

# Risk Management Services

## Lockout/Tagout

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## **INTRODUCTION**

### **PURPOSE**

The purpose of this Health and Safety Instruction (HSI) is to prevent injury to employees by potentially hazardous energy when machines or equipment are being repaired or serviced.

### **BACKGROUND**

Failure to control potentially hazardous energy during equipment repair or service accounts for nearly 10 percent of the serious accidents in the workplace. Typical injuries include fractures, lacerations, contusions, amputations and puncture wounds. To control or eliminate this hazard, the Occupational Safety and Health Administration (OSHA) issued the Control of Hazardous Energy Standard (29 CFR 1910.147), also known as the “Lockout/Tagout Standard.” It requires that:

- Energy sources for equipment be turned-off or disconnected.
- The switch either be locked or labeled with a warning tag.
- The equipment cleared of personnel, tools and other items.
- The effectiveness of the lockout and/or tagout tried by operating the on/off switch to confirm that the equipment does not start.

Under the Control of Hazardous Energy Standard, the ***University of Arizona (UA)*** is required to:

- Establish a written Energy Control Plan which tells how to lockout and tagout equipment to prevent injury to employees performing repairs or service (i.e., Lockout Tagout Program).
- Provide training to ensure employees understand the Lockout/Tagout Program and know how to perform lockout/tagout procedures safely.
- Conduct periodic inspections of specific lockout/tagout procedures to ensure that they are being followed faithfully and safely.

This HSI, developed by ***Risk Management Services*** serves as the University of Arizona’s written Energy Control Plan. It outlines the minimum requirements for disabling machines or equipment to ensure that all potentially hazardous energy is isolated before any servicing or maintenance activities are conducted. It also outlines the minimum requirements for achieving compliance with OSHA’s Control of Hazardous Energy Standard.

## WHO'S COVERED?

**Employees** are covered by this HSI if they are involved with service and maintenance on machines or equipment where the unexpected energization, start-up, or release of stored energy could cause injury. This includes Affected Employees, Authorized Employees, and Owners.

**Employees** are not covered by this HIS if they are involved with:

- Work on cord and plug connected electric equipment when it is unplugged and the employee working on the equipment has complete control over the plug.
- Hot tap operations involving gas, steam, water or petroleum products, when they are performed on pressurized pipelines; when continuity of service is essential and shutdown of the system is impractical and employees are provided with an alternative type of protection that is equally effective.
- Normal production operations and minor servicing tasks including repetitive, routine, minor adjustments (e.g., tool changes and adjustments), and maintenance (e.g., lubricating, cleaning, unjamming) when the power-on condition is essential to accomplish a particular task and when alternative measures that give effective protection are employed.

## RESPONSIBILITIES

Safety is a line-management function. The core of the document is color-coded as below to clearly identify who is responsible for the various aspects of the Program:

- **Management** is ultimately responsible for implementation of the Hazard Communication Program, including ensuring that those under their control have the authority and resources to implement the Program, and for ensuring that areas under their charge are in compliance with the Program.
- **Supervision** is operationally responsible for implementation of the Program, and
- **Employees** are responsible for following rules and working safely.
- **Risk Management Services** is a technical resource to line-management.

**EXPLANATION OF KEY TERMS**

**Potentially hazardous energy** includes electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other similar energies capable of causing bodily harm.

**Energy isolating device** includes all switches, valves, circuit breakers or other devices that serve to shut off the supply of energy to machinery or equipment (push buttons, selector switches and other control circuit type devices are not energy isolating devices).

An **Affected Employee** is any employee whose job requires him/her to operate or use machinery or equipment on which servicing or maintenance is being performed under lockout/tagout or whose job requires him/her to work in an area in which such work is being performed.

An **Authorized Employee** is a person who puts the lock on machines or equipment to perform the 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.

The **Owner** is the principal authorized employee who is primarily responsible for the piece of machinery or equipment during servicing or maintenance.

## **HOW IT WORKS**

### **GENERAL LOCKOUT/TAGOUT PROCEDURE**

This procedure must be followed *in sequence* by **authorized employees** to render a piece of equipment safe for personal contact:

**First-line supervisors** are responsible for providing proper locks, tags and lockout devices for their authorized employees (see Appendix A for a list of specifications of proper locks, tags and lockout devices).

#### **Get Ready**

1. Let all affected employee know you will be locking and/or tagging out the machine or equipment and why.
2. Identify potential hazardous energies associated with the machine or equipment
3. Locate the switches, valves, circuit breakers or other main disconnect, energy isolating devices for each potentially hazardous energy.
4. Shutdown the machine or equipment by normal procedures, if in operation or service.
5. Deactivate (turn off) all switches, valves, circuit breakers or other energy isolating devices. Be sure the machine or equipment is isolated from all potentially hazardous energies.
6. Dissipate or restrain any stored energy. Energy may be stored in springs, elevated machine parts, rotating flywheels, hydraulic systems, and air, gas, steam or water pressure. Use methods such as repositioning, blocking movement or bleeding pressure.

#### **Lock**

Apply appropriate lockout devices and/or locks to all energy isolating devices. This ensures they are held in a “safe” or “off” position and that no person or unforeseen action can start or activate the machine or release potentially hazardous energy from the equipment.

Lockout devices and locks may be omitted, but only if the energy isolating device is not capable of being lock-out.

If a tag alone is used, additional safety measures that can provide the same level of safety as a lock must be employed. This might include removing and isolating a circuit element, blocking access to a controlling switch or removing a valve handle to reduce the potential for any inadvertent activation.

**Tag**

1. Alert everyone that the machine or equipment is not in service by attaching a proper tag to all locks or energy isolating devices (in the case where locks cannot be used).
2. Write your name, the date and the purpose for the lockout/tagout on the tag.

**Clear**

1. Clear the area around the equipment of personnel, tools and other non-essential items.
2. Ensure that all guards are in place.

**Try**

1. Try or test the operating controls to make sure that the machine or equipment will not operate or release other potentially hazardous energies.
  - If work involves electrical conductors or circuit parts, a qualified person (i.e., one who is knowledgeable in electrical hazards and safety measures) must verify the absence of voltage. Test equipment must be checked for proper operation immediately before and after this test (i.e., 3-point testing) and appropriate shock and arc flash protective equipment, specific for the tasks to be performed, must be used when testing (see NFPA 70E 2012).
  - Interlocked equipment must be checked carefully to make sure that the equipment is lockout out properly and not temporarily inoperative because of an interlock.
2. Return the energy isolating device(s) to their “off” or “safe” position.

The equipment has now been locked and/or tagged out by the owner (i.e., the principle authorized employee). Any other **authorized employees** wishing to work on this machine or equipment must apply their own locks and/or tags and, after all personnel are clear of the equipment, must try the effectiveness of the lockout/tagout before commencing work. This means, if there are 10 people working on the machine at any one time, there will be 10 locks and/or tags on the energy isolating devices (for example by using multi-lock hasps), unless the **owner** uses a group lock out system, such as a lock box, where he/she performs lockout/tagout on the machine and places his/her keys in a lock box and other **authorized employees** verify lockout/tagout of the machine and place their locks and tags on the lock box.



## GENERAL LOCK/TAG REMOVAL PROCEDURE

This procedure must be followed *in sequence* by **authorized employees** to remove locks and/or tags and restore energy to the machine or equipment.

1. Clear the equipment and the area around the equipment of personnel, tools or other non-essential items.
2. Ensure that all guards are in place.
3. Remove locks, lockout devices and/or tags.
  - Only the same authorized employee who installed the lock(s) and/or tag(s) may remove them (There are limited exceptions which are described under, "Removal of Locks by Others").
  - If more than one authorized employee is involved in the lockout/tagout procedure, the **owner** must be the last to remove their lock(s) and/or tag(s).
4. The **owner** must restore energy to the machine or equipment and confirm that the equipment is operational.
5. The **owner** must let all affected employees know that the machine or equipment is operational again.

## MACHINE/EQUIPMENT-SPECIFIC PROCEDURES

**First-line supervisors** must develop and document specific lockout/tagout and lock/tag removal procedures for each covered activity (see page 3 and Appendix C - How to Write a Machine/Equipment-Specific Lockout/Tagout Procedure). *Exception:* Specific, written procedures are not required when all the following elements exist:

- There is no potential for stored energy.
- There is only a single energy source and it is easily identified and isolated by a single lockout device.
- Isolation results in complete deenergization.
- Lockout is under the complete control of the authorized employee.
- There is no history of accidents with the specific machine or equipment being serviced or maintained.

## SHIFT OR PERSONNEL CHANGE PROCEDURE

This procedure must be followed *in sequence* by **authorized employees** when lockout/tagout-related work is to extend beyond the original shift and lockout/tagout must change ownership.

1. All **authorized employees** involved in the lockout/tagout must remove their lock(s) and/or tag(s). The lock(s) and/or tag(s) of the current owner from the original shift must remain on the equipment.
2. The **new owner** must then perform a lockout/tagout in accordance with this HSI.
3. The **current owner** transfers the lockout/tagout responsibility to the new owner (from the subsequent shift) by removing their lock(s) and/or tag(s).

## PROCEDURE FOR TESTING AND POSITIONING OF MACHINES

When lockout/tagout must be interrupted to allow for testing or repositioning of equipment, the **authorized employee** must complete the following procedure:

1. Clear the machine or equipment of tools and/or materials.
2. Clear the machine or equipment of personnel.
3. Remove the lockout and tagout devices.
4. Proceed with test, repositioning, etc.
5. If the maintenance or servicing is not complete, de-energize the machine or equipment as in the lockout/tagout procedure and reinstall all lockout and/or tagout devices.

## REMOVAL OF LOCKS/TAGS BY OTHERS

If the authorized employee is still on site, or not known to have left the site, that employee's locks and/or tags must not be removed by any other person. During an emergency while the authorized employee is off site, the **authorized employee's immediate supervisor** or **other member of the line organization above them** can remove their lock and/or tag after a complete check of the equipment to determine that no hazard can result from the lock and/or tag removal.

The authorized employee must be informed that their lock and/or tag was removed before their return to work

## LOCKOUT CAPABILITY

Whenever existing machines or equipment undergo major replacement, repair, renovation, modification, and whenever new machines or equipment are installed, the **employee responsible for the work or design** must ensure that the machines or equipment have, or are made to have, lockable energy isolating devices.

## TRAINING

**First-line supervisors** are responsible for providing lockout/tagout training before employees are allowed to be involved in the servicing and maintenance of machines or equipment.

- All authorized employees must be trained to recognize applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means (procedures) necessary to isolate and control hazardous energy.
- All affected employees must be trained to understand the purpose and function of lockout/tagout procedures and the prohibition of trying to restart machines or equipment that are locked or tagged out.



When tagout alone is used, employees must also be trained in the following limitations of tags:

- Tags are only warning devices and do not provide the physical restraint offered by locks.
- Tags may only be removed by the authorized employee who attached them and they are never to be bypassed, ignored, or otherwise defeated (see “Removal of Locks/Tags by Others” for the only exception to the rule).
- Tags must be easy to read and understand in order to be effective.
- Tags and their means of attachment must be made of durable materials which will withstand the environmental conditions encountered in the workplace.
- Tags must be securely attached to energy isolating devices to ensure that they cannot be accidentally detached.
- Tags may create a false sense of security and their meaning needs to be understood as part of the overall Energy Control Program.

Training must be easy to understand and communicated orally, either in person or through audio or audiovisual means.

**First-line supervisors** must keep written certification to show that training has been provided (the form in Appendix B can be used for documentation). The certification document must include each employee’s name, the signature(s) or initials of the trainer(s) and the date of training.

Retraining must be provided for all authorized and affected employees whenever there is a change in machines, equipment or processes that present a new hazard, or when there is a change in this HSI or a specific lockout/tagout procedure.

Retraining must also be conducted whenever a periodic inspection reveals that there are inadequacies in the employee’s knowledge or use of the lockout/tagout procedure. Retraining must also be conducted whenever first-line supervisors have other reasons to believe that these inadequacies exist. The retraining must reestablish employee proficiency and introduce new or revised lockout/tagout procedures, as necessary.

To assist first-line supervisors in providing lockout/tagout training, **Risk Management Services** can provide general lockout/tagout training. Call 621-1790 for details.

## MANAGING OUTSIDE CONTRACTORS AND INFORMING AFFECTED EMPLOYEES

Procurement specifications for outside contractors shall include a detailed scope of work, and require that prospective contractors submit copies of their written lockout/tagout procedure, documentation that employees to be assigned are appropriately qualified, trained and certified for the activities described in the scope of work.

**UA employees who oversee, direct, or manage outside servicing personnel** (i.e., contractors), are responsible for:

- Obtaining a copy of the contractor's lockout/tagout procedure in advance of the scheduled work start date.
- Providing to the outside contractor site supervisor a copy of the UA's lockout/tagout procedures.
- Verifying that outside contractors have informed their employees on site about their lockout/tagout procedures and any known hazards on site.
- Informing first-line supervisors of affected UA employees, about the outside employer's lockout/tagout procedures.

**First-line supervisors** are responsible for informing affected employee under their supervision about the presence of outside contractors, and about their lockout/tagout procedures.

### Pre-Project Safety Meeting

Before work is authorized to begin, the **UA Project Manager** shall arrange a safety meeting with all on-site supervisors for the outside contractor. This meeting will be conducted to accomplish the following tasks:

- Exchange and compare the lockout/tagout procedures of each organization, including any machine specific lockout/tagout procedures.
- Identify and reconcile any differences in procedure and jointly determine which procedure will be followed for the scope of work at hand.
- Verify in advance all responsibilities for de-energizing of equipment, and subsequent lockout/tagout of that equipment.
- Contractor supervisors shall be advised of the location of applicable line diagrams for energized equipment to be accessed within the scope of the project.
- Results of these safety meetings shall be recorded in writing and kept in the project file.

**PERIODIC INSPECTIONS**

***First-line supervisors*** are responsible for conducting and documenting annual inspections of specific lockout/tagout procedures to ensure that the procedure and the requirements of this HSI are being followed by their employees. The periodic inspections must include a review between the first-line supervisor and each authorized and affected employee. Documentation must include the date, employee's and supervisor's name and the name of the machine or equipment (the form in Appendix B can be used for documentation).

***First-line supervisors*** are responsible for correcting any deviations or inadequacies identified.

## **APPENDIX A**

### **REQUIREMENTS FOR LOCKOUT AND TAGOUT DEVICES**

Lockout devices provided protection by holding the energy isolating device (e.g., switch, valve). In the safe position. Tagout devices provide protection by identifying the device as a source of potential danger that must not be operated until the tag is removed.

These devices must be:

- **Durable** – They must withstand the environment where they will be used for the full duration of time they are expected to be used. Tagout devices must not deteriorate or become unreadable during use.
- **Standardized** – They must be standardized according to color, shape or size. Tagout devices must also be standardized according to print and format.
- **Substantial** – They must be substantial enough to minimize early or accidental removal. Locks must withstand all removal attempts except by means of bolt cutters or other special high-force tools. Tags must be attached by approved one-piece cable ties or equivalent devices.
- **Identifiable** – They must clearly identify the employee who applies them. Tags must also warn against hazardous conditions if the machine or equipment is energized.

To ensure compliance with these requirements, use only those lockout/tagout devices specifically approved by your supervisor and/or Risk Management Services.

**APPENDIX B****UNIVERSITY OF ARIZONA  
LOCKOUT/TAGOUT TRAINING AND INSPECTION RECORD FORM**

|   |  |   |  |
|---|--|---|--|
| <b>General Lockout/Tagout Training</b> <i>(For affected and authorized employees)</i> |  |   |  |
|   |  |   |  |
| Trainer Name:   |  | Trainer Signature:  |  |
| Employee Name:  |  | Employee Signature:   |  |
| Date:   |  | <input type="checkbox"/> Affected employee <input type="checkbox"/> Authorized employee |  |
|   |  |   |  |
| <i>(Below is for authorized employees only)</i>                                       |  |   |  |
|   |  |   |  |
| <b>Training on Specific Lockout/Tagout Procedures</b>                                 |  |   |  |
|   |  |   |  |
| Employee Name:  |  | Employee Signature:   |  |
| Supervisor Name:  |  | Supervisor Signature:   |  |
| Machine/Equipment:  |  |   |  |
| Inspection Date:  |  | <input type="checkbox"/> Acceptable <input type="checkbox"/> Unacceptable performance   |  |
| Corrective Actions (if unacceptable):   |  |   |  |
|   |  |   |  |
| Employee Name:  |  | Employee Signature:   |  |
| Supervisor Name:  |  | Supervisor Signature:   |  |
| Machine/Equipment:  |  |   |  |
| Inspection Date:  |  | <input type="checkbox"/> Acceptable <input type="checkbox"/> Unacceptable performance   |  |
| Corrective Actions (if unacceptable):   |  |   |  |
|   |  |   |  |
| Employee Name:  |  | Employee Signature:   |  |
| Supervisor Name:  |  | Supervisor Signature:   |  |
| Machine/Equipment:  |  |   |  |
| Inspection Date:  |  | <input type="checkbox"/> Acceptable <input type="checkbox"/> Unacceptable performance   |  |
| Corrective Actions (if unacceptable):   |  |   |  |
|   |  |   |  |

## **APPENDIX C**

### **HOW TO WRITE A MACHINE/EQUIPMENT-SPECIFIC LOCKOUT/TAGOUT PROCEDURE?**

If ALL the following elements apply - then a machine/equipment-specific written Lockout/Tagout (LOTO) procedure IS NOT required and you just need to follow the “General Lockout/Tagout and Removal Procedures” (see page 6).

- There is no potential for stored energy.
- There is only a single energy source and it is easily identified and isolated by a single lockout device.
- Isolation results in complete deenergization.
- Lockout is under the complete control of the authorized employee.
- There is no history of accidents with the specific machine or equipment being serviced or maintained.

If ALL the above elements DO NOT apply – a machine/equipment-specific written procedure required IS required

The general “Planning for Safety” concept provides a good framework for developing a machine/equipment-specific written LOTO procedure.

#### **Planning for Safety**

GET READY

1. Get the total picture.
2. Prepare of the unexpected.
3. Let others know what you are doing.

DO

1. Follow safety rules and procedures.
2. Be alert for changing or unusual conditions.

PUT AWAY

1. Leave the job in a safe condition.

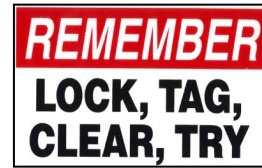
Applying the “Planning for Safety” concept to LOTO we get the outline of the “General Lockout/Tagout and Removal Procedures”:

#### **General Lockout/Tagout Procedure**

GET READY

1. Inform others
2. Identify hazards (type and magnitude)
3. Locate energy isolation devices
4. Shut down equipment
5. Isolate energy
6. Dissipate/restrain stored energy

- DO
1. Lock equipment
  2. Tag equipment
  3. Clear the area
  4. Try equipment/test electrical equipment



### **General Lock/Tag Removal Procedure**

- PUT AWAY
1. Clear equipment
  2. Replace guards
  2. Remove lock/tag
  3. Make operational
  4. Inform others

### **Machine/Equipment-Specific Lockout/Tagout Procedure**

The "General Lockout/Tagout and Removal Procedures" can be customized to create machine/equipment-specific written LOTO procedures using the blank form on the following page (the blank form is followed by completed example).

**MACHINE/EQUIPMENT-SPECIFIC LOTO PROCEDURE**

|                      |                    |
|----------------------|--------------------|
| Machine/Equipment:   | Procedure No.:     |
| Bldg.:               | Origin Date:       |
| Location:            | Revision Date:     |
| Service/Maintenance: | Locks/Tags Needed: |

**GENERAL PROCEDURE**

| Lockout/Tagout   |  | Lock/Tag Removal  |
|--|--|---|
| <b>GET READY</b><br><input type="checkbox"/> Inform others<br><input type="checkbox"/> Identify hazards (type and magnitude)*<br><input type="checkbox"/> Locate energy isolation devices*<br><input type="checkbox"/> Shutdown equipment<br><input type="checkbox"/> Isolate energy (method)*<br><input type="checkbox"/> Dissipate/restrain stored energy* | <b>DO</b><br><input type="checkbox"/> <u>L</u> ock equipment*<br><input type="checkbox"/> <u>T</u> ag equipment*<br><input type="checkbox"/> <u>C</u> lear the area<br><input type="checkbox"/> <u>T</u> ry equipment/<br>test electrical equipment* | <div style="text-align: center; border: 2px solid red; padding: 5px; width: fit-content; margin: 0 auto;"> <b>REMEMBER</b><br/> <b>LOCK, TAG,</b><br/> <b>CLEAR, TRY</b> </div> <b>PUT AWAY</b><br><input type="checkbox"/> Clear equipment<br><input type="checkbox"/> Replace guards<br><input type="checkbox"/> Remove lock/tag<br><input type="checkbox"/> Make operational<br><input type="checkbox"/> Inform others |
| *Equipment-specific procedural steps are described below   |  |   |

**Photos/Diagrams**

| ID | Energy Source<br>(type and magnitude) | Energy Isolation Device | Device Location | Method | Try/Test |
|----|---------------------------------------|-------------------------|-----------------|--------|----------|
|    |                                       |                         |                 |        |          |
|    |                                       |                         |                 |        |          |
|    |                                       |                         |                 |        |          |
|    |                                       |                         |                 |        |          |
|    |                                       |                         |                 |        |          |



### MACHINE/EQUIPMENT-SPECIFIC LOTO PROCEDURE

|   |                      |
|---|----------------------|
| Machine/Equipment: Chiller #1                               | Procedure No.: 00023 |
| Bldg.: East Refrigeration Plant                             | Origin Date: 8-2-13  |
| Location: 1800 E. Noname St.                                | Revision Date: NA    |
| Service/Maintenance: Service pressurized refrigeration loop | Locks/Tags Needed: 5 |

#### GENERAL PROCEDURE

| Lockout/Tagout  |  | Lock/Tag Removal  |
|---|--|---|
| <b>GET READY</b> <ul style="list-style-type: none"> <li>■ Inform others</li> <li>■ Identify hazards (type and magnitude)*</li> <li>■ Locate energy isolation devices*</li> <li>■ Shutdown equipment</li> <li>■ Isolate energy (method)*</li> <li>■ Dissipate/restrain stored energy*</li> </ul> | <b>DO</b> <ul style="list-style-type: none"> <li>■ <u>Lock</u> equipment*</li> <li>■ <u>Tag</u> equipment*</li> <li>■ <u>Clear</u> the area</li> <li>■ <u>Try</u> equipment/<br/>test electrical equipment*</li> </ul> | <b>PUT AWAY</b> <ul style="list-style-type: none"> <li>■ Clear equipment</li> <li>■ Replace guards</li> <li>■ Remove lock/tag</li> <li>■ Make operational</li> <li>■ Inform others</li> </ul> |
| *Equipment-specific procedural steps are described below  |  |   |

#### Photos/Diagrams



| ID  | Energy Source (type and magnitude) | Energy Isolation Device | Device Location                | Method   | Try/Test                      |
|-----|------------------------------------|-------------------------|--------------------------------|--|-------------------------------|
| E-1 | Electrical<br>4,400 V              | Padlock                 | Disconnect in room MCC6        | Move E-1 disconnect "Chiller #1" to off. Lock out. | Attempt restart at CP-1       |
| W-1 | Cooling Tower Supply – 60 psi      | Cable device            | Valve east of chiller overhead | Turn W-1 valve to closed position. Lock out.       | Verify pressure has bled off. |
| W-2 | Cooling Tower Return – 60 psi      | Cable device            | Valve east of chiller overhead | Turn W-2 valve to closed position. Lock out.       | Verify pressure has bled off. |
| W-3 | Chilled Water Supply -             | Gate valve device       | Valve east of chiller overhead | Turn W-3 valve to closed position. Lock out.       | Verify pressure has bled off. |
| W-4 | Chilled Water Return -             | Gate valve device       | Valve east of chiller overhead | Turn W-4 valve to closed position. Lock out.       | Verify pressure has bled off. |