
**THE UNIVERSITY OF OKLAHOMA
PHYSICAL/MECHANICAL HAZARDS PROGRAM**

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**THE UNIVERSITY OF OKLAHOMA
PHYSICAL/MECHANICAL HAZARDS PROGRAM**

I. CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

A. INTRODUCTION

The Control of Hazardous Energy Standard, OSHA 29 CFR 1910.147 and OSHA 29 CFR 1910.269, also known as the Lockout/Tagout Standard, applies to servicing and maintenance of machines and equipment (including processes) during which unexpected energization of equipment or release of energy could cause injury. The Lockout/Tagout Standard requires employers to establish procedures for providing appropriate lockout/tagout devices or otherwise disabling machines or equipment to prevent unexpected energization, start-up, or their release of stored energy to prevent injury.

B. SCOPE

This policy covers all persons employed by the University of Oklahoma (OU) and related facilities whose work includes servicing or maintenance of machines and equipment (including processes) during which unexpected energization of equipment or release of energy could cause injury. This policy does not address hot tap work, which must be approved on a case-by-case basis by the Environmental Health and Safety Office (EHSO).

C. DEFINITIONS

Additional supplemental definitions for the purpose of this program may be found in Appendix A.

1. **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 servicing or maintenance is being performed.
2. **Authorized Employee:** A person who locks or implements a tagout system procedure on machines or equipment to perform the servicing or maintenance on that machine or equipment. An authorized employee and an affected employee may be the same person when the affected employee's duties also include performing maintenance or service on a machine or equipment which must be locked out or a tagout system implemented.
3. **Energized:** Connected to an energy source or contained residual or stored energy.
4. **Energy Isolating Device:** A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following:
 - a. A manually operated electrical circuit breaker.

- b. A disconnect switch.
- c. A manually operated switch by which the conductors of a circuit can be disconnected from all underground supply conductors and, in addition, no pole can be operated independently.
- d. A slide gate.
- e. A slip blind.
- f. A line valve.
- g. A block.
- h. Any similar device used to block or isolate energy.

The term Energy Isolating Device does not include a push button, selector switch, or other control circuit type devices.

- 5. **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.
- 6. **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.
- 7. **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.
- 8. **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.
- 9. **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 the established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

D. WORK REQUIRING ENERGY CONTROL PROCEDURES

1. General

- a. Energy control procedures are required when:
 - (1) an employee is required to remove or bypass a guard or other safety device; or
 - (2) an employee must place any part of his/her body into an area on a machine or equipment where work is performed upon the material being processed (point of operation) or where an associated danger zone exists during a machine operating cycle; or
 - (3) any other task where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy.

- b. Examples of servicing and/or maintenance that requires energy control procedures:
 - (1) Opening/removing guards
 - (2) Opening/removing panels and covers
 - (3) Adding or changing equipment parts such as belts, bearings, pulleys, sheaves, etc.
 - (4) Bypassing/removing safety devices such as thermostats, pressure valves, limit switches, cutoff switches, alarms, etc.
 - (5) Lubrication, cleaning, or unjamming of machines or equipment where the employee must place any part of his/her body into a danger zone.

- c. Energy control procedures are not required for cord and plug connected electrical equipment when the hazards of unexpected start-up are controlled by unplugging of equipment from the electrical source and the electrical plug is controlled only by the employee performing the work. Generally this would mean that the plug connection is visible to the worker while working.

E. TRAINING

Only personnel trained in proper lockout/tagout procedures should perform any work which requires energy control procedures.

1. Authorized Employees

- a. Authorized employees are those who lock out or tag out machines or equipment in order to perform servicing or maintenance on that machine or equipment.

- b. Authorized employees must be trained annually in:
 - (1) the purpose of the energy control program;
 - (2) recognition of applicable energy sources;
 - (3) type and magnitude of energy available in the workplace;
 - (4) methods and means necessary for energy isolation and control and lockout/tagout;
 - (5) the limitations of tags, in that they 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; and
 - (6) 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.

- c. Additional training must occur for authorized employees whenever one or more of the following occurs:
 - (1) a change in job assignment,
 - (2) a change in machines/equipment that present a new hazard,
 - (3) a change in the Energy Control Procedures, or
 - (4) a periodic inspection reveals, or the EHSO has reason to believe, that there are deviations from or inadequacies in the employee's knowledge or use of lockout/tagout.

2. Affected Employees

- a. Affected employees are those employees whose job requires them to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires them to work in an area in which such servicing or maintenance is being performed.

- b. Affected employees must be trained annually in:
 - (1) the purpose of the energy control program;
 - (2) the use of applicable energy control procedures including lockout and tagout procedures;
 - (3) the importance of not bypassing the procedures;
 - (4) the limitations of tags, in that they 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; and
 - (5) the limitation that 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.

- c. Additional training for affected employees must occur whenever one or

more of the following occurs:

- (1) a change in job assignment,
- (2) a change in machines/equipment that present a new hazard,
- (3) a change in the Energy Control Procedures, or
- (4) a periodic inspection reveals, or the EHSO has reason to believe, that there are deviations from or inadequacies in the employee's knowledge or use of lockout/tagout.

3. **Other Employees**

- a. All other employees whose work operations are or may be in an area where energy control procedures are in use must be provided training prior to working in any area where such procedures are used and annually thereafter.
- b. Training must include the following:
 - (1) general orientation to the lockout/tagout system,
 - (2) instructions to not remove lockout/tagout devices,
 - (3) instructions to not attempt to re-start locked- or tagged-out equipment or machines.

F. **PROCEDURES FOR CONTROLLING HAZARDOUS ENERGY**

1. Only trained personnel should perform control of hazardous energy procedures. Hazardous energy is controlled using the **P.R.O.P.E.R.** steps:
 - a. **P - Process Shutdown**
 - (1) Before an authorized or affected employee turns off a machine or equipment, the authorized employee shall have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.
 - (2) The machine or equipment shall be turned off or shut down using the procedures established for the machine or equipment. An orderly shutdown must be utilized to avoid any additional or increased hazard(s) to employees as a result of the equipment stoppage.
 - b. **R - Recognize Energy**
 - (1) An inspection should be performed to identify all potentially hazardous energy sources including adjacent equipment or energy sources that represent hazards to personnel.
 - (2) Examples of types of energy include the following:

- (a) Mechanical motion (kinetic energy), including inertial, linear, oscillating, rotating, and translation motion/energy;
- (b) Potential energy (residual and/or stored), including atmospheric pressure (positive or negative), hydraulic, pneumatic, and tension/compression in springs or torsion bars;
- (c) Gravity;
- (d) Electrical energy, including generated electrical power (AC or DC), electrical charges found in cathodic protection, and static electricity;
- (e) Thermal energy, including steam, hot or cold processes including surface temperatures, or unexpected releases of energy which can be harmful to human tissue above 45°C (113°F) or below 4°C (39°F); and
- (f) Chemical energy, including endothermic (lowers temperatures) and exothermic (raises temperatures) reactions that can cause burns and/or damage of human tissue or other health effects.

c. **O - Off (Shut-off or Disconnect)**

- (1) All identified hazardous energy sources, including stored or residual energy constituting a personnel hazard shall be isolated, blocked, or dissipated at points of control that cannot be overridden or by-passed with reasonable effort. Energy is considered adequately isolated, blocked, or dissipated when an unplanned event would not reactivate the flow of energy.
 - (a) Operate all switches, valves, or other energy isolating devices to ensure all energy sources (electrical, mechanical, hydraulic, etc.) are disconnected or isolated from the equipment and/or circuits.
 - (b) Stored energy, such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure, etc., must also be dissipated or restrained by methods such as grounding, repositioning, blocking, bleeding down, etc.
- (2) Those energy devices or sources that cannot be disconnected should be identified and addressed in the next step.

d. **P - Place Lock or Tag**

- (1) Lockout or tagout shall be performed only by the authorized employees who are performing the servicing or maintenance.
 - (2) Authorized employees shall notify affected employees of the intent
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- to apply the lockout or tagout devices before such devices are applied.
- (3) Each authorized employee who will perform servicing or maintenance shall place a lock or tag on the energy isolating device to secure points of control of energy sources so that unauthorized persons are prevented from re-energizing the machine, process, or system. When more than two persons or more than one shop/department/organization is involved, refer to the group lockout/tagout procedures in Section I.G.
- (4) If the point of control is capable of being secured by being locked out, the lockout method **must** be used.
- (a) Lockout devices, where used, shall be affixed in a manner that will hold the energy isolating devices in a "safe" or "off" position.
- (b) Lockout devices shall be singularly identified; shall be the only devices(s) used for controlling energy; shall not be used for other purposes; and shall meet the following requirements:
- i) be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected;
- ii) be standardized within the facility in at least one of the following criteria: color; shape; or size so that all personnel identify the device as that which is used for lockout procedures;
- iii) be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or other metal cutting; and
- iv) shall indicate the identity of the person applying the lockout.
- (c) Where a lock is used, a tag meeting the requirements of this policy shall also be applied.
- (5) Only when the points of control are not capable of being locked out may the tagout system be employed.
- (a) Tagout devices, where used, shall be affixed in such a manner as will clearly indicate that the operation or movement of energy isolating devices from the "safe" or "off" position is prohibited.
- (b) The tagout warning must be placed at the points of control located as close as safely possible to the energy isolating
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- device, in a position that will be immediately obvious to anyone attempting to operate the device. Access to the area must be limited at all times to persons who are trained to understand and observe the posted warning.
- (c) Tagout devices used shall be singularly identified; shall be the only devices(s) used for controlling energy; shall not be used for other purposes; and shall meet the following requirements:
- i) be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected;
 - ii) be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible;
 - iii) not deteriorate when used in corrosive environments such as areas where acid and alkali chemicals are handled and stored;
 - iv) be standardized within the facility in at least one of the following criteria: color; shape; or size; and print and format shall be standardized;
 - v) be substantial enough to prevent inadvertent or accidental removal;
 - vi) shall indicate the identity of the employee applying the device(s); and
 - vii) shall warn against hazardous conditions if the machine or equipment is energized and shall include a legend such as the following: **Do Not Start. Do Not Open. Do Not Close. Do Not Energize. Do Not Operate.**
- (d) Tagout devices, including their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal. Tagout device attachment means shall be of a non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds and having the general design and basic characteristics of being at least equivalent to a one-piece, all-environment-tolerant nylon cable tie.
- (e) When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for placing it, and it is never to be bypassed, ignored, or otherwise defeated.

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- e. **E - Energy (Release Stored Energy)**
 - (1) Following the application of lockout or tagout devices to energy isolating devices, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained, and otherwise rendered safe.
 - (2) If there is a possibility of reaccumulation of stored energy to a hazardous level, verification of isolation shall be continued until the servicing or maintenance is completed, or until the possibility of such accumulation no longer exists.

 - f. **R - Recheck**
 - (1) Prior to starting work on machines or equipment that have been locked out or tagged out, the authorized employee shall verify that isolation and deenergization of the machine or equipment have been accomplished.
 - (a) After verifying that no personnel are exposed, and as a check on having disconnected the energy sources, operate the push button or other normal operating controls to make certain the equipment will not operate.
 - (b) In the event that electrical circuits have been locked out, verify that the circuits are de-energized by applying an appropriate voltage tester that itself has been tested on live circuits.

 - (2) Be sure to return all operating controls to the neutral position.
2. Documented **P.R.O.P.E.R.** procedures for controlling hazardous energy for many routine tasks are attached as Appendix B, *Electrical Equipment*; Appendix C, *Electrical Powered Air Compressors*; Appendix D, *Electric Generators*; Appendix E, *Electric Rollup Doors*; Appendix F, *Forklifts*; Appendix G, *Control of Hazardous Energy for Boilers*; Appendix H, *Control of Hazardous Energy for HVAC Systems*; and Appendix I, *Control of Hazardous Energy For Brush/Wood Chippers*. More specific standard operating procedures may be found at the OUHSC Steam & Chill Water Plant, OU Norman Power Plant and OU Tulsa Boiler House. Individual shops may develop more specific standard operating procedures with the assistance of the EHSO. Copies of all standard operating procedures shall be forwarded to the EHSO.
3. Formal written energy control procedures, such as those found in the appendices, are not required when all of the following elements exist. However, the general P.R.O.P.E.R. procedures (shutting down, locking out, etc.) are still required prior to performing work where an employee is required to remove or bypass a guard or other safety device or the employee must place any part of his/her body into a

danger zone on a machine or equipment.

- a. the machine or equipment has no potential for stored or residual energy or reaccumulation of stored energy after shut down which could endanger employees;
- b. the machine or equipment has a single energy source which can be readily identified and isolated;
- c. the isolation and locking out of that energy source will completely deenergize and deactivate the machine or equipment;
- d. the machine or equipment is isolated from that energy source and locked out during servicing or maintenance;
- e. a single lockout device will achieve a locked-out condition;
- f. the lockout device is under the exclusive control of the authorized employee performing the servicing or maintenance;
- g. the servicing or maintenance does not create hazards for other employees; and
- h. there have been no accidents at OU involving the unexpected activation or reenergization of the machine or equipment during servicing or maintenance.

G. GROUP LOCKOUT/TAGOUT

When servicing and/or maintenance is performed by more than two persons or more than one crew, craft, department or other group, the group may utilize either of the following methods for group lockout/tagout.

1. Multiple Lockout Devices

Each employee performing work applies his/her own lock and only removes his/her own lock. The last person to complete the project, removes his/her lock and completes the procedures for restoring the equipment back to operation.

2. Group Lockout Device

- a. The project supervisor designates an authorized employee to be the primary authorized employee in charge for that group lockout/tagout procedure.
- b. Each authorized employee shall affix a personal lockout or tagout device to the group lockout device, group lockbox, or comparable mechanism when he/she begins work.

- c. Each authorized employee will give the primary authorized employee his/her lock key which will be secured by the primary authorized employee.
- d. When the employee stops working on the machine or equipment being serviced or maintained, the employee will retrieve his/her lock key from the primary authorized employee and remove his/her lock.

3. **Shift or Personnel Changes**

Procedures for the orderly transfer of lockout or tagout devices between off-going and on-coming employees to minimize exposure to hazards from unexpected energization, start-up of the machine or equipment, or release of stored energy are as follows:

- a. All on-coming personnel shall notify all off-going personnel that they are ready to begin work on the machine or equipment.
- b. All lockout and/or tagout devices attached to the machine or equipment by the off-going personnel shall be removed and immediately replaced with like devices by the on-coming authorized personnel.
- c. The primary authorized employee shall ensure that all pertinent coordination between off-going and on-coming personnel has been completed before the on-coming authorized personnel begin work on the machine or equipment, and that all applicable energy sources have been rendered safe.

H. **RESTORING EQUIPMENT AND/OR CIRCUITS TO SERVICE**

The following procedures must be followed, in order, after the work has been performed and before start-up of the equipment, machines, or processes.

1. The work area shall be inspected to ensure that nonessential items have been removed and to ensure that machine or equipment components are operationally intact.
2. The work area shall be checked to ensure that all employees have been safely positioned or removed.
3. When the equipment and/or circuits are clear, each employee should remove his/her lock or tag. Under no circumstance should an employee give his/her key to another employee to remove the device. The person who applied the control device is the only person who can remove that device. The only exception to this is when the authorized employee who applied the device is unable to remove the device, the supervisor has ensured that the proper procedures have been completed in compliance with this program, and the supervisor removes the device. When this exception is used, documentation must be provided to the EHSO identifying the

circumstances and reason for removal of the device, and must include documentation of the following actions:

- a. verification by the supervisor that the authorized employee who applied the device is not at the facility;
 - b. verification that all reasonable efforts to contact the authorized employee to inform him/her that the lockout or tagout device needed to be removed; and
 - c. notification of the authorized employee that the supervisor has removed the employee's lockout device.
4. After lockout or tagout devices have been removed and before a machine or equipment is started, all affected employees shall be notified that the lockout or tagout device(s) have been removed.

I. INSPECTIONS

1. Inspections and evaluation of the *OU Lockout/Tagout Program* should be conducted at least once per year by the EHSO. The inspections do not have to cover all the procedures in the OU campuses, only a representative number to verify that the program is working correctly. The inspection should include:
 - a. review of the energy control procedures to ensure the procedures are in place; being used, and comply with regulatory requirements;
 - b. review of each Authorized employee's responsibilities under the energy control program (for either lockout or tagout systems); and
 - c. corrections to any deviations from the procedures or problems with following the procedures during servicing and/or maintenance work.
2. Annual inspection records (see Appendix J, *EHSO Control of Hazardous Energy Inspection Form*) should include the following:
 - a. identification of the machine or equipment on which energy control procedures were utilized,
 - b. date of the inspection,
 - c. names of employees, and
 - d. names of the persons performing the inspection.

J. RECORDKEEPING

1. Inspection records shall be maintained by the EHSO.
2. Training records shall be maintained by the EHSO.

II. MACHINE GUARDING/POWER TOOLS

A. INTRODUCTION

Proper selection and use of tools and guards is an essential part of an overall safety program. Both hand tools and power tools can cause injuries if not handled properly. Improper modification or removal of guards can cause loss of life or limb. This program outlines safety procedures to minimize injury and damage to equipment and facilities.

B. SCOPE

This section covers all persons employed by the University of Oklahoma (OU) and related facilities who may use powered tools or equipment that have the potential to be hazardous.

C. RESPONSIBILITIES

1. The Environmental Health and Safety Office (EHSO) is responsible for providing training for employees in the proper guarding and use of hazardous tools or equipment. The EHSO will also conduct random inspections of tools and equipment and provide guidance on the purchase of new tools.
2. Departmental supervisors are responsible for ensuring compliance with safe use of all tools and equipment including use of appropriate personal protective equipment when needed and assuring that guards are utilized and are not removed or modified. They are also responsible for assuring that tools are maintained and repaired.
3. Employees are responsible for performing their work in a safe manner according to training received, utilizing personal protective equipment and guards as instructed, following manufacturer's instructions, and reporting unsafe conditions to their supervisor, including broken or damaged tools or tools with missing guards.

D. MACHINE GUARDING

1. **General Requirements**

- a. One or more methods of machine guarding shall be provided to protect the operator and other employees in the machine area from hazards such as those created by point of operation, ingoing nip points, rotating parts, flying chips and sparks. Examples of guarding methods are barrier guards, two hand tripping devices and/or electronic safety devices.

- b. Tools shall be guarded at:
 - (1) exposed points of operation (see Section II.D.2.),
 - (2) ingoing nip points,
 - (3) blades,
 - (4) rotating parts, or
 - (5) any point that sends off chips, sparks or other flying debris.
- c. Guards shall be affixed to the machine where possible and secured elsewhere if for any reason attachment to the machine is not possible. The guard shall be such that it does not offer an accident hazard in itself.
- d. Revolving drums, barrels, and containers shall be guarded by an enclosure which is interlocked with the drive mechanism, so that the barrel, drum, or container cannot revolve unless the guard enclosure is in place.
- e. When the periphery of the blades of a fan is less than seven (7) feet above the floor or working level, the blades shall be guarded. The guard shall have openings no larger than one-half (1/2) inch.
- f. Machines designed for a fixed location shall be securely anchored to prevent walking or moving.
- g. Examples of guarding devices are barrier guards, hostage control, presence-sensing, pullback, restraint, and two-hand control operations.

2. **Point of Operation Guarding**

- a. The point of operation of machines whose operation exposes an employee to injury shall be guarded.
 - (1) Point of operation is the area on a machine where work is actually performed upon the material being processed.
 - (2) The following are some of the machines which usually require point-of-operation guarding:
 - (a) Guillotine cutters
 - (b) Shears
 - (c) Alligator shears
 - (d) Power presses
 - (e) Milling machines
 - (f) Power saws
 - (g) Jointers
 - (h) Portable power tools
 - (i) Forming rolls and calenders
- b. The guarding device shall be in conformity with any appropriate standards,

or, in the absence of applicable specific standards, shall be so designed and constructed as to prevent the operator from having any part of his body in the danger zone during the operating cycle.

- c. Special hand tools for placing and removing material shall be such as to permit easy handling of material without the operator placing a hand in the danger zone. Such tools shall not be in lieu of other guarding required by this section, but can only be used to supplement protection provided.

3. **Machine Guarding Safety Rules**

- a. Never modify any tool or disable any protective device on a tool.
- b. Be familiar with the operation of a tool before you begin use, and know how to turn it on and off quickly. Ask for someone to demonstrate a tool if you have never used it before or read the instructions.
- c. Pay attention to your work and never hurry through a job. Haste is often a cause of accidents.
- d. If you find a damaged or malfunctioning tool, report it to the supervisor or foreman and do not let anyone else use the tool until it is repaired or replaced.
- e. When feeding material into a machine, use a stick, tool, or other item and not your hands.

E. **TOOL SAFETY**

One of the primary hazards of any tool is the tendency for users to become complacent about their hazards. Tools such as grinders, chisels, saws, and others can create flying debris that can damage the eyes or cause severe lacerations. To avoid accidents and injuries, it is essential that tools be properly selected, maintained and handled properly during use.

1. **Tool Selection**

- a. Select the proper tool for the job.
 - b. If you are right-handed be sure to use right-handed tools; if you are left-handed use left-handed tools.
 - c. When selecting new tools, specify those that are lighter, quieter, and have less vibration.
 - d. Maintain tools to keep vibration low as the tool ages.
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- e. Inspect tools before use for chips, defects, loose parts, or missing parts. Do not use a tool if it is broken or defective.

2. **Tool Safety**

- a. Always turn a tool off when making an adjustment or fixing it.
- b. Never tamper with a safety guard on a piece of equipment.
- c. Report all unsafe tools to the supervisor.
- d. Keep power cords secured and off the floor if possible to avoid tripping.
- e. Gloves can be a safety tool when properly selected. Gloves can help reduce the effects of vibration on hands and reduce or prevent cuts, scratches and bruising. Be sure that gloves are not loose enough to catch in a machine or tools with moving parts. Gloves must also not be so tight as to restrict circulation or hand movements.
- f. Never wear loose clothing, jewelry, or gloves that can be caught in a tool. Secure long hair and wear proper shoes or boots.
- g. Always wear eye protection. Regular eye glasses are not acceptable, even though they may be made of impact resistant plastic or glass. Side shields are required to be present at all times.
- h. Wear hearing protection if the tools being used are noisy.
- i. Keep the area clean and be especially careful with the use of flammable liquids that could be ignited by a spark from power tools.
- j. Never use compressed air for cleaning at more than 30 p.s.i and always wear appropriate eye protection when doing so.

3. **Tool Maintenance**

- a. Keep sharp tools sharp and in their sheaths when not in use.
 - b. Clean tools after use and return them to their proper place.
 - c. Keep all cutting edges sharp. Repair or discard screwdrivers or chisels with damaged tips.
 - d. Replace missing or damaged parts with proper replacement parts.
 - e. Discard, do not straighten, bent tools.
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III. ELECTRICAL SAFETY

A. INTRODUCTION

The Occupational Health and Safety Administration (OSHA) has established specific rules regarding the safe use of electricity. Subpart S, Electrical, of 29 CFR, 1910.301 covers design safety standards for electrical systems, safety-related work practices, safety-related maintenance requirements, and safety requirements for special equipment. For construction activities, electrical safety is also covered in Subpart K of 1926.400-408. There are also various applicable codes and standards such as those from the American National Standards Institute (ANSI), BOCA building codes, the National Electric Code and the National Fire Protection Association (NFPA).

B. SCOPE

This section covers all persons employed by the University of Oklahoma (OU) and related facilities who may encounter electrical hazards in the course of their duties.

C. RESPONSIBILITIES

1. The EHSO is responsible for providing awareness training for all employees who may encounter hazardous electrical energy and conducting periodic, random inspections of facilities and work practices for compliance.
2. Foremen and supervisors are responsible for assuring that employees follow safe work practices and attend required training and maintaining safe working conditions and equipment.
3. Electricians are responsible for maintaining a current Oklahoma State Electrician's Journeyman License.
4. Employees are responsible for performing their work in a safe manner in accordance with their training, and reporting unsafe work conditions to their departmental supervisor.

D. GENERAL ELECTRICAL SAFETY RULES

1. Wiring should provide plenty of grounded outlets on circuits of the right size for the tools being used.
2. Use the proper safety features of tools such as 3-prong plugs or double insulated tools and safety switches. Use a ground-fault circuit interrupter (GFCI) in high-risk areas such as wet locations or on all construction sites.
3. Wear proper protective equipment and clothing when working with electrical equipment. Wear rubber sole shoes, rubber gloves, remove jewelry, and never wear clothing that can become entangled.

4. Maintain, inspect and properly store all electrical equipment.
5. Protect electric cords from excessive wear, heat, and chemicals. Coil them properly or use a cord tender. Replace frayed and damaged cords immediately.
6. Keep away from overhead powerlines when working outdoors. Unqualified persons must stay at least 10 feet away from overhead power lines. If work is to be done near overhead power lines, the lines must be deenergized and grounded by the owner or operator of these lines, or other protective measures must be taken before work is started. If voltage is over 50,000 volts, the clearance should be increased by 4 inches for each additional 10,000 volts.
7. Never use electric tools outdoors in wet conditions or on wet surfaces.
8. Live parts of electric equipment operating at 50 volts or more must be guarded against accidental contact. Guarding of live parts may be accomplished by:
 - a. placing them in a room, vault, or similar enclosure accessible only to qualified persons;
 - b. using permanent, substantial partitions or screens to exclude unqualified persons;
 - c. placing them on a suitable balcony, gallery, or platform elevated and arranged to exclude unqualified persons; or
 - d. placing them at an elevation of 8 feet or more above the floor.

APPENDIX A
SUPPLEMENTAL HAZARDOUS ENERGY CONTROL DEFINITIONS

SUPPLEMENTAL HAZARDOUS ENERGY CONTROL DEFINITIONS

- A. **CAPABLE OF BEING LOCKED OUT**: An energy isolating device will be considered to be capable of being locked out either if it is designed with a hasp or other attachment or integral part to which, or through which, a lock can be affixed, or if it has a locking mechanism built into it. Other energy isolating devices will also be considered to be 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.
- B. **DISSIPATE ENERGY**: To cause energy to be spread out or reduced to levels tolerable by humans. When the word "dissipate" is applied to the word "energy" the term may be interpreted differently. The following concepts should be used to determine the dissipation activities:
1. **Dissipate Mechanical Motion**: Motion tends to continue because of inertia after removal of energy; therefore, mechanical motion should be dissipated. For example, a fly wheel or counter balance should be allowed to come to rest before starting work.
 2. **Dissipate Potential Energy**: Potential energy can be manifested in the form of pressure (above or below atmospheric), springs, and gravity.
 - a. Pressure may be locked, isolated, or dissipated. The term "dissipate pressure" implies reducing pressure to a level that would not harm humans. Normally, this pressure value is atmospheric.
 - b. Springs (or torsion bar/rods) can be released (to dissipate stored energy) or the stored energy can be controlled.
 - c. Gravity can never be eliminated or dissipated: it can only be controlled.
 3. **Dissipate Electrical Energy**:
 - a. Generated electrical power can be turned off and isolated.
 - b. Stored electrical energy in some electrical components (e.g., capacitors and condensers) can be dissipated by discharging or grounding after the energy source has been isolated.
 - c. Static electricity can not be turned off: it can only be dissipated by bonding and grounding.
 4. **Dissipate Thermal Energy**: Human tolerance to temperature is very limited. Human tissue may be harmed when it is exposed to temperature above 45 degrees C (113 F) or below 4 degrees C (39 F). Since temperature cannot be isolated or blocked, the only way to control its effects on humans is through dissipation or employee protection. Therefore, when energy sources that affect temperatures are identified in equipment, processes, or systems, control of the energy source should be effected to allow the temperature to dissipate to a tolerable
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level.

5. Dissipation of Chemicals: The term "dissipation of chemicals" implies those actions needed to prevent chemical reactions that would (a) raise or lower temperatures or (b) cause effects which humans cannot tolerate.
 - a. Chemical reactions can be endothermic or exothermic. Endothermic reactions lower temperatures and exothermic reactions raise temperatures that can cause a variety of effects such as fires, explosions, burns, etc.
 - b. Chemicals (gas, liquid, vapor) exposures which humans cannot tolerate must be controlled properly and personal protective equipment issued when necessary.

C. ENERGY SOURCES

1. Mechanical motion can be linear, translation or rotation, or it can produce work which, in turn, produces changes in temperature. This type of energy can be turned off or left on.
2. Potential energy can be due to pressure (above or below atmospheric) as in hydraulic, pneumatic, or vacuum systems, or it can be due to springs or gravity. Potential energy manifested as pressures or in springs can be dissipated or controlled: it cannot be turned off or on. Gravity can never be eliminated or dissipated: it can only be controlled.
3. Electrical energy refers to generated electrical power or static electricity. In the case of generated electricity, the electrical power can be turned on or turned off. Static electricity may not be turned off. It can only be dissipated.
4. Thermal energy is manifested by high or low temperature. This type of energy is the result of mechanical work, radiation, chemical reaction, or electrical resistance. It cannot be turned off or eliminated, however, it can be dissipated or controlled.
5. Chemical reactions are manifested by exothermic or endothermic effects. In either case, the energy-on/energy-off approach does not apply. Any material which should chemically react should be eliminated, dissipated, or controlled. That is, some positive measures must be taken to:
 - a. eliminate the chemical so that no chemical reaction can take place, or
 - b. control the reaction so that the energy released by the chemical reaction will not harm humans.
6. Double block and bleed is the closure of a line, duct, or pipe by closing and locking or tagging two in-line valves (upstream & downstream of the bleed valve) and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

D. INSPECTION: Checking or testing machinery, equipment, system, etc., against established

standards.

- E. **ISOLATED OR BLOCKED ENERGY:** Energy is considered isolated or blocked when its flow would not be reactivated by a foreseeable unplanned event. The term "isolate" means to set apart from other. The term "block" (noun) means an obstacle or obstruction, to prevent normal functioning.
- F. **NORMAL PRODUCTION OPERATIONS:** The utilization of a machine or equipment to perform its intended production function.
- G. **PERSONNEL HAZARD:** A condition which could lead to injury or death. A personnel hazard exists when the environment, conditions, natural phenomena, or equipment characteristics may release levels of energy that exceed human tolerance.
- H. **POINT(S) OF CONTROL:** The point(s) from which energy-blocking, energy-isolating, or energy-dissipating devices are controlled.
- I. **SECURING THE POINT(S) OF CONTROL:** The point(s) of control are secured to prevent unauthorized persons from reactivating the flow of energy. Securing is a separate and distinct action from isolating or blocking the energy sources. The use of locks, tags, or posting a qualified person or a combination thereof are methods of accomplishing these criteria.
- J. **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 start up of the equipment or release of hazardous energy.
- K. **SETTING UP:** Any work performed to prepare a machine or equipment to perform its normal production operation.

APPENDIX B
CONTROL OF HAZARDOUS ENERGY FOR ELECTRICAL EQUIPMENT

CONTROL OF HAZARDOUS ENERGY FOR ELECTRICAL EQUIPMENT

I. P - Process Shutdown

- A. The senior employee on the site shall ensure the shutdown of the equipment will not have adverse effects on other operating equipment.
- B. This person will notify the equipment operator and all other affected employees and contractors that a lockout system is going to be used.

II. R - Recognize Energy Types

This equipment has electrical as the only energy source.

III. O - Off (Shut-off or Disconnect)

- A. Identify the appropriate disconnect switch.
- B. Turn off electrical power at the breaker box by moving the switch in a smooth, non-stop motion to the disconnected position.

IV. P - Place Lock and Tag

- A. If a large number of people are involved refer to the group lockout section.
- B. Each person shall verify each electrical circuit is disconnected.
- C. Each person shall place a lock with an identification tag on the electrical disconnect.
- D. Ensure the lock prevents switch operation.
- E. Tags must include name of owner of lock, time and date tag applied.

V. E - Energy (Release Stored Energy)

Push the start button to verify all electrical energy is eliminated.

NOW THE PLANNED WORK MAY BE SAFELY DONE.

VI. R - Recheck

- A. Ensure equipment is intact and all nonessential items removed.
- B. Ensure all people are safely positioned or removed.
- C. The senior person on site shall notify all affected persons that the lockout devices are being removed.
- D. Each person shall unlock and remove his/her lock.
- E. Start up the equipment in accordance with the standard operating procedure.

APPENDIX C

CONTROL OF HAZARDOUS ENERGY FOR ELECTRICAL POWERED AIR COMPRESSORS

CONTROL OF HAZARDOUS ENERGY FOR ELECTRICAL POWERED AIR COMPRESSORS

I. P - Process Shutdown

- A. The senior employee on the site shall ensure that shutdown of the equipment will not have adverse effects on other operating equipment.
- B. This person will notify the equipment operator and all other affected employees and contractors that a lockout system is going to be used.

II. R- Recognize Energy Types

- A. This equipment has electrical, stored pressure and mechanical energy sources.
- B. The senior employee on site will determine whether other types of energy and/or hazardous substances are involved.

III. O - Off (Shut-off or Disconnect)

- A. Close all valves on lines discharging from the compressor and tank.
- B. Turn off electrical power for the compressor motor at the breaker box.
- C. Turn off electrical power for the electrical controls.

IV. P - Place Lock and Tag

- A. If a large number of people are involved, refer to the group lockout section.
- B. Each person shall verify each valve is closed and each electrical circuit is disconnected.
- C. Each person shall place a lock with an identification tag on each valve and electrical disconnect. Also, lock out the energy supply to each motor operated valve.
- D. Ensure the lock prevents opening or operation. Use a chain if necessary.
- E. Tags must include name of owner of lock, time and date tag applied.

V. E - Energy (Release Stored Energy)

- A. Push the compressor start button to verify all electrical energy is eliminated.
- B. Slowly depressurize the tank and piping by opening bleed valve(s). Leave these valves open to ensure the release of any unexpected pressure.
- C. Blind or misalign piping if the integrity of block valves is in question or if toxic materials are involved.

NOW THE PLANNED WORK MAY BE SAFELY DONE.

VI. R - Recheck

- A. Ensure equipment is intact and all nonessential items removed.
- B. Close bleed lines.
- C. Ensure all people are safely positioned or removed.
- D. Each person shall unlock and remove his/her own lock.

- E. Start up the unit in accordance with the standard operating procedure.

APPENDIX D

CONTROL OF HAZARDOUS ENERGY FOR ELECTRIC GENERATORS

CONTROL OF HAZARDOUS ENERGY FOR ELECTRIC GENERATORS

I. P - Process Shutdown

- A. The senior employee on the site shall ensure the shutdown of the equipment will not have adverse effects on other operating equipment.
- B. This person will notify the equipment operator and all other affected employees and contractors that a lockout system is going to be used.

II. R - Recognized Energy Types

- A. This equipment has electrical, thermal, and mechanical energy sources.
- B. The senior employee on site will determine whether other types of energy and/or hazardous substances are involved.

III. O - Off (Shut-off or Disconnect)

- A. Shut down the prime mover. This may be fueled by an alternate energy source.
- B. Close the fuel valve.
- C. Disable the starter. Disconnect the battery or shut the valve to the start air system.
- D. Disconnect the generator from the electrical power distribution system.
- E. Turn off electrical power at the breaker box.

IV. P - Place Lock and Tag

- A. If a large number of people are involved, refer to the group lockout section.
- B. Each person shall verify each valve is closed and each electrical circuit is disconnected.
- C. Each person shall place a lock with an identification tag on each valve and electrical disconnect.
- D. Tags must include name of owner of lock, time and date tag applied.

V. E - Energy (Release Stored Energy)

- A. Let the engine and generator cool down.
- B. Push the start button to verify all starter energy is eliminated.
- C. Test the circuits to ensure electrical power is not being supplied from an alternate source.
- D. Slowly depressurize the start air and fuel gas lines by opening bleed valves. Leave these valves open to ensure the release of any unexpected pressure.
- E. Energy stored in capacitors may need to be dissipated.

NOW THE PLANNED WORK MAY BE SAFELY DONE.

VI. R - Recheck

- A. Ensure equipment is intact and all nonessential items removed.
- B. Close bleed lines.

- C. Ensure all people are safely positioned or removed.
- D. The senior person on site shall notify all affected persons that the lockout devices are being removed.
- E. Each person shall unlock and remove his/hr own lock.
- F. Start up the unit in accordance with the standard operating procedure.

APPENDIX E

CONTROL OF HAZARDOUS ENERGY FOR ELECTRIC ROLL-UP DOORS

CONTROL OF HAZARDOUS ENERGY FOR ELECTRIC ROLL-UP DOORS

I. P - Process Shutdown

- A. The senior employee on the site shall ensure that the use of the door in question is not necessary for daily operations.
- B. This person will notify the equipment operator and all other affected employees and contractors that a lockout system is going to be used.

II. R - Recognize Energy Types

- A. This equipment has electrical, mechanical, potential, and gravity energy sources.
- B. The senior employee on site will determine whether other types of energy and/or hazardous substance are involved.

III. O - Off (Shut-off or Disconnect)

- A. Identify the appropriate disconnect switch
- B. Turn off electrical power at the breaker box by moving the switch in a smooth, non-stop motion to the disconnected position.
- C. Block springs in a safe position by pinning or clamping the device eliminating the potential of unrestricted and undesired travel.
- D. Block the door in place using metal or wood blocks under the mechanism or pin the linkages in a position where gravity will not cause the mechanism to inadvertently fall.

IV. P - Place Lock and Tag

- A. If a large number of people are involved, refer to the group lockout section.
- B. Each person shall verify each electrical circuit is disconnected.
- C. Each person shall place a lock with an identification tag on the electrical disconnect.
- D. Ensure the lock prevents switch operation.
- E. Tags must include name of owner of lock, time and date tag applied.
- F. Attach warning tags to the pins and clamps and restrict release or access to trained personnel.
- G. Attach warning tags to blocks, linkages, and pins and restrict access to trained personnel.

V. E - Energy (Release Stored Energy)

- A. If possible, lower the door to the closed position before work begins.
- B. Push the start button to verify all electrical energy is eliminated.

NOW THE PLANNED WORK MAY BE SAFELY DONE.

VI. R - Recheck

- A. Ensure equipment is intact and all nonessential items removed.
- B. Ensure all people are safely positioned or removed.

- C. The senior person on site shall notify all affected persons that the lockout devices are being removed.
- D. Each person shall unlock and remove his/her own lock.
- E. Door may now be used as necessary.

APPENDIX F
CONTROL OF HAZARDOUS ENERGY FOR FORKLIFTS

CONTROL OF HAZARDOUS ENERGY FOR FORKLIFTS

I. P - Process Shutdown

- A. The senior employee on the site shall ensure that the shutdown of the equipment will not affect daily operations.
- B. This person will notify the equipment operator and all other affected employees and contractors that a lockout system is going to be used.

II. R - Recognize Energy Types

This equipment has potential for pressure, gravity, thermal and mechanical energy.

III. O - Off (Shut-off or Disconnect)

- A. Lower the forks until they are resting on the ground.
- B. Remove the key from the ignition switch.
- C. Let the heat from the motor dissipate.
- D. Disconnect the battery cables.

IV. P - Place Lock and Tag

- A. Place tag on the battery cables notifying that the fork lift is locked out.
- B. Tags must include name of owner of the tag, time and date.

V. E - Energy (Release Stored Energy)

With the key removed, battery disconnected, and the forks on the ground, the stored energy is released.

NOW THE PLANNED WORK MAY BE SAFELY DONE.

VI. R - Recheck

- A. Ensure equipment is intact and all nonessential items removed.
- B. Ensure all people are safely positioned or removed.
- C. The senior person on site shall notify all affected persons that the lockout devices are being removed.
- D. Each person shall unlock and remove his/her own lock.
- E. Start up the equipment in accordance with the standard operating procedure.

APPENDIX G
CONTROL OF HAZARDOUS ENERGY FOR BOILERS

CONTROL OF HAZARDOUS ENERGY FOR BOILERS

I. P - Process Shutdown

- A. The senior employee on the site shall ensure that the shutdown of the equipment will not affect daily operations.
- B. This person will notify the equipment operator and all other affected employees and contractors that a lockout system is going to be used.

II. R - Recognize Energy Types

This equipment has potential for volatile fuel, thermal, and electrical energy sources.

III. O - Off (Shut-off or Disconnect)

- A. Valve off fuel source.
- B. Open all electric disconnects to boiler, controls, pumps, circulators, and receivers.
- C. Valve off water supply.

IV. P - Place Lock and Tag

- A. If a large number of people are involved, refer to the group lockout section.
- B. Each person shall verify that each valve is closed and each electrical circuit is disconnected.
- C. Each person shall place a lock with identification tag on each valve and electrical disconnect.
- D. Tags must include name of owner of lock, time and date tag was applied.

V. E - Energy (Release Stored Energy)

- A. Let boiler cool down.
- B. Push the start button to verify that all starter energy is eliminated.
- C. Test the circuits to ensure that electrical power is not being supplied from an alternate source.
- D. Drain boiler of water.
- E. Valve open the safety relief valve to displace the steam pressure.

NOW THE PLANNED WORK MAY BE SAFELY DONE.

VI. R - Recheck

- A. Ensure equipment is intact and all nonessential items removed.
- B. Ensure all people are safely positioned or removed.
- C. The senior person on site shall notify all affected persons that the lockout devices are being removed.
- D. Each person shall unlock and remove his/her own lock.
- E. Start up the equipment in accordance with the standard operating procedure.

APPENDIX H
CONTROL OF HAZARDOUS ENERGY FOR HVAC SYSTEMS

CONTROL OF HAZARDOUS ENERGY FOR HVAC SYSTEMS

I. P - Process Shutdown

- A. The senior employee on the site shall ensure that the shutdown of the equipment will not affect daily operations.
- B. This person will notify the equipment operator and all other affected employees and contractors that a lockout system is going to be used.

II. R - Recognize Energy Types

This equipment has mechanical and electrical energy sources.

III. O - Off (Shut-off or Disconnect)

- A. Open electric disconnect to unit.
- B. Valve off forced water, chilled water or steam.
- C. If unit has energy recovery coil, valve off supply and return lines.
- D. Open electric disconnect to pumps.
- E. If unit has electrostatic filters, then open electric disconnect.
- F. If unit has electric re-heat, then open electric disconnect.

IV. P - Place Lock and Tag

- A. If a large number of people are involved, refer to the group lockout section.
- B. Each person shall verify that each valve is closed and each electrical circuit is disconnected.
- C. Each person shall place a lock with identification tag on each valve and electrical disconnect.
- D. Tags must include name of owner of lock, time and date tag was applied.

V. E - Energy (Release Stored Energy)

- A. Push the start button to verify that all starter energy is eliminated.
- B. Test the circuits to ensure that electrical power is not being supplied from an alternate source.

NOW THE PLANNED WORK MAY BE SAFELY DONE.

VI. R - Recheck

- A. Ensure equipment is intact and all nonessential items removed.
- B. Ensure all people are safely positioned or removed.
- C. The senior person on site shall notify all affected persons that the lockout devices are being removed.
- D. Each person shall unlock and remove his/her own lock.
- E. Start up the equipment in accordance with the standard operating procedure.

APPENDIX I
CONTROL OF HAZARDOUS ENERGY FOR WOOD CHIPPERS

CONTROL OF HAZARDOUS ENERGY FOR BRUSH/WOOD CHIPPER

I. P - Process Shutdown

- A. The senior employee on the site shall ensure that the shutdown of the equipment will not affect daily operations.
- B. This person will notify the equipment operator and all other affected employees and contractors that a lockout system is going to be used.

II. R - Recognize Energy Types

This equipment has potential for pressure, gravity and mechanical energy sources.

III. O - Off (Shut-off or Disconnect)

- A. Return feed control bar to neutral position.
- B. Reduce engine speed to idle.
- C. Fully disengage belt tightener.
- D. Turn ignition key to OFF position and remove key.
- E. Wait for cutter disc and belt to stop. **NOTE:** Cutter disc will continue to turn for a short time after engine has stopped.
- F. Close and latch feed table.

IV. P - Place Lock and Tag

- A. Place tag on the feed table latch notifying that the chipper is locked out.
- B. Tags must include name of owner of the tag, time and date.

V. E - Energy (Release Stored Energy)

- A. Let the engine and chipper cool down.
- B. Push the start button to verify the engine will not start.
- C. Verify cutter disc has stopped. Cutter disc rotation can be checked by looking at the of the shaft on the left rear side of cutter disc housing.

NOW THE PLANNED WORK MAY BE SAFELY DONE.

VI. R - Recheck

- A. Ensure equipment is intact and all nonessential items removed.
- B. Ensure all people are safely positioned or removed.
- C. The senior person on site shall notify all affected persons that the lockout devices are being removed.
- D. Each person shall unlock and remove his/her own lock.
- E. Start up the equipment in accordance with the standard operating procedure.

APPENDIX J

EHSO CONTROL OF HAZARDOUS ENERGY INSPECTION FORM

THE UNIVERSITY OF OKLAHOMA
CONTROL OF HAZARDOUS ENERGY
EHSO INSPECTION FORM

1. Date of inspection: _____

2. Name of person performing inspection: _____

3. Machine or equipment to be locked & tagged out: _____

4. Employees involved in lockout tagout procedure:

5. Results of inspection: _____

6. Recommendations or comments: _____

