

LOCKOUT/TAGOUT FOR MACHINES & EQUIPMENT: WRITTEN PROCEDURES

(For assistance, please contact EHS at (402) 472-4925, or visit our web site at <http://ehs.unl.edu/>)

Introduction

During normal operation, guards must be in place to protect employees from contacting moving or dangerous parts of machines or equipment that could lead to entanglement, amputation/laceration, and pinching, pinning, crushing, or other injury. However, it may be necessary to remove or inactivate guards during maintenance and repair operations. In these situations, a lockout/tagout (LO/TO) program must be observed, which typically includes development and implementation of written equipment and task-specific LO/TO procedures, as well as other program requirements. See EHS SOP, ***Lockout/Tagout for Machines & Equipment: Program Overview***.

Regulatory Basis

The content of this SOP and UNL's LO/TO program is based on the Occupational Safety and Health Administration (OSHA) general industry standard, 29 CFR 1910.147, *The Control of Hazardous Energy*.

Overview of Written LO/TO Procedures

As a general rule, specific procedures must be documented for each piece of equipment subject to LO/TO. Written procedures are not required if ALL of the following conditions are met:

- The machinery/equipment has no potential for stored or residual hazardous energy or re-accumulation of stored energy after shutdown;
- The machinery/equipment has a single energy source which can be readily identified and isolated;
- The isolation and locking out of that energy source will completely de-energize and deactivate the machinery/equipment;
- The machinery/equipment is isolated from the one identified energy source and locked-out during servicing or maintenance;
- A single lockout device will achieve a locked-out condition;
- The lockout device is under the exclusive control of the "Authorized Employee" performing the service or maintenance;
- The servicing or maintenance does not create hazards for other employees;
- There have been NO accidents involving the unexpected activation or re-energization of the machine or equipment during prior servicing or maintenance.

While written procedures are not required if ALL of the above conditions are met, all mandatory LO/TO steps (as previously discussed) must be completed in the prescribed order. See EHS SOP, ***Lockout/Tagout for Machines & Equipment: Special Circumstances***.

LO/TO Procedural Steps

Steps to effectively accomplish a LO/TO state are listed below and depicted in the flow charts at the end of this SOP (reprinted from OSHA). Each step must be accomplished in the stated order, and captured/described in a written LO/TO procedure. All affected and authorized employees must receive LO/TO training, including procedures specific to their work. See EHS SOP, ***Lockout/Tagout for Machines & Equipment: Training & Inspections***.

- Step 1: Identify Hazardous Energy
- Step 2: Communicate
- Step 3: Shut-down
- Step 4: Isolate
- Step 5: Apply LO/TO device(s)
- Step 6: Relieve Stored Energy
- Step 7: Verify
- Step 8: Service
- Step 9: Inspect
- Step 10: Remove LO/TO
- Step 11: Communicate
- Step 12: Restart

Hazard Identification

The first step in LO/TO involves identifying all forms of potentially hazardous energy associated with the specific machinery/equipment and task at hand. This involves evaluating and understanding all potentially hazardous energy sources (remember, there may be more than one), including: potential magnitude of damage and injuries that each energy source could cause, if uncontrolled; and isolation point(s) for each type of hazardous energy. Types of energy to consider include electrical, hydraulic, pneumatic, thermal, chemical, mechanical, gravity, and radiation energy.

Communicate

All affected employees who work on or near machinery/equipment that is the subject of a LO/TO procedure must be informed of the intent to apply LO/TO. They must be advised to refrain from attempts to restart the equipment/machine or other action that may adversely affect safety during the duration of the LO/TO. They must be informed of the person who is responsible for the LO/TO and the method that will be used to notify them when the LO/TO is complete.

Shut-down

Shut down must be conducted using the standard procedures established for the machine or equipment (not emergency procedures or other shortened/simplified method).

Isolate

After shutdown of the machinery/equipment, the next step is to physically locate and operate all energy isolation devices. An energy isolation device is “a mechanical device that, when utilized or activated, 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, bolted blank flange, and bolted slip blinds;
- A block (e.g., a safety block); or
- Any similar device used to block or isolate energy.

Push-buttons, selector switches, safety interlocks and other control circuit type devices are NOT energy isolation devices. Programmable logic controllers (PLCs) are used in many machine applications. These circuit control devices are NOT considered energy-isolating devices for purposes of the LO/TO standard.

Apply LO/TO device(s)

After applying or activating an energy isolation device, the next step is to apply LO/TO devices to every energy isolation device. Tagout devices can be used in lieu of lockout devices only in very limited situations, generally, only when an energy isolation device is not capable of being locked out. A Lockout Device is 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 energizing of machinery or equipment. Included in this category are blank flanges and bolted slip blinds.

- LO/TO devices must be **personal** (labeled to identify the NAME of the specific employee who is authorized to apply and remove it).
- LO/TO devices must be **unique/distinct and durable**. LO/TO devices can be used for no purpose other than controlling hazardous energy sources. LO/TO devices used must be standardized according to color, shape, or size. Devices must be able to withstand harsh environments and not easily removed (require excessive force and special tools (e.g., bolt cutters) to defeat).

Relieve Stored Energy

Following application of LO/TO apparatus to all energy-isolating devices, all potentially hazardous stored or residual energy must be relieved, disconnected, restrained, or otherwise rendered safe. Stored energy must be relieved in

accordance with manufacturer's recommendations or recognized industry standards.

Verify

The last step to take before actually conducting the repair/service work is to verify that the LO/TO procedures and devices have effectively isolated and de-energized all energy sources associated with the machinery/equipment. Verification must consider both primary and stored-energy sources. If there is potential for build-up of energy during the service/maintenance/repair, the verification must be on-going throughout the entire service/maintenance/repair period.

Usually, verification must include both visual inspection and physical testing. Visual inspection involves confirmation that switches, valves, breakers, etc. have been properly moved to and secured in the "off" or "safe" position. Visual inspection also verifies that LO/TO and other protective devices have been applied to the control points in a manner that prevents unsafe movement of the switches or valves. Additionally, a visual inspection is used to verify that isolation has taken place by determining that all motion has stopped and all coasting parts such as flywheels, grinding wheels, saw blades, etc. have come to rest.

In the majority of situations, visual inspection techniques must be accompanied by physical testing to ensure that the steps taken to isolate hazardous energy have worked successfully to isolate the energy from the machinery/equipment. Physical tests are conducted with appropriate instruments (e.g., voltmeters, combustible gas indicators, bleeder valves, etc.) or techniques (i.e., flange-breaking) and may also involve deliberate attempts to start-up the machine/equipment.

When an instrument is used as part of the verification process, it must be checked for proper operation before and after being used to check the effectiveness of energy isolation and LO/TO. This will ensure that the instrument is reliable. It is also important to maintain the instrument in accordance with manufacturer's recommendations.

Service

All service/maintenance should be conducted only by qualified individuals who are knowledgeable of the machinery/equipment and in accordance with manufacturer's specifications and/or industry standards, as applicable.

Inspect

After the service/repair work is complete, and before LO/TO devices are removed and energy is restored to machinery/equipment, the work area must be inspected to ensure that:

- Non-essential items have been removed from the machine and operating area;
- Machinery/equipment components are operationally intact; and
- Employees are safely positioned.

Remove LO/TO

Once it has been determined through the inspection process that a safe condition exists and guards have been replaced or properly re-positioned, LO/TO devices may be removed by the authorized employee who placed them.

Communicate

Affected employees should then be notified that LO/TO devices have been removed. This communication must occur before the equipment/machine is restarted and only after inspection confirms a safe condition.

Restart

The machinery/equipment should be restarted using the appropriate start-up sequence and procedures.

Written Procedures

Appendix A to this SOP contains an adaptation of OSHA's typical, minimal lockout procedure (29 CFR 1910.147, Appendix A), which supervisors can use as a guide in developing written procedures.

Periodic Review

Supervisors must periodically (at least annually) review written procedures & observe employees performing tasks to verify continued efficacy and employee adherence to LO/TO procedures. The OSHA standard requires documentation of such review to include:

- Date of review;
- Name of the person conducting the review;
- Identification of the machinery/equipment/procedure that was reviewed;
- Name(s) of employee(s) involved in the review (generally the name(s) of the employee(s) who were actually implementing the procedure).
- Description of any deficiencies in the procedure or implementation of the procedure and corrective actions taken.

The review must include discussion with "Authorized" and "Affected Employees" to reinforce each employee's responsibilities relative to the procedure.

Figure 3-2a: Implementation of Lockout/Tagout (Part 1)

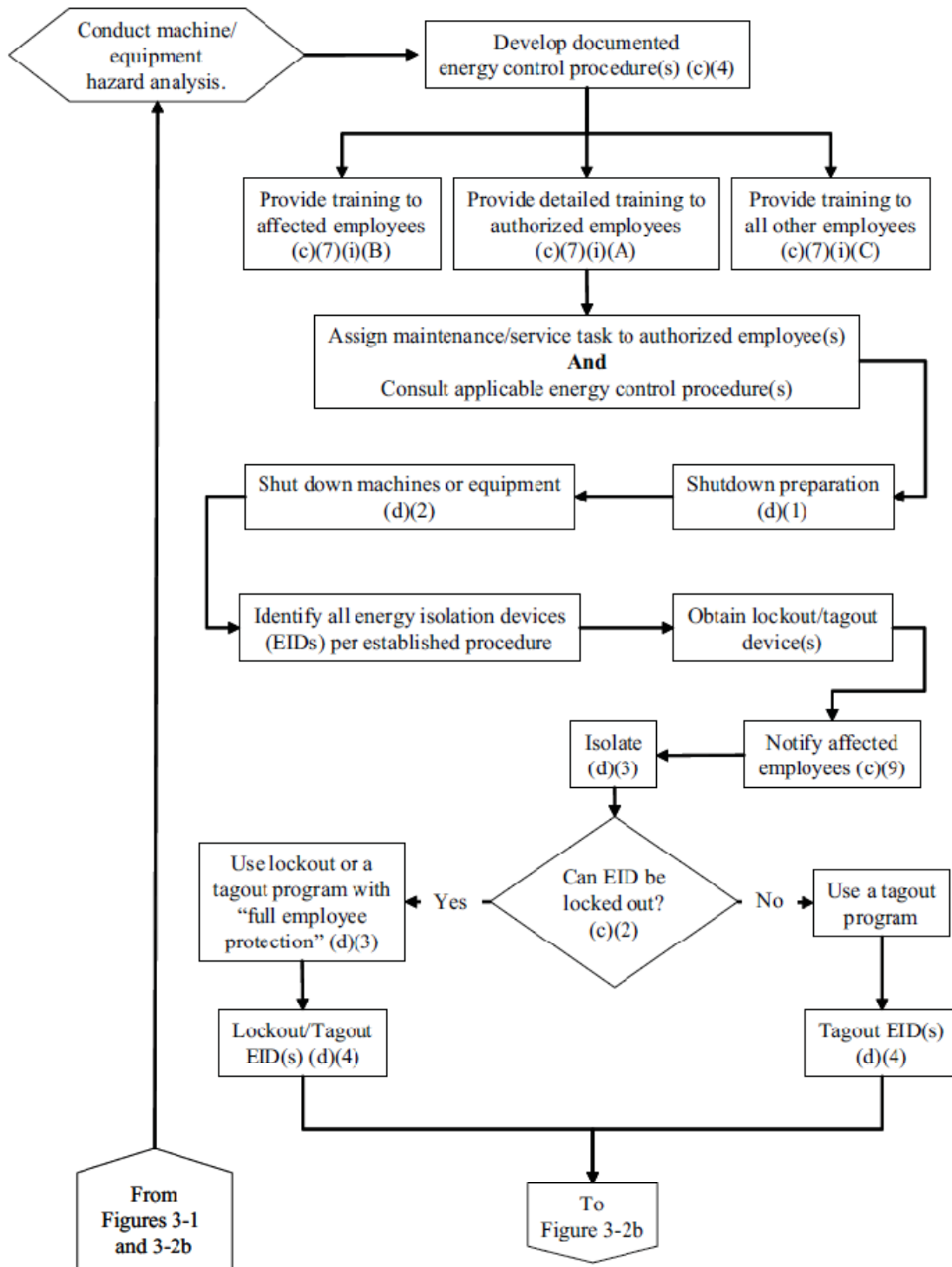
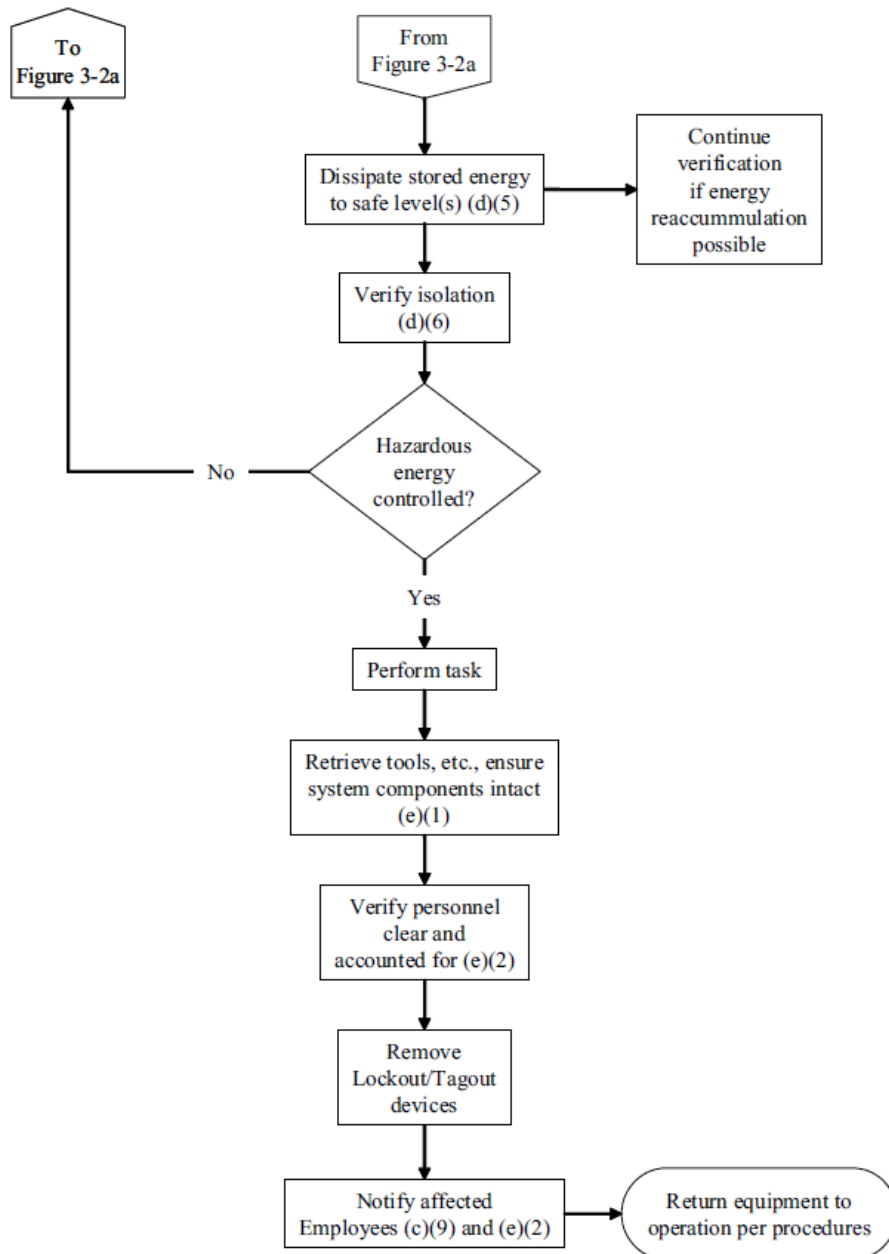


Figure 3-2b: Implementation of Lockout/Tagout (Part 2)



This flow diagram does not constitute the exclusive or definitive means of complying with the standard in any particular situation. It is presented solely as an aid. Also, it does not include paragraph (f) *Additional requirements*.

Appendix B: OSHA Typical, Minimal LO/TO Procedures

Applicability

Department	
Equipment/Machine (Name/make/model or description (attach photo if desired, as well as diagrams of controls, hazardous points-of-operation, etc.).	
Equipment Location	
Author of this Procedure	
Date of this Procedure	

Purpose

This procedure establishes the minimum requirements for the lockout of energy isolating devices whenever maintenance or servicing is done on the specified machine/equipment. It shall be used to ensure that the machine or equipment is stopped, isolated from all potentially hazardous energy sources, and locked out before employees perform any servicing or maintenance where the unexpected energization or start-up of the machine or equipment or release of stored energy could cause injury.

Compliance With This Program

All affected and authorized employees are required to comply with the restrictions and limitations imposed upon them during the use of lockout. Authorized employees are required to perform the lockout in accordance with this procedure. All employees, upon observing a machine or piece of equipment which is locked out to perform servicing or maintenance shall not attempt to start, energize, or use that machine or equipment. Failure to adhere to this procedure may result in injury to personnel or damage to equipment and may result in severe disciplinary action in accordance with existing UNL Human Resource Policies and Procedures.

Authorized Employees Trained to Perform this Procedure

Name	Job Title

Sequence of Lockout

(1) Notify all affected employees (as listed below) that servicing or maintenance is required on the machine or equipment and that the machine or equipment must be shut down and locked out to perform the servicing or maintenance.

Names/Job Titles	Method of Notification

(2) Identification of Hazardous Energy: Hazardous energy associated with this machine or equipment is described below and must be known by the authorized employee. The authorized employee shall refer to the company procedure to identify the type and magnitude of the energy that the machine or equipment utilizes, shall understand the hazards of the energy, and shall know the methods to control the energy. Consider all forms of potentially hazardous energy associated with the machine or equipment, such as: electrical, hydraulic, pneumatic, thermal, chemical, mechanical, gravity, and radiation energy.

Type of Energy (e.g., chemical, thermal, mechanical, etc.)	Magnitude	Hazards of the energy considering type and magnitude (e.g., electrocution, amputation, etc.)	Danger Zone(s) and Isolation Point(s)

(3) Shut-down: If the machine or equipment is operating, shut it down by the normal stopping procedure. Types and locations of machine/equipment operating controls are summarized below. Recommendation: Attach copy of schematic showing location of operating controls.

Operating Control Description	Location

(4) Isolate: De-activate the energy isolating device(s) so that the machine/equipment is isolated from the energy source(s). Recommendation: Attach copy of schematic showing location of energy isolating devices.

Description of Energy Isolating Device	Location

(5) Apply LO/TO. Lock out the energy isolating device(s) with assigned individual lock(s).

(6) Relieve Stored Energy: Stored or residual energy (such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure, etc.) must be dissipated or restrained by methods such as grounding, repositioning, blocking, bleeding down, etc.

Type of Stored Energy	Method to Dissipate or Restrain

(7) Verify: Ensure that the equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verify the isolation of the equipment as described below (include make/model or description of test equipment). If operating controls are activated, return them to the neutral or "off" position after verifying the isolation of the equipment. Use visual and physical verification methods.

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(8) Service: Conduct service in accordance with manufacturer's or industry specifications.

Restoring Equipment to Service

When the servicing or maintenance is completed and the machine or equipment is ready to return to normal operating condition, the following steps shall be taken.

(9) Inspect: Check the machine or equipment and the immediate area around the machine to ensure that nonessential items have been removed and that the machine or equipment components are operationally intact. Check the work area to ensure that all employees have been safely positioned or removed from the area. Verify that the controls are in neutral and guards/interlocks/safety devices have been repositioned.

(10) Remove the lockout devices and energy-isolating devices.

(11) Notify affected employees that the servicing or maintenance is completed.

(12) Restart the machine/equipment using appropriate start-up procedures.

Annual Review Documentation

Date of Review	Name of Reviewer	Persons observed implementing procedure	Changes Needed (describe in text box below)

Change Summary:

Date	Summary of Changes