

OSH INFORMATION MEMORANDUM 90-X-86

TO: All OSH Compliance Personnel

FROM: W.M. Lybrand

DATE: January 2, 1991

SUBJECT: Inspection Guidelines for Enforcing the Control of Hazardous Energy Sources (Lockout/Tagout)

A. Background.

1. Since the inception of its enforcement program, OSHA had to rely on the use of the "General Duty Clause" to ensure that employers provided safeguarding for their employees through the use of lockout/tagout from the hazards involving the unintentional release of hazardous energy. This approach met with limited success and therefore required the development and promulgation of a lockout/tagout standard.
2. Federal OSHA has been working since 1977 to gather sufficient information to enable the Agency to write a comprehensive standard for hazardous energy control in general industry. The final rule addresses practice and procedures that are necessary to disable machinery or equipment and to prevent the release of potentially hazardous energy while maintenance and servicing activities are being performed.
3. The lockout/tagout provisions of this standard are for the protection of general industry workers while performing servicing and maintenance functions and augment the safeguards specified at Subparts O, S, and other applicable portions of 1910.

B. Effective Dates.

The standard was adopted on November 21, 1989 and administratively stayed until January 2, 1990.  
Previously existing 1910.147 was redesignated as 1910.150, Sources of Standards

C. Inspection Guidelines.

This standard incorporates performance requirements which allow employers flexibility in developing lockout/tagout programs suitable for their particular facilities. In addition to the standard itself, the preamble accompanying it provides further guidance.

1. Evaluation of compliance with 1910.147 shall be conducted during all general Industry inspections with the scope of the standard. The review of records shall include special attention to injuries related to maintenance and servicing operations.
2. The compliance officer shall evaluate the employer's compliance with the specific requirements of the standard. The following guidance provides a general framework that is designed to assist the CO/IH with all inspections.
  - a. Ask the employer for hazard analysis or other basis on which the program related to the standard was developed. Although, this is not a specific requirement of the Standard, such information will aid in determining the adequacy of the program.
  - b. Ask the employer for the documentation including: procedures for the control of hazardous energy including shutdown, equipment isolation, lockout/tagout application, release of stored energy, verification of isolation; certification of periodic inspections; and certification of training. The document procedure must identify the specific type of energy to be controlled and in instances where a common procedure is to be used, the specific equipment covered by the common procedure must be identified at least by type and location. The identification of the energy to be controlled may be by magnitude and type of energy. Note the exception to documentation requirements at paragraph 1910.147 (c)(4)(i), "Note". The employer need not document the required procedure for a particular machine or equipment procedure for a particular machine or equipment when all eight elements listed in the "Note" exist.
  - c. Evaluate the employer's training programs for "authorized," "affected" and "other" employees. Interview a representative sampling of selected employees as part of this evaluation (1910.147 (c)(7)(i)).
    1. Verify that the training of authorized employees includes:
      - a. Recognition of hazardous energy;
      - b. Type and magnitude of energy found in the workplace;
      - c. The means and methods of isolating and/or controlling energy; and
      - d. The means of verification of effective energy control, and the purpose of the procedures to be used.
    2. Verify that affected employees have been instructed in the purpose and use of the energy control procedures.

3. Verify that all other employees who may be affected by the energy control procedures are instructed about the procedure and the prohibition relating to attempts to restart or reenergize such machines or equipment.
  4. When the employer's procedures permit the use of tagout, the training of authorized, affected and other employees shall include the provisions of 1910.147 (c)(7)(ii) and (d)(4)(iii).
- d. Evaluate the employer's manner of enforcing the program (1910.147 (c)(4)(ii)).
3. The compliance officer shall evaluate the employer's compliance with the specific requirements of the standard, with particular attention to the following items:
    - a. Evaluate compliance with requirements for periodic inspection of procedures.
    - b. Ensure that the person performing the periodic inspection is an authorized employee other than the one implementing the procedure being inspected.
    - c. Evaluate compliance with retraining requirements as a result of periodic inspection of procedures and practices or changes in equipment/processes.
    - d. Evaluate employer's procedure and training program for assessment and correction of situations resulting in near misses and/or injuries, or under any circumstances which would indicate that modifications are necessary.
    - e. Identify procedures for release of lockout/tagout including machine or equipment inspection, notification and safe positioning of employees and removal of lockout/tagout device(s).
    - f. Ensure that where group lockout/tagout is used, it affords a level of protection equivalent to individual lockout or tagout.

The lockout/tagout standard, therefore, additional guidance is provided in Appendix C of this instruction to assist in effective implementation by employers and for uniform enforcement by OSHA field staff.

D. Scope of the Standard

1. The standard as specified in 1910.147(b) applies to any source of mechanical, hydraulic, pneumatic, chemical, thermal or other energy.

- a. The standard applies to piping systems, and requires, at 1910.147(d)(5) that all potentially hazardous stored or residual energy be relieved, disconnected, restrained and otherwise rendered safe. If there is a possibility of reaccumulation of stored energy to a hazardous level, continued monitoring shall be performed while a potential hazard exists.
- b. The standard also applied to high intensity electromagnetic fields regulated at 1910.97 nonionizing radiation. Such electromagnetic devices shall be deenergized and held off whenever workers are present within a high intensity ambient field
- c. Servicing/maintenance of fire alarm and extinguishing systems and their components, upon which other employees are dependent on fire safety, are not required to meet the requirements of this standard if the worker performing servicing/maintenance upon fire extinguishing systems are protected from hazards related to the unexpected release of hazardous energy by appropriate alternative measures. (1910. Subpart L)
- d. The standard does not apply to servicing and maintenance when employees are not exposed to the unexpected release of hazardous energy
- e. Safeguarding workers from the hazards of contacting electrically live parts (exposure to electric current) continues to be regulated in Subpart S.
- f. Servicing and maintenance functions conducted during normal production operations are not regulated at 1910.147 if the safeguarding provisions of Subpart O or other applicable portions of 1910 prevent worker exposure to hazards created by the unexpected energization or start-up of the machine or equipment. However, lockout/tagout procedures are required if the production safeguards are rendered ineffective while an employee is exposed to hazardous portions of the machines or equipment
- g. Generally, activities such as lubrication, cleaning or unjamming, servicing machine or equipment and making adjustments or tool changes, where the employee may be expose to the UNEXPECTED energization or start-up of the equipment or releases of hazardous energy, are covered by this standard. However, minor tool changes and adjustments, and other minor servicing activities which take place during normal production operations, are not covered by this standard if they are routine, repetitive and integral to the use of equipment for production and if work is performed using alternative protective measures which provide effective employee protection. Thus, lockout or tagout is not required by this standard if the alternative protective measures enable the servicing employee to clean or unjam, or otherwise service the machine without being exposed to unexpected energization or activation of the equipment or the release of stored energy

Note: Appendix C, Section A, provides further guidance in this area.

- h. The exclusion of plug and cord connected equipment, at 1910.147(a)(2)(iii)(A), applies only when the equipment is unplugged and the plug is under exclusive control of the employee performing the servicing and/or maintenance.
  - 1. The plug is under the exclusive control of the employee if it is physically in the possession of the employee, or in arm's reach and in line of sight of the employee or if the employee has affixed a lockout/tagout device on the plug.
  - 2. The company lockout/tagout procedures required by the standard at 1910.147(c)(4)(i) shall specify the acceptable procedure for handling cord and plug connected equipment.

## 2. Procedures

- a. The employer must develop and document procedures and techniques to be used for the control of hazardous energy. The standard, at 1910.147(c)(4)(i) "Note," identifies eight (8) conditions that must exist in order to excuse the employer's obligation to maintain a written procedure for a specific machine or piece of equipment.
- b. 1910.147(d)(3) and (d)(5) provide that energy isolation be a mandatory part of the employer's control procedure where either a lockout system or a tagout system is used.
- c. Similar machines and/or equipment (such as those using the same type and magnitude of energy and the same or similar types of controls) can be covered with a single written procedure.

## 3. Lockout vs. Tagout

- a. OSHA has determined that lockout is a surer means of ensuring deenergization of equipment than tagout, and that is the preferred method.
- b. Section 1910.147(c)(3)(ii) provides that: When using a tagout program in those instances where the equipment is capable of being locked out, the employer shall demonstrate that the tagout program will provide a level of safety equivalent to that obtained when using a lockout program. Additional means beyond those necessary for lockout are required. (Additional means include: additional safety measures such as the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnection device or the removal of a valve handle to reduce the likelihood of inadvertent energization.)
- c. Section 1910.147(c)(4)(ii) provides that: Where lockout/tagout programs are used, the employer is required to implement an effective means of enforcing the program.

- d. Section 1910.147 (c)(7)(ii)(A-F) provide that: additional training of unauthorized, affected and other employees is required when tagout programs are used.
- e. Section 1910.147 (c)(5)(ii)(A) requires that lockout and tagout devices be capable of withstanding the environment to which they are exposed. Devices which are not exposed to harsh environments need not be capable of withstanding such exposures.
- f. Section 1910.147 (c)(5)(ii)(C)(2) requires that tagout devices having reusable, non-locking, easily detachable means of attachment (such as string, cord or adhesive) are not permitted.

#### 4. Employees and Training

- a. The standard recognizes three types of employees: (1) “authorized” and (2) “affected”, defined in 1910.147 (b), and (3) “other”, defined in 1910.147 (c)(7)(ii)(C). Different level of training are required based upon the respective roles of employees in the control of energy and the knowledge which they must possess to accomplish their tasks safely and to ensure the safety of fellow workers as related to the lockout/tagout procedures (1910.147 (c)(7)(i)).
- b. Employees who exclusively perform functions related to normal production operations, and who perform servicing and/or maintenance under the protection of normal machine safeguarding need only be trained as “affected” (rather than “authorized”) employees even if tagout procedures are used.
- c. The employer’s training program must cover, at a minimum, the following three areas: energy control program, elements of energy control procedures relevant to employee duties, and the pertinent requirements of the standard 1940.147 (c)(7) and (d) through (f).
- d. The employer must provide:
  - 1. Effective initial training;
  - 2. Effective retraining as needed; and
  - 3. Certification of training. The certification shall contain each employee’s name and dates of training (1910.147 (c)(7)(iv)).
- e. Retraining of authorized and affected employees is required:
  - 1. Whenever there is a change in employee job assignments;
  - 2. Whenever a new hazard is introduced due to a change in machines, equipment or process;
  - 3. Whenever there is a change in the energy control procedures; or
  - 4. Whenever a periodic inspection by the employer reveals inadequacies in the company procedures or in the knowledge of the employees.

#### 5. Periodic Inspection by the Employer

- a. At least annually, the employer shall ensure that an authorized employee other than the one(s) utilizing the energy control procedure being

inspected, is required to inspect and verify the effectiveness of the company energy control procedures. These inspections shall at least provide for a demonstration of the procedures and may be implemented through random audits and planned visual observations. These inspections are intended to ensure that the energy control procedures are being properly implemented and to provide an essential check on the continued utilization of the procedures (1910.147(c)(6)(i)).

1. When lockout is used, the employer's inspection shall include a review of the responsibilities of each authorized employee implementing the procedure with that employee. Group meetings between the authorized employee who is performing the inspection and all authorized employees who implement the procedure would constitute compliance with this requirement.
  2. When tagout is used, the employer shall conduct this review with each affected and authorized employee.
  3. Energy control procedures used less frequently than once a year need to be inspected only when used.
  - b. The periodic inspection must provide for and ensure effective correction of identified deficiencies (1910.147 (c)(6)(i)(B)).
  - c. The employer is required to certify that the prescribed periodic inspections have been performed (1910.147(c)(6)(ii)).
6. Equipment Testing or Positioning Under 1910.147(f)(1), OSHA allows the temporary removal of lockout or tagout devices and the reenergization of the machine or equipment ONLY during the limited time necessary for the testing or positioning of machines, equipment or components. After the completion of the temporary reenergization, the authorized employees shall again deenergize the equipment and resume lockout/tagout procedures.
7. Group Lockout/Tagout Group lockout/tagout procedures shall be tailored to the specific industrial operation and may be unique in the manner that employee protection from the release of hazardous energy is achieved. Irrespective of the situation, the requirements of this generic standard specify that each employee performing maintenance or servicing activities shall be in control of hazardous energy during his/her period of exposure.
- a. Group operations normally require that a lockout/tagout program be implemented which ensures that each authorized employee is protected from the unexpected release of hazardous energy by his/her personal lockout/tagout devices(s). No employee may affix the personal lockout/tagout device of another employee. Various group lockout/tagout procedures discussed in Appendix C provide for each authorized employee's use of his/her personal lockout/tagout devices(s).
  - b. One of the most difficult problems addressed by the standard involves the servicing and maintenance of complex equipment. Such equipment is frequently used in the petrochemical and chemical industries. Acceptable

group lockout/tagout procedures for complex equipment are discussed further at Appendix C.

8. Compliance with Group Lockout/Tagout. These operations shall, at a minimum, provide the following:
  - a. Before the machine or equipment is shut down, each authorized employee who is to be involved during the servicing/maintenance operation shall be made aware by the employer of the type, magnitude, and hazards related to the energy to be controlled and of the method or means to control the energy. In the event that the machine or equipment is already shut down, the authorized employee shall be made aware of these elements before beginning his/her work (1910.147 (d)(1)). Verification shall be performed as noted at D.8.f. of this instruction.
  - b. An orderly shutdown of the machine or equipment shall be conducted which conforms to the documented company procedure and which will not create hazards (1910.147(d)(2)).
  - c. All energy isolating devices needed to isolate the machine or equipment shall be effectively positioned and/or installed (1910.147(d)(3)).
  - d. The authorized employees(s) performing the servicing or maintenance (following the company procedure) shall personally affix a lock or tag upon each energy isolation device (1910.147 (d)(4)(i)). The company procedure must ensure that no employee affixes a personal lockout/tagout device for another employee.
    1. A single lock upon each energy isolating device, together with the use of a lockbox for retention of the keys and to which each authorized employee affixes his/her personal lock or tag, also satisfies the requirement of (1910.147 (f)(3)(i)).
    2. Locks shall be affixed in a manner that will hold the energy isolating device in a safe (off) position (1910.147(d)(4)(ii)).
    3. Tagout devices, where used, shall be affixed at the same location as would a lock if such fittings are provided, or shall be affixed in a manner that will clearly indicate that movement of the isolating device is prohibited (1910.147 (d)(4)(iii)).
  - e. Following the application of locks or tags, all potentially hazardous stored energy or residual energy shall be relieved, disconnected, restrained, and otherwise rendered safe (1910.147 (d)(5)(i)).
    1. Verification of energy isolation shall be monitored as frequently as necessary if there is a possibility of reaccumulation of stored energy (1910.147(d)(5)(ii)).
    2. Monitoring may be accomplished, for example, by observation or with the aid of a monitoring device which will sound an alarm if a hazardous energy level is being approached.
  - f. Authorized employees shall verify that isolation and deenergization have been effectively accomplished before starting servicing/maintenance work. Verification is also necessary by each group of workers before starting work at shift changes.

- g. Release from lockout/tagout shall be accomplished in compliance with the requirements at 1910.147 (e).
  - 9. The machine or equipment area shall be cleared of nonessential items to prevent malfunctions which could result in employee injuries (1910.147 (e)(1)).
    - 10. The authorized employees shall remove their respective locks or tags from the energy isolating devices for from the group lockbox(s) following the procedure established by the company (1910.147(e)(3)).
    - 11. In all instances, the company procedure must provide a system which identifies each authorized employee involved in the servicing/maintenance operation.
    - 12. Before reenergization, all employees in the machine or equipment area shall be safely positioned or moved from the area, and the affected employees shall be notified that the lockout/tagout devices have been removed (1910.147(e)(2)).
  - h. During all group lockout/tagout operations where the release of hazardous energy is possible, each authorized employee performing servicing or maintenance shall be protected by his/her personal lockout or tagout device and by the company procedure. As described at Appendix C, B.1.g., a master tag is a personal tagout device if each employee personally signs on and signs off on it and if the tag clearly identifies each authorized employee who is being protected by it.
9. Compliance of Outside Personnel Outside servicing and maintenance personnel (contractors, etc.) engaged in activities regulated under 1910.147 are subject to the requirements of that standard.
- a. The CO/IH shall verify that the outside employer and the on-site employer have exchanged information regarding the lockout/tagout energy control procedures used by each employer's workers (1910.147(f)(2)(i)).
  - b. The CO/IH shall verify that the on-site employer has effectively informed his/her personnel of the restrictions and prohibitions associated with the outside employer's energy control procedures (1910.147(f)(2)(ii)).
  - c. When an outside employer is engaged in servicing and maintenance activities within an on-site employer's facility and if that contractor's activities are subject to the requirements of 1910.147, the CO/IH shall coordinate with the Assistant Director to obtain permission to initiate an independent inspection of the outside contractor's activities.
10. Appendix B contains an example of a functional flow diagram to implement safe lockout/tagout procedures. This flow diagram is presented solely as an aid and does not constitute the exclusive or definitive means of complying with the standard in any particular situation.

E. Classification of Violations.

1. Serious violations shall be issued whenever a deficiency in the employer's energy control program and/or procedure can contribute to a potential exposure capable of producing serious physical harm or death.
2. The lack of training of authorized, affected, and other employees shall normally be cited as serious.
3. Paperwork deficiencies in lockout/tagout programs where effective lockout/tagout work procedures are in place shall be cited as other than serious.

Appendix A

The following listing indicates a number of OSHA standards which currently impose lockout/tagout related requirements. The list does not necessarily include all lockout/tagout related OSHA 29 CFR 1910 standards.

Process Safety Management

1910.119(f)(4)  
Appendix C #10

Accident Prevention Signs and Tags

1910.145(f)(3)

Confined Space Entry

1910.146 "Isolation"  
1910.146(f)(8)(Note:)

Powered Industrial Trucks

1910.178(q)(4)

Overhead and Gantry Cranes

1910.179(g)(5)(i), (ii), (iii), (v)  
1910.179(l)(2)(i)(c), (d)

Derricks

1910.181(f)(2)(i)(c)

Woodworking Machinery

1910.213(a)(10)  
1910.213(b)(5)

Mechanical Power Presses

1910.217(b)(8)(i)  
1910.217(d)(9)(iv)

Forging Machines

1910.218(a)(3)(iii), (iv)  
1910.218(d)(2)  
1910.218(e)(1)(ii), (iii)  
1910.218(f)(1)(i), (ii), (iii)  
1910.218(f)(2)(i), (ii)

1910.218(h)(2), (5)  
1910.218(i)(1), (2)  
1910.218(j)(1)

**Welding, Cutting and Brazing**

1910.252(c)(1)(i)

**Pulp, Paper and Paperboard Mills**

1910.261(b)(4)  
1910.261(b)(5)  
1910.261(e)(2)  
1910.261(e)(10)  
1910.261(e)(12)(iii)  
1910.261(e)(13)  
1910.261(f)(6)(i)  
1910.261(g)(15)(i)  
1910.261(g)(19)(iii)  
1910.261(g)(21)  
1910.261(j)(1)(iii)  
1910.261(j)(4)(iii)  
1910.261(j)(5)(iii)  
1910.261(j)(6)(i)  
1910.261(k)(2)(ii)

**Textiles**

1910.262(c)(1)  
1910.262(n)(2)  
1910.262(p)(1)  
1910.262(q)(2)

**Bakery Equipment**

1910.263(k)(12)  
1910.263(l)(3)(iii)(b), 1910.263(l)(8)(iii)

**Sawmills**

1910.265(c)(13)  
1910.265(c)(26)(v)  
1910.265(c)(26)(viii)

**Logging**

1910.266(h)(4)(iii)

**Telecommunications**

1910.268(l)(2)

Electric Power Generation

1910.269(d)  
Appendix A  
1910.269(r)(2)(i)  
1910.269(v)(11)(viii)

Grain Handling

1910.272(e)(1)(ii)  
1910.272(g)(1)(ii)  
1910.272(1)(4)  
Appendix A

Electrical

1910.305(c)(1)  
1910.305(j)(4)(ii)(A), 1910.305(j)(4)(ii)(C)(1)  
1910.306(a)(1)  
1910.306(b)(1)(ii)  
1910.306(c)(3)  
1910.306(i)(2)  
1910.333(b)

Conveyors

1917.48(i)  
1917.49(h)(2)  
1917.49(i)(2)  
1917.49(L)(3)  
1917.151(b)(7)

General Requirements

1926.20(b)(3)

Process Safety Management

1926.64(f)(4)  
Appendix C #10

Woodworking

1926.304(a)

Electrical

1926.405(c)  
1926.405(j)(4)(ii)(A)  
1926.405(j)(4)(ii)(c)(1)

Specific Purpose Equipment & Installations

1926.406(a)(1)(ii)

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Lockout and tagging of circuits

1926.417

Conveyors

1926.555(a)(7)

Requirements for Equipment & Tools

1926.702(j)

1926.702(a)(2)

Explosives

1926.905(j)

1926.906(j)

1926.910(a)

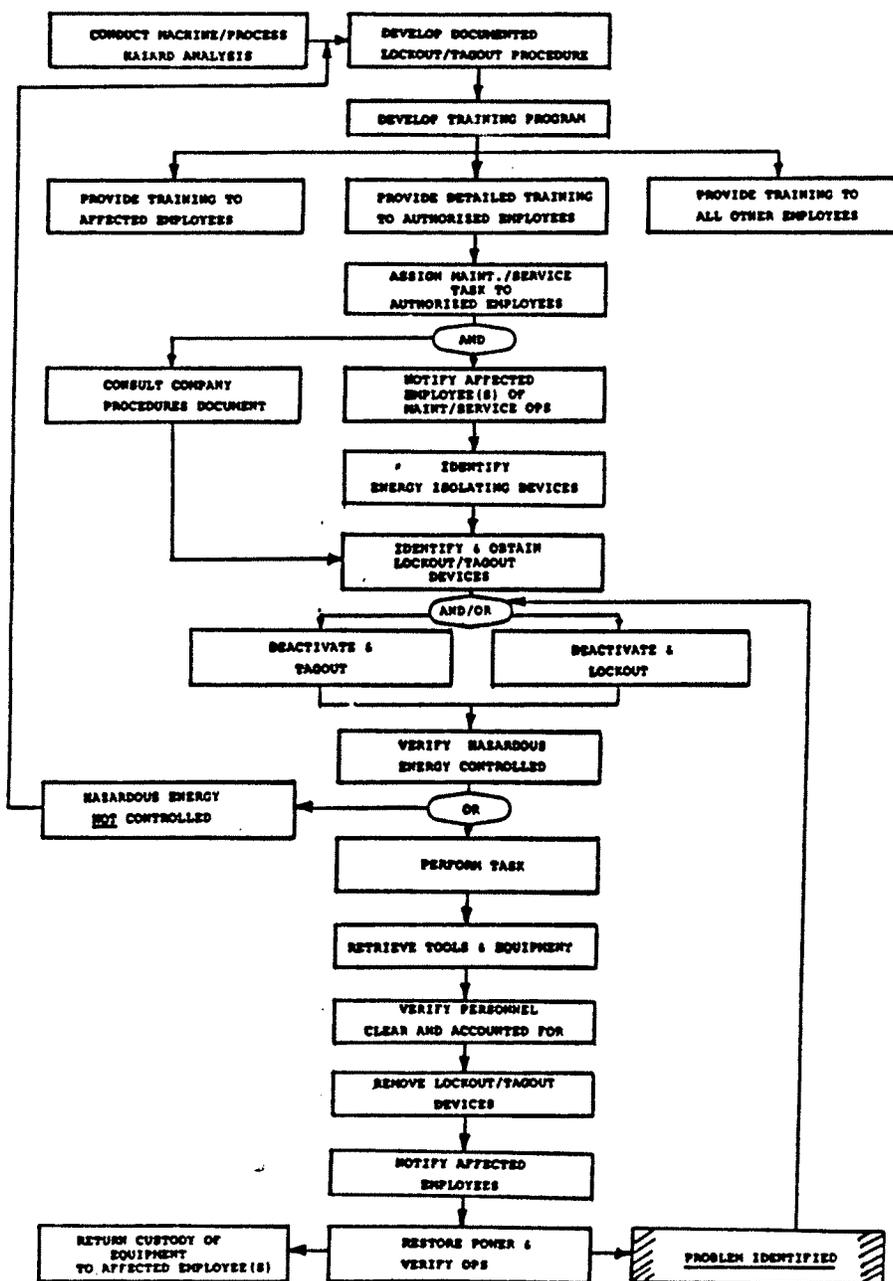
Power Transmission

1926.950(d)

## Appendix B

This flow diagram does not constitute the exclusive or definitive means of complying with the standard in any particular situation and is presented solely as an aid.

EXAMPLE - FUNCTIONAL FLOW DIAGRAM FOR IMPLEMENTATION OF LOCKOUT / TAGOUT REQUIREMENTS



Appendix C

This appendix provides guidelines to assist the compliance officer during evaluations of employer operations.

- A. Normal Production Operations. The lockout/tagout standard, 29 CFR 1910.147, addresses the safety of employees engaged in servicing and maintenance activities in general industry workplaces. The standard complements the requirements for machine and process operator safety prescribed by the various general industry standards in 29 CFR Part 1910. Subpart O of 29 CFR 1910 provides the principal, though not exclusive, machine guarding requirements.
1. Safeguarding of servicing and maintenance workers can be ensured either by:
    - a. Effective machine safeguarding in compliance with Subpart O, or
    - b. Compliance with 29 CFR 1910.147 in situations where the normal production operations safeguards are rendered ineffective or do not protect the servicing/maintenance worker.
  2. Activities which are routine, repetitive, and integral to the use of equipment for production are not covered by this standard if alternative measures provide effective worker protection from hazards associated with unexpected energization. Compliance with the machine guarding requirements of Subpart O is an example of such alternative measures. In addition, supplemental personal protective equipment may be necessary during a servicing or maintenance operation when a toxic substance is to be isolated. Under such circumstances, the requirements of applicable standards, such as 29 CFR 1910.134 and Subpart Z, also must be met.
  3. An employer who requires employees to perform routine maintenance and/or servicing while a machine or process is operating in the production mode, must provide employee safeguarding under the applicable requirements of Subpart O. (Ref. 29 CFR 1910.212(a)(1)). Operations such as lubricating, draining sumps, servicing of filters, and inspection for leaks and/or mechanical malfunction are examples of routine

operations which often can be accomplished with effective production-mode safeguards. However, the replacement of machine or process equipment components such as valves, gauges, linkages, support structure, etc., is not considered to be a normal routine maintenance function which can safely be accomplished during machine or process equipment operation. Such maintenance requires energy isolation and should be evaluated by OSHA field staff. They also may be an appropriate subject of a variance request.

4. Several alternative means of safeguarding the hazardous portions of machines and equipment are presented by the national consensus standard, ANSI B11.19-1990. Although that standard is not all inclusive, it describes effective safeguarding alternatives for the protection of employees. The safeguards described include: interlocked barrier guards, presence sensing devices and various devices under the exclusive control of the employee. Such devices or guards, properly applied, may be used in clearing minor jams and performing other minor servicing functions which occur during normal production operations and which meet the criteria described in paragraph A.2. of this appendix.

- B. Group Lockout/Tagout. The group lockout/tagout procedures described in this instruction at paragraph I.8. require each authorized employee to be in control of potentially hazardous energy release during their servicing/maintenance work assignments. Under most circumstances, where servicing/maintenance is to be conducted during only one shift by an individual or a small number of persons working together, the installation of each individual's lockout/tagout device upon each energy isolating device would not be a burdensome procedure. However, when many energy sources or many persons are involved, and/or the procedure is to extend over more than one shift, (possibly several days, or weeks) consideration must be given to the implementation of a lockout/tagout procedure that will ensure the safety of the employees involved and will provide for each individual's control of the energy hazards. The following procedures are presented as examples to illustrate the implementation of a group lockout/tagout procedure involving many energy isolating devices and/or many servicing/maintenance personnel. They illustrate several alternatives for having authorized employees affix personal lockout/

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tagout devices in a group lockout/tagout setting. These examples are not intended to represent the only acceptable procedures for conducting group operations.

1. Definitions. Various terms used in the examples are defined below.
  - a. PRIMARY AUTHORIZED EMPLOYEE is the authorized employee who exercises overall responsibility for adherence to the company lockout/tagout procedure. (See 29 CFR 1910.147(f)(3)(ii)(A).)
  - b. PRINCIPAL AUTHORIZED EMPLOYEE is an authorized employee who oversees or leads a group of servicing/maintenance workers (e.g., plumbers, carpenters, electricians, metal workers, mechanics).
  - c. JOB-LOCK is a device used to ensure the continuity of energy isolation during a multi-shift operation. It is placed upon a lock-box. A key to the job-lock is controlled by each assigned primary authorized employee from each shift.
  - d. JOB-TAG with TAB is a special tag for tagout of energy isolating devices during group lockout/tagout procedures. The tab of the tag is removed for insertion into the lock-box. The company procedure would require that the tagout job-tag cannot be removed until the tab is rejoined to it.
  - e. MASTER LOCKBOX is the lockbox into which all keys and tabs from the lockout or tagout devices securing the machine or equipment are inserted and which would be secured by a "job-lock" during multi-shift operations.
  - f. SATELLITE LOCKBOX is a secondary lockbox or lockboxes to which each authorized employee affixes his/her personal lock or tag.
  - g. MASTER TAG is a document used as an administrative control and accountability device. This device is normally controlled by the operations department personnel and is a personal tagout device if each employee personally signs on and signs off on it and if the tag clearly identifies each authorized employee who is being protected by it.



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maintenance employees during a one-shift operation to a comprehensive operation involving many workers over a longer period.

- (1) Type A. Each authorized employee places his/her personal lock or tag upon each energy isolating device and removes it upon departure from that assignment. Each authorized employee verifies or observes the deenergization of the equipment.
- (2) Type B. Under a lockbox procedure, a lock or job-tag with tab is placed upon each energy isolation device after deenergization. The key(s) and removed tab(s) are then placed into a lockbox. Each authorized employee assigned to the job then affixes his/her personal lock or tag to the lockbox. As a member of a group, each assigned authorized employee verifies that all hazardous energy has been rendered safe. The lockout/tagout devices cannot be removed or the energy isolating device turned on until the appropriate key or tab is matched to its lock or tag.
- (3) Type C. After each energy isolating device is locked/tagged out and the keys/tabs placed into a master lockbox, each servicing/maintenance group "principal" authorized employee places his/her personal lock or tag upon the master lockbox. Then each principal authorized employee inserts his/her key into a satellite lockbox to which each authorized employee in that specific group affixes his/her personal lock or tag. As a member of a group, each assigned authorized employee verifies that all hazardous energy has been rendered safe. Only after the servicing/maintenance functions of the specific subgroup have been concluded and the personal locks or tags of the respective employees have been removed from the satellite lockbox can the principal authorized employee remove his/her lock from the master lockbox.

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- (4) Type D. During operations to be conducted over more than one shift (or even many days or weeks) a system such as described here might be used. Single locks/tags are affixed upon a lockbox by each authorized employee as described at Type B or Type C above. The master lockbox is first secured with a job-lock before subsequent locks by the principal authorized employees are put in place on the master lockbox. The job-lock may have multiple keys if they are in the sole possession of the various primary authorized employees (one on each shift). As a member of a group, each assigned authorized employee verifies that all hazardous energy has been rendered safe. In this manner, the security provisions of the energy control system are maintained across shift changes while permitting reenergization of the equipment at any appropriate time or shift.
- b. Normal group lockout/tagout procedures require the affixing of individual lockout/tagout devices by each authorized employee to a group lockout device, as discussed in paragraph B.3.a. of this appendix. However, in the servicing and maintenance of sophisticated and complex equipment, such as process equipment in petroleum refining, petroleum production, and chemical production, there may be a need for adaptation and modification of normal group lockout/tagout procedures in order to ensure the safety of the employees performing the servicing and maintenance. To provide greater worker safety through implementation of a more feasible system, and to accommodate the special constraints of the standard's requirement for ensuring employees a level of protection equivalent to that provided by the use of a personal lockout or tagout device, an alternative procedure may be implemented if the company documentation justifies it. Lockout/tagout, blanking, blocking, etc., is often supplemented in these situations by the use of work permits and a system of continuous worker accountability. In evaluating whether the equipment being serviced or maintained is so complex as to necessitate a departure from the normal group lockout/tagout procedures (discussed

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in paragraph B.3.a.), to the use of an alternative procedure as set forth below, the following factors (often occurring simultaneously) are some of those which must be evaluated: physical size and extent of the equipment being serviced/maintained; the relative inaccessibility of the energy isolating devices; the number of employees performing the servicing/maintenance; the number of energy isolating devices to be locked/tagged out; and the interdependence and interrelationship of the components in the system or between different systems.

- (1) Once the equipment is shut down and the hazardous energy has been controlled, maintenance/servicing personnel, together with operations personnel, must verify that the isolation of the equipment is effective. The workers may walk through the affected work area to verify isolation. If there is a potential for the release or reaccumulation of hazardous energy, verification of isolation must be continued. The servicing/maintenance workers may further verify the effectiveness of the isolation by the procedures that are used in doing the work (e.g., using a bleeder valve to verify depressurization, flange-breaking techniques, etc.). Throughout the maintenance and/or servicing activity, operations personnel normally maintain control of the equipment. The use of the work permit or "master tag" system (with each employee personally signing on and signing off the job to ensure continual employee accountability and control), combined with verification of hazardous energy control, work procedures, and walk-through, is an acceptable approach to compliance with the group lockout/tagout and shift transfer provisions of the standard. (Note, B.1.g. of this appendix.)
- (2) Specific issues related to the control of hazardous energy in complex process equipment are described below in a typical situation which could be found at any facility. This

discussion is intended only as an example and is not anticipated to reflect operations at any specific facility.

- (a) Complex process equipment which is scheduled for servicing/maintenance operations is generally identified by plant supervision. Plant supervision would issue specific work orders regarding the operations to be performed.
- (b) In most instances where complex process equipment is to be serviced or maintained, the process equipment operators can be expected to conduct the shutdown procedure. This is generally due to their in-depth knowledge of the equipment and the need to conduct the shutdown procedure in a safe, economic and specific sequence.
- (c) The operations personnel will normally prepare the equipment for lockout/tagout as they proceed and will identify the locations for blanks, blocks, etc., by placing "operations locks and/or tags" on the equipment. The operations personnel can be expected to isolate the hazardous energy, and drain and flush fluids from the process equipment following a standard procedure or a specific work permit procedure.
- (d) Upon completion of shutdown, the operations personnel would review the intended job with the servicing and maintenance crew(s) and would ensure their full comprehension of the energy controls necessary to conduct the servicing or maintenance safely. During or immediately after the review of the job, the servicing and maintenance crews would install locks, tags and/or special isolating devices at previously identified equipment locations following the specified work permit procedure.

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- (e) Line openings necessary for the isolation of the equipment would normally be permitted only by special work permits issued by operations personnel. (Such line openings should be monitored by operations personnel as an added safety measure.)
- (f) All of the previous steps should have been documented by a master system of accountability and retained at the primary equipment control station for the duration of the job. The master system of accountability may manifest itself as a Master Tag which is subsequently signed by all of the maintenance/servicing workers if they fully comprehend the details of the job and the energy isolation devices actuated or put in place. This signing by the respective workers further verifies that energy isolation training relative to this operation has been conducted.
- (g) After the system has been rendered safe, the authorized employees verify energy controls as described in B.3.b.(1) of this appendix.
- (h) Specific work functions are controlled by work permits which are issued for each shift. Each day each authorized employee assigned must sign in on the work permit at the time of arrival to the job and sign out at departure. Signature, date, and time for sign-in and sign-out would be recorded and retained by the applicable crew supervisor who upon completion of the permit requirements would return the permit to the operations supervisor. Work permits could extend beyond a single shift and may subsequently be the responsibility of several supervisors.

- (i) Upon completion of the tasks required by the work permit, the authorized employees' names can be signed off the Master Tag by their supervisor once all employees have signed off the work permit. The work permit is then attached to the Master Tag. (Accountability of exposed workers is maintained.)
  - (j) As the work is completed by the various crews, the work permits and the accountability of personnel are reconciled jointly by the primary authorized employee and the operations supervisor.
  - (k) During the progress of the work, inspection audits are conducted.
  - (l) Upon completion of all work, the equipment is returned to the operations personnel after the maintenance and servicing crews have removed their locks, tags, and/or special isolating devices following the company procedure.
  - (m) At this time all authorized employees who were assigned to the tasks are again accounted for and verified to be clear from the equipment area.
  - (n) After the completion of the servicing/maintenance work, operations personnel remove the tags originally placed to identify energy isolation.
  - (o) Operations personnel then begin check-out, verification and testing of the equipment prior to being returned to production service.
- C. It should be noted that the purpose of the lockout/tagout standard is to reduce the likelihood of worker injuries and fatalities during servicing/maintenance operations. Therefore, when compliance officers inspect workplaces, they should evaluate the potential for employee exposure to the

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unexpected release of hazardous energy during servicing/  
maintenance operations. When a hazard is noted, the various  
requirements of the standard should be applied in a manner  
which will result in abatement of the hazardous circum-  
stance.