# PHYSICAL/MECHANICAL HAZARDS
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# PHYSICAL/MECHANICAL HAZARDS

## I. CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

### A. INTRODUCTION

The Control of Hazardous Energy Standard, OSHA 29 CFR 1910.147, also known as the Lockout/Tagout standard, has been designed to cover the servicing and maintenance of machines and equipment (including processes) where unexpected energization of equipment or release of energy could cause injury. OSHA defines servicing and/or maintenance as workplace activities such as construction, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning, or unjamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy." Other definitions for the purpose of this program may be found in Appendix A. 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 section covers all persons employed by the Oklahoma City and Tulsa campuses of the University of Oklahoma Health Sciences Center (OUHSC) and related facilities who may potentially experience an injury through servicing or maintenance of machines and equipment because of the release of energy from such machines or equipment.

### C. WORK NOT REQUIRING ENERGY CONTROL PROCEDURES

Energy control procedures (lockout/tagout) are not required for the following situations.

1. Cord and plug connected electrical equipment when:

    a) hazards of unexpected start-up are controlled by unplugging of equipment from the electrical source, and
    b) 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.

2. Hot tap operations where:

   a) continuity of service is essential,
   b) shutdown of the system is impractical,
   c) documented procedures are followed, and
   d) special equipment is used which provides proven effective employee protection.

3. Routine servicing or maintenance involving minor tool changes, adjustments, and other minor servicing activities which take place during normal operations such as:

   a) adjusting,
   b) calibrating,
   c) cleaning,
   d) changing crankcase/gear box oil,
   e) greasing/lubricating,
   f) housekeeping, or
   g) painting.

4. Repetitive, minor routine adjustments which would be covered under OSHA=s machine guarding standard.

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.

   b) Examples of servicing and/or maintenance that normally require energy control procedures:

(1) adding or changing parts,
(2) bypassing/removing safety devices,
(3) opening/removing panels or covers,
(4) opening/removing guards,
(5) renovating/modifying equipment, and
(6) replacing components.

2. **Work Requiring Undocumented Energy Control Procedures**

Appropriate energy control procedures must be followed but do not require formal documentation when all of the following conditions are met.

a) The machine or equipment has a single energy source which is readily identified and blocked/isolated.
b) The machine or equipment has potential for stored or residual energy and/or reaccumulation of stored energy after shutdown.
c) A single point of control (lock and/or lockout device) achieves a blocked/isolated condition.
d) The blocking and locking out of the single energy source completely de-energizes and deactivates the machine or equipment.
e) The machine or equipment is blocked/isolated and locked out from the energy source during servicing or maintenance.
f) The point of control (lock and/or lockout device) is under the exclusive control of the authorized employee performing the servicing or maintenance.
g) The affected employee and/or the authorized employee (may be the same person in some cases) follows the manufacturer's recommended maintenance procedure.
h) Servicing or maintenance does not create hazards for other personnel.

3. **Work Requiring Documented Energy Control Procedures**

a) Servicing or maintenance work requires documented energy control procedures if it:

(1) involves more than one energy source, or
(2) does not meet the requirements of Section I.C. or Section I.D.2.

b) Documentation requirements for energy control procedures include:

(1) preparation for shutdown,
(2) machine or equipment shutdown,
(3) machine or equipment isolation,
(4) lockout or tagout device application,
(5) dissipation of stored energy (relieved, disconnected, restrained), and
(6) verification of isolation.

c) 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) Ensure machine is intact and all nonessential items removed.
(2) Employees must be safely positioned or removed.
(3) All affected personnel must be notified that the lockout or tagout device has been removed.
(4) Remove the lockout or tagout device.

E. GUIDELINES FOR CONTROLLING HAZARDOUS 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. Each identified hazardous energy source must be controlled and the device controlling the energy source must be secured and verified. Examples of types of energy include the following.

a) Mechanical Motion (kinetic energy)

(1) Inertia
(2) Linear
(3) Oscillation
(4) Rotation
(5) Translation

b) Potential Energy (residual and/or stored)

(1) Pressure (above or below atmospheric)

(a) Enhanced recovery systems (air - $O_2$ - $H_2O$)
(b) Hydraulic
(c) Negative pressure systems

(d) Pneumatic

(2) Springs/Torsion Bars

(a) Tension
(b) Compression

(3) Gravity

c) Electrical Energy

(1) Cathodic protection
(2) Generated electrical power

(a) Alternating current (A/C)
(b) Direct current (D/C)

(3) Static Electricity

d) Thermal energy (steam hot, or cold processes including surface temperatures or unexpected releases of energy which can be harmful to human tissue)

(1) Above 45°C (113°F)
(2) Below 4°C (39°F)

e) Chemical

(1) Endothermic (lowers temperatures)
(2) Exothermic (raises temperatures)
(3) Burn and/or damage of human tissue
(4) Health effects

2. The following steps accomplish the control of hazardous energy sources.

a) Isolate, block, or dissipate all identified hazardous energy sources 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.

b) Isolate, block, or dissipate all stored or residual energy constituting a personnel hazard.

c) Secure points of control so unauthorized persons are prevented from re-energizing the machine, process, or system. Three alternative methods of securing the points of control are described below.

(1) Secure by physical means (lockout) so re-energizing the system requires special equipment available only to the person who applied the control. A warning tag containing appropriate information should be displayed at the points of control.

(2) Post a warning (tagout) at the points of control and limit access to persons who are trained to understand and observe the posted warning. The warning should provides information on:

(a) why the energy sources have been isolated, blocked, or dissipated,
(b) the date,
(c) the persons responsible for the control measure, and
(d) the persons responsible for the work to be accomplished.

(3) Post qualified personnel with the specific responsibility of protecting against unauthorized actuation at the points of control during the maintenance activity. This applies mainly to short duration work in the immediate vicinity of the points of control.

d) Before starting maintenance, verify that Sections I.E.2.a) through c) have been effective in isolating, blocking or dissipating hazardous energy, and securing the points of control.

e) Verify that all personnel are clear of the points of danger before re-energizing the machine, process, or system.

3. In order for the five steps listed in Sections I.E.2.a) through e) to comprise a valid energy source control technique the following two precautions must be met.

a) Procedures used to accomplish these steps must be documented.

b) The personnel who implement these steps shall be qualified and each worker must thoroughly understand all documented procedures. Training shall be performed to establish and maintain proficiency and include procedural or equipment changes which affect energy control procedures.

F. CONTROL OF HAZARDOUS ENERGY PROCEDURES

1. Hazardous energy is controlled using the P.R.O.P.E.R. steps

(1) P - Process Shutdown
(2) R - Recognize Energy Types
(3) O - Off (Shut-off Isolating Devices)
(4) P - Place Lock and Tag
(5) E - Energy (Release Stored Energy)
(6) R - Recheck

2. PROPER procedures for controlling hazardous energy are attached as Appendix B, *Electrical Equipment*, Appendix C, *Electrical Powered Air Compressors*, Appendix D, *Electric Generators*, Appendix E, *Electric Rollup Doors*, and Appendix F, *Forklifts*.

G. LOCKOUT & TAGOUT DEVICE REQUIREMENTS

1. **Lockout**

Lockout devices must meet the following criteria.

a) singularly identified,
b) the only device for control of energy,
c) durable to the type environment and duration of work,
d) standardized color, shape, and size,
e) substantial, and
f) identify person applying the lockout.

2. **Tagout**

a) Tagout devices must meet the following criteria.

(1) All of the criteria shown above for lockout devices must be met.
(2) Print and form shall be standardized.
(3) Must be substantial enough to prevent inadvertent or accidental removal. Tagout attachment means or the device must be non-reusable, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of 50 lbs.
(4) Must withstand weather, wet or damp locations or harsh environments (caustics etc.) such that the tag information does not deteriorate beyond legibility.
(5) Must warn against hazardous conditions if the machine or equipment is energized.

b) Tagout devices should not be used in lieu of lockout unless a lockout cannot be utilized and personnel safety will not be jeopardized.
c) Tags are warning devices placed on energy isolating devices and do not provide the physical restraint on the isolating device provided by a lock.
d) Procedures must be in place to ensure that a tag is not be removed without the authorization of the person who attached the tag.
e) Tags must be legible and understandable by all authorized employees, affected employees, and all other employees in the area.
f) Tags may invoke a false sense of security. Their meaning needs to be clearly understood by all affected employees to prevent an accident or incident.
g) Tags and means of attachment must be made of materials which withstand workplace environmental conditions.
h) Tags must be securely attached to energy isolating devices to avoid inadvertent detachment during use.
i) When a tagout device is used on an energy isolating device capable of being locked out, the tagout device must be attached at the same location that a lockout device would have been attached and the employer shall demonstrate that the tagout program will provide protection equivalent to a lockout program.
j) Additional elements are necessary to provide full employee protection available from a lockout device, such as:

(1) removal of an isolating circuit element,
(2) blocking of a control switch,
(3) opening of an extra disconnecting device, and
(4) removal of a valve handle.

H. TRAINING

1. **Training Categories**

Training is divided into three groups of Authorized, Affected, and Other. Definitions of each are given below.

a) Authorized - employees that actually place a lock or tag on machines or equipment.
b) Affected - employees performing servicing and/or maintenance on the locked or tagged out machine or equipment. The affected employee is also the authorized employee for most operations and training designed for authorized employees will be sufficient without additional affected employee training.
c) Other - employees whose work operations are or may be in an area where energy control procedures are in use such as engineers, other maintenance/repair personnel, and contractors.

2. **Training Frequency**

a) Authorized and/or affected employees receive annual training and re-trained whenever one or more of the following occur:

(1) change in job assignment,
(2) change in machines/equipment that present a new hazard, and
(3) change in the Energy Control Procedures.

b) Other employees are to be advised of pertinent information prior to working in the area. This is precautionary so equipment is not re-started due to lack of knowledge.

3. **Training Components**

a) Authorized Employee

(1) 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

b) Affected Employee

(1) Purpose of the Energy Control Program
(2) Use of Applicable Energy Control Procedures

c) Other Employees

(1) General Orientation to the Lockout/Tagout System
(2) Warning Not Remove Lockout/Tagout Devices
(3) Warning Not to Attempt Re-start Locked or Tagged out Equipment or Machines

## I. PERIODIC INSPECTIONS

1. Inspections should be conducted at least once per year by an Authorized employee other than one(s) using the particular energy control procedure being inspected.

2. The inspections do not have to cover all the procedures in the OUHSC campus, only a representative number to ensure 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.

3. Annual inspection records 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. RECORD KEEPING

1. Documentation required under Sections I.E.2.a) through e) of this program shall be maintained by the departmental supervisor and shall be subject to review 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.

### B. SCOPE

This section covers all persons employed by the Oklahoma City and Tulsa campuses of the University of Oklahoma Health Sciences Center (OUHSC) 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, 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. 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 should 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 (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 therefore, 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, bu sure to use a right-handed tool; 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.
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. Just 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 make 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 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 blunted tips.
d) Replace missing parts with proper replacement parts.
e) Discard, do not straighten, bent tools.

## 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 Oklahoma City and Tulsa campuses of the University of Oklahoma Health Sciences Center (OUHSC) 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 employee who may encounter hazardous electrical energy and conducting periodic, random inspections of Site Support facilities and workpractices 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. Site Support electricians are responsible for maintaining a current Oklahoma State Electrician=s Journeyman=s 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. Employees should check all circuits in the work area. 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 and 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 form 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

HAZARDOUS ENERGY CONTROL DEFINITIONS

## HAZARDOUS ENERGY CONTROL DEFINITIONS

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

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.

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.

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:

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.

Dissipate Potential Energy: Potential energy can be manifested in the form of pressure (above or below atmospheric), springs, and gravity.

E) 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.

F) Springs (or torsion bar/rods) can be released (to dissipate stored energy) or the stored energy can be controlled.

G) Gravity can never be eliminated or dissipated: it can only be controlled.

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.

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 level.

Dissipate Chemicals: The term "dissipation of chemicals" implies those actions need 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 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.

ENERGIZED: Connected to an energy source or contained residual or stored energy.

ENERGY ISOLATING DEVICE: A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following:

A) 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 value.

G) A block.
H) And any similar device used to block or isolate energy.

NOTE: The term device does not include a push button, selector switch, and other control circuit type devices.

ENERGY SOURCES:

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.

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.

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.

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.

Chemical reaction is 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:

1. Eliminate the chemical so that no chemical reaction can take place, or

2. Control the reaction so that the energy released by the chemical reaction will not harm humans.

Hot Tap: is 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.

Inspection: Checking or testing machinery, equipment, system, etc., against established standards.

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.

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

Lockout Device: A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energizing of a machine or equipment.

Normal Production Operations: The utilization of a machine or equipment to perform its intended production function.

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.

Point(s) of Control: The point(s) from which energy-blocking, energy-isolating, or energy-dissipating devices are controlled.

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.

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.

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

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

Tagout Device: A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with 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.

# 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 isolating devices)

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 lock out 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 their 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 if other types of energy and if hazardous substances are involved.

III. O- Off (shut-off isolating devices)

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 lock out 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) The senior person on site shall notify all affected persons that the lockout devices are being removed.
E) Each person shall unlock and remove their lock.
F) 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 if other types of energy are involved and if hazardous substances are involved.

III. O- Off (shut-off isolating devices)

A) Shut down the prime mover. This may be fueled by either diesel or natural gas.
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 lock out 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) You may need to discharge energy stored in capacitors.

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 their 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 if other types of energy are involved and if hazardous substance are involved.

III. O- Off (shut-off isolating devices)

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 lock out 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) Push the start button to verify all electrical energy is eliminated.
B) If possible lower the door to the closed position before work begins.

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 their 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 effect 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 pressure, potential gravity, thermal and mechanical energy.

III. O- Off (shut-off isolating devices)

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 from the hydraulic system.

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) Start up the equipment in accordance with the standard operating procedure.