
CONTROL OF HAZARDOUS ENERGY – LOCKOUT/TAGOUT PROGRAM

I. Purpose

To provide protection for employees who are servicing and maintaining machines and equipment in which the unexpected energization or start up of the machines or equipment, or the release of stored energy could cause injury to employees.

II. Scope

The Control of Hazardous Energy - Lockout/Tagout (LOTO) program applies to all faculty, staff and students; including supervisors, full time, part time and temporary employees who have been designated as authorized employees, affected employees or other employees that may be associated with equipment/machinery being locked out or tagged out.

When an outside contractor, working at or for the University is engaged in work and/or processes that require LOTO they shall follow their own company LOTO program which shall conform to the requirements of OSHA Standard 29 CFR 1910.147, Control of Hazardous Energy. If the outside contractor's work requires the assistance of university personnel, then the contractor shall follow any additional requirements set forth in WPI's policy and coordinate with WPI personnel to ensure a safe multi-employer work environment. Contractors not requiring the assistance of university personnel must fully comply with all OSHA Lockout/Tagout requirements and the guidelines set forth in the Worcester Polytechnic Institute Contractor Safety and Environmental Management Program found at the following URL:

www.wpi.edu/+ehs

III. Application

This program applies to the control of hazardous energy during servicing and/or maintenance of machines and equipment 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 an area on a machine or piece of equipment where work is performed (point of operation) or where an associated danger zone exists during a machine operating cycle.

This program does not apply to the following:

- Work on cord and plug connected electric equipment for which exposure to the hazards of unexpected energization, stored energy or start up of the equipment is controlled by the unplugging of the equipment from the energy source and by the plug being under the exclusive control of the employee performing the servicing or maintenance.
- Minor tool changes and adjustments, and other minor servicing activities, which take place during normal production operations, are not covered by this OSHA standard if they are routine, repetitive, and integral to the use of the equipment for production, provided that the work is performed using alternative measures which provide effective protection.
- Hot tap operations involving transmission and distribution systems for substances such as gas, steam, water or petroleum products when they are performed on pressurized pipelines, provided that the employer demonstrates that continuity of service is essential; shutdown of the system is impractical; and documented procedures are followed, and special equipment is used which will provide proven effective protection for employees.

- Installations under the exclusive control of electric utilities for the purpose of power generation, transmission and distribution, including related equipment for communication or metering, which is covered by OSHA Standard 29 CFR 1910.269
- Exposure to electrical hazards from work on, near, or with conductors or equipment in electric utilization installations, which is covered by OSHA Standards 29 CFR 1910.301-1910.399 (Electrical-Subpart S).

IV. Definitions

The following definition section includes a few selected OSHA defined terms from the OSHA standard 29 CFR 1910.147 – definitions which will help clarify sections of this Program. Please refer to the OSHA standard for a complete listing of definitions.

Affected employee – An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

Authorized employee – A person who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered under this section.

Capable of being locked out – An energy-isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which a lock can be affixed, or 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.

Energized – Connected to an energy source or containing residual or stored energy.

Energy isolating device – A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: A manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors, and, in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.

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

Hot tap – A procedure used in the repair, maintenance and services activities which involves welding on a piece of equipment (pipelines, vessels or tanks) under pressure, in order to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.

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

Lockout device – A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds.

Servicing and/or maintenance – Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy.

Setting up – Any work performed to prepare a machine or equipment to perform its normal production operation.

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

Tagout device – A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

V. Procedures

Minimum requirements:

The following are minimum requirements for the use of energy isolating devices whenever maintenance or servicing is done. They shall be used to ensure that the machine or equipment is stopped and isolated from all potentially hazardous energy. Additionally, they will serve as a guideline to protect workers from the inadvertent release of hazardous energy.

Locking devices and tags shall be used when employees are performing maintenance or service to any machine or system where unexpected or unintentional motion could cause harm. Locking devices shall also be used when guards or other safety devices must be removed during service or when moving or energized parts put any part of the employee's body at risk of injury. Examples of conditions where locking and tagging should be used may include, but are not limited to:

- Clearing blocked or jammed mechanical equipment.
- Maintenance or repair work on equipment with moving parts (Refer to the Worcester Polytechnic Institute Machine Safety Program).
- Confined space entries (Refer to the Worcester Polytechnic Institute Confined Space Program).
- Repairs or installation of electrical equipment.

If the equipment being serviced must be temporarily re-activated (for example, to test the equipment as part of the installation) all start-up and lockout procedures must be followed.

Specific Instructions for Hazardous Machinery:

Specific instructions shall be developed for the locking and tagging of machinery or equipment under the following conditions:

- When the machine being serviced has the potential for stored or residual energy, or the re-accumulation of stored energy after shut down
- When the machine has multiple energy sources

- When the isolation and locking of the machine will not completely deactivate it
- When the machine cannot be locked out
- When a single lockout device will not achieve a lockout condition
- When a cord or plug will not be under the exclusive control of the authorized employee performing the service.

Working Without a Lock:

Generally, working without a lock is not allowed at WPI. However, under special circumstances, if a lock cannot be applied to the equipment, and the LOTO Coordinator can demonstrate that the tagging procedure will provide a level of safety equivalent to that obtained by the use of a lock, a tag may be used instead. A tag used without a lock shall be supplemented by one additional safety measure that provides a level of safety equivalent to that obtained by the use of a lock. Additional safety methods may include the removal of an isolating circuit element, blocking of a control switch, opening of an extra disconnecting device or the removal of a valve handle to reduce the likelihood of inadvertent activation. The tagout device shall be attached to the same location that the lockout device would have been attached. Employees working without a lock must be trained in accordance with Section VII of this Program and receive specific approval from EHS.

Implementing Lockout/Tagout:

Employees shall implement an orderly shutdown of machinery to avoid any additional or increased hazards resulting from equipment stoppage. The following is a list of steps to be used during shutdown.

1. Preparing for Shutdown

- Identify the types of energy and sources
- Notify affected employees of intent to service equipment

2. Shutting Down the Equipment

- Turn off equipment
- Deactivate energy
- Release all stored or residual energy
- Attach locking and tagging devices
- Verify that the equipment is secure and deactivated

3. Preparing to Return Equipment to Service

- Remove all tools from the equipment
- Inspect the controls to verify they are in the “off” position
- Remove all locking and tagging devices
- Re-energize the equipment
- Notify affected employees when machine is back in service

Preparation For Shutdown:

1. Identification of the Energy Type or Source

- Determine where and how equipment is being energized. Since some equipment is powered by several sources (e.g., electrical, mechanical, pneumatic, chemical, thermal and hydraulic), all energizing sources shall be identified.
- For complex equipment, refer to the manufacturer's control diagram detailing the locations of all isolating points.
- These points may include breaker panels, switches and valves. Furthermore, possible residual energy and methods used to dissipate or restrain that energy shall be identified. In addition to identifying energy sources, the employee must determine the magnitude of the energy, the hazards of the energy to be controlled and the methods or means to control the energy. If authorized employees are unable to determine each form of energy, they must consult their supervisors before work is started.

2. Notification of employees

- Affected & other employees must be notified by authorized personnel of the intent to service equipment. Notification shall be given before LOTO controls are applied and should contain the name and job titles of authorized employees, location of equipment being serviced, and duration/date of service.

Shutdown of Equipment/Machine:

1. Shut Off Equipment

- If the machine or equipment is operating, employees shall shut it down by the normal stopping procedures (depress the stop button, open the switch, close valve, etc.).

2. Deactivate the Energy

- Disconnect the device from all energy sources and release all residual energies that may present a hazard.
- Inspect the equipment to ensure all energy sources are disconnected.

3. Release of Stored or Residual Energy

- Release stored or residual energy, such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems and pressurized systems (air, gas, steam, chemical, or water). If energy is incapable of being released, the employee shall reposition, block or utilize some other protective measure to prevent the release of residual energy while service is in progress.

4. Attach a Lock and Tag

- Attach a lock and tag, of designated color, type and descriptive warning, on each disconnecting means used to de-energize circuits and equipment on which work is to be performed. The lock shall be attached to prevent persons from operating the equipment. Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use. Additionally, tags shall be attached to all points where equipment or circuits can be energized. If multiple

employees are servicing the same equipment, each shall attach their own lock to a multiple lock plate so as to give each employee the same level of protection.

5. Verify that equipment is secure and deactivated
 - Test the deactivation of the equipment to ensure that equipment cannot be energized and potential energy sources secured. The following steps detail the minimum requirements for proper verification:
 - Check that no personnel are exposed.
 - Verify the isolation of equipment by operating the push button or other normal operating controls.
 - Secure all switches to prevent movement to the “on” or “start” position.
 - Check pressure gauges to ensure de-pressurization of lines.
 - Test electrical circuits to confirm zero voltage.

Note: All employees should consider equipment to be operable at all times except when they have personally locked it out.

Returning Equipment to Service:

After service has been completed and the machine is ready to be tested or returned to service the following steps must be completed.

1. Inspect the machine and work area.
 - Inspect the machine(s) to insure that non-essential materials have been removed and the machine is in operating order.
 - Visual inspections shall be conducted to ensure that tools and equipment are removed and secured safeguards are in place; and blocks, pins and chain (used during the lockout) are removed (Refer to the Worcester Polytechnic Institute Machine Safety Program).
 - Employees shall verify all equipment components are fully assembled and operational.
 - Employees shall inspect the work area to ensure that all employees have been safely positioned or removed from the area.
2. Inspect the controls
 - Verify the controls are in a neutral or “off” position.
3. Remove the lock devices
 - Each lock shall be removed by the authorized employee that applied it or under his/her direct supervision. If the authorized employee is absent from the work place then the lock or tag can be removed by a qualified person designated to perform this task provided that the immediate supervisor:
 - Verifies that the employee is not present and therefore unable to remove the lock
 - Makes all reasonable efforts to inform the authorized employee that the lockout/tagout device has been removed.

4. Re-energize the machine
 - After completing the above steps, restore the energy to the machine.
5. Notify affected & other employees
 - Notify affected employees that the servicing or maintenance is completed and the machine or equipment is ready for use.

VI. Responsibilities

Department Managers and Supervisors:

- Identify all potentially dangerous equipment capable of releasing hazardous energy during maintenance in work areas or facilities under their control.
- Implement all provisions of the Control of Hazardous Energy – LOTO Program for work areas under their control.
- Develop and maintain equipment specific LOTO procedures for equipment and machinery and provide a copy to each authorized employee performing LOTO.
- Identify persons authorized to implement LOTO procedures and assure that each person attends training provided by EHS or their designee.
- Report all workplace injuries, unsafe conditions and near-misses to EHS.
- Instruct authorized LOTO personnel regarding the applicability of this plan to their respective area.
- Provide proper locking and tagging equipment including locks, tags, multiple lock holders, etc.
- Provide equipment specific LOTO training to all authorized employees prior to their performing LOTO activities.
- Conduct and document annual inspections of the equipment specific LOTO procedures.

Authorized Employees:

- Adhere to the requirements of the Control of Hazardous Energy – LOTO Program.
- Complete all safety training requirements and comply with documentation procedures.
- Complete equipment specific LOTO training prior to performing LOTO activities.
- Follow guidelines referenced in this plan to protect themselves and others from the release of hazardous energy.
- Ensure the security of their issued locking devices.
- Report all workplace injuries, unsafe conditions and near misses to their supervisors and/or EHS.

Affected Employees:

- Never attempt to operate or repair equipment that needs servicing and/or maintenance.
- Notify the appropriate maintenance staff when equipment needs servicing and/or maintenance.
- Follow all instructions given by the authorized employees to ensure personal and facility safety.

Other Employees (*Faculty, Staff and Students who are not authorized or affected employees*):

- Never attempt to operate or repair equipment that needs servicing and/or maintenance.
- Follow all instructions given by authorized employees, affected employees or supervisors to ensure personal and facility safety.

Office of Environmental Health & Safety:

- Provide consultation to assist in the identification of equipment where LOTO should be utilized.
- Review this Program annually and revise as needed.
- Make a copy of this document available on the EHS website and provide a hard copy, upon request, to each affected department for distribution to all individuals who are authorized by the department to perform maintenance on energized equipment.
- Perform periodic safety inspections of LOTO procedures and recommend action to correct conditions of non-compliance.
- Investigate and document all reported accidents and/or near-miss accidents that are directly or indirectly related to the locking and tagging of equipment.
- Shall provide or coordinate scheduling with an approved designee to provide training and retraining to all authorized and affected employees.

VII. Training Requirements

Worcester Polytechnic Institute shall provide training to ensure that the purpose and function of the energy control program are understood by employees and that the knowledge and skills required for the safe application, usage, and removal of the energy controls are acquired by employees.

Each authorized employee shall receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control. Each affected employee shall be instructed in the purpose and use of the energy control procedure. All other employees whose work operations are or may be in an area where energy control procedures may be utilized, shall be instructed about the procedure, and about the prohibition relating to attempts to restart or reenergize machines or equipment which are locked out or tagged out.

When tagout systems are used, employees shall also be trained in the following limitations of tags:

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

Employee Retraining:

- Retraining shall be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in machines, equipment or processes that present a new hazard, or when there is a change in the energy control procedures.
- Additional retraining shall also be conducted whenever a periodic inspection or whenever the employer has reason to believe that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedures.
- The retraining shall reestablish employee proficiency and introduce new or revised control methods and procedures, as necessary.

VIII. References

U.S. Department of Labor. OSHA Standard 29 CFR 1910.147, Control of Hazardous Energy. Occupational Safety and Health Administration.