform in the exact sequence stated:

1. Remove all blocking and replace any critical parts removed during the lockout procedure.

2. Ensure that all tools or equipment have been removed from the hazard zone.
3. Close and secure all cover panels and doors. If all panels or doors cannot be closed, which may occur when testing, place barricades or rope-off a safety zone with non-conductive material and post prominent warning signs around the area.
4. Advise all Affected and Other Employees that the system is to be re-energized.
5. Ensure all persons are clear of the equipment to the normal condition.
6. Remove locks and tags. NOTE: Ordinarily, only the person who placed the locks and tags may remove them. If the person who placed the locks and tags is not available, only his/her supervisor may cut off the locks and tags, after personally ascertaining it is safe to do so.
7. Energize the equipment and restore the equipment to the normal condition.
8. Notify all Affected and Other Employees that the lockout condition has been cleared.

This program does not cover the following conditions:

- Certain tasks, such as minor tool changes and adjustments that are part of normal production operations and can be accomplished without removing protective guards or with the use of tools where the employee is not potentially exposed to hazardous energy or inadvertent startup of the equipment.
- Work on electrical equipment or systems where the work must be done on exposed, energized electrical parts or where there may be a potential for electric shock or electric burns. This type of work is to be done only after responsible supervision has determined that the work must be performed with the equipment energized. Only Authorized Lockout/Tagout Employees will be allowed to perform energized electrical work while wearing appropriate protective equipment using approved work techniques.

Enforcement

Supervisors and managers of Authorized Lockout/Tagout Employees shall periodically audit their employees on the job to ensure compliance with lockout procedures.

Employees who fail to adhere to lockout and tagout procedures are subject to disciplinary action.

Program Review

Each hazardous energy control procedure must be inspected at least annually to verify its effectiveness. The Lockout/Tagout Coordinators, together with EH&S, who is not actively participating in the lockout procedure being evaluated, must perform this review. The completed review form will be retained as certification that the required review has been accomplished.

The reviewer must review with each Authorized Lockout/Tagout Employee, participating in the lockout procedure, their responsibilities under the written hazardous energy control procedure. The inspection shall be certified in accordance with the [Hazardous Energy Control Procedure Review Checklist \(Appendix B\)](#).

Any observed deviations from the written lockout procedure or inadequacies in the employee's required knowledge or understanding of their responsibility under the procedure will be noted on the audit form. Refresher training must be conducted to correct these deficiencies.

No employee shall install, service, remove, or perform electrical or mechanical maintenance on any electrical equipment or machinery unless he/she is trained, and "Authorized" for the specific tasks to be performed, which shall include the specific lockout procedures necessary for that task.

6. Reporting Requirements

There is no requirement to report information to any agency.

7. References

- California Code of Regulations, 8 CCR 3314, "Cleaning, Repairing, Servicing, and Adjusting Prime Movers, Machinery, and Equipment"
- Federal OSHA 29 CFR 1910.147 - The Control of Hazardous Energy (Lockout/Tagout)