

A Guide to the Control of Hazardous Energy (Lockout/Tagout)

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Acknowledgments

This edition of *A Guide to the Control of Hazardous Energy (Lockout/Tagout)* has been updated to include material prepared by Michael R. Smith, formerly of the N.C. Department of Labor; U.S. Department of Labor, Occupational Safety and Health Administration; and U.S. Department of Health and Human Services (NIOSH).

This guide is intended to be consistent with all existing OSHA standards; therefore, if an area is considered by the reader to be inconsistent with a standard, then the OSHA standard should be followed.

To obtain additional copies of this book, or if you have questions about North Carolina occupational safety and health standards or rules, please contact:

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Additional sources of information are listed on the inside back cover of this book.

The projected cost of the OSHNC program for federal fiscal year 2003–2004 is \$13,190,191. Federal funding provides approximately 39 percent (\$5,162,000) of this total.



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Foreword

Nothing can kill or injure someone more quickly than electricity or charged equipment. When a worker reaches for a power line or puts an arm inside a piece of heavy machinery, he or she acts in good faith that all hazardous energy has been locked out from the work zone.

A Guide to the Control of Hazardous Energy (Lockout/ Tagout) examines the threat workers face from these hazards and explains the Occupational Safety and Health Act rules regarding such dangers. There are also sections in this guide to help employers devise lockout/tagout safety procedures and plans at their companies.

In North Carolina, N.C. Department of Labor inspectors enforce the federal Occupational Safety and Health Act through a state plan approved by the U.S. Department of Labor. The N.C. Department of Labor's Division of Occupational Safety and Health offers many educational programs to the public and produces publications, including this guide, to help inform people about their rights and responsibilities regarding occupational safety and health.

When looking through this guide, please remember OSHA's mission is greater than just to enforce regulations. An equally important goal is to help people find ways to create safe workplaces. This booklet, like the other educational materials produced by the N.C. Department of Labor, can help.

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Introduction

Background Information

Controlling hazardous energy sources and establishing systematic lockout-tagout procedures always has been part of the mission for the Occupational Safety and Health Administration. However, OSHA rules for lockout/tagout were scattered through the agency's general industry standards until 1990 when *The Control of Hazardous Energy Sources (Lockout/ Tagout)* standard was adopted. The effective date for compliance with the standard in areas under federal OSHA jurisdiction was January 2, 1990.

The standard, 29 CFR 1910.147, was adopted by the N.C. Department of Labor as part of the requirements of the Occupational Safety and Health Act of North Carolina. The effective date for compliance in North Carolina was July 5, 1990. The standard is enforced by the Division of Occupational Safety and Health, N.C. Department of Labor.

The Scope of This Guide

What the Guide Includes

On September 1, 1989, OSHA issued a final rule on the control of hazardous energy (lockout/tagout) in Title 29 of the Code of Federal Regulations (29 CFR) Part 1910.147. The standard for lockout/tagout (1910.147) went into effect on January 2, 1990. This standard helps safeguard employees from hazardous energy while they are performing service or maintenance on machines and equipment. The standard identifies the practices and procedures necessary to shut down and lock out or tag out machines and equipment, requires that employees receive training in their role in the lockout/tagout program, and mandates that periodic inspections be conducted to maintain or enhance the energy control program. This guide seeks to aid with understanding and applying the standard for control of hazardous energy (lockout/tagout). The requirements of 1910.147 are covered in four parts within this guide.

- Part 1 offers general information.
- Part 2 summarizes the standard.
- Part 3 provides an example/illustration of a plan, one possible plan that can be customized to train management and employees about the standard as it applies to the individual employer's establishment; note step 5 in part 4 seeks to dissuade the employer/employee from tagging out whenever locking out can also be accomplished.
- Part 4 provides a checklist for implementing the standard.

The lockout/tagout standard applies to general industry employment and covers the servicing and maintenance of machines and equipment in which the unexpected startup or the release of stored energy could cause injury to employees. (If employees are performing service or maintenance tasks that do not expose them to the unexpected release of hazardous energy, the standard does not apply.)

OSHA standards for construction also contain requirements for protecting workers from electrical hazards (29 CFR 1926.416 and 29 CFR 1926.417). These standards require that workers exposed to any part of an electrical power circuit be protected through de-energizing and grounding of the circuit or through appropriate guarding. These standards also require that all de-energized circuits be rendered inoperable and tagged out.

What the Guide Does Not Include

This guide does not attempt to address fully: group lockout/tagout procedures; periodic inspections, required by the standard; lockout/tagout procedures at shift changes; equipment testing or positioning; or lockout/tagout for complex operations. The References section, however, does offer information to assist the reader in these areas.

The Need to Control Hazardous Energy

General industry uses electrical, mechanical, hydraulic, pneumatic, chemical, thermal and other energy types to power machines. Energized machinery makes possible the advantages of our modern culture. Unless the energy is controlled, however, it also poses serious hazards to employees.

Uncontrolled energy is a hazard to operators and other employees in the area of the machinery, equipment or processes. Those who service and maintain machinery or equipment are especially vulnerable because it might become energized while being serviced.

No detailed national data are available on the number of workers killed each year by contact with uncontrolled hazardous energy. However, during the period 1982-1997, NIOSH investigated 1,281 fatal incidents as part of its Fatality Assessment and Control Evaluation program. Of these, 152 involved installation, maintenance, service or repair tasks on or near machines, equipment, processes or systems. Because the FACE program was active in only 20 states between 1982 and 1997, these fatalities represent only a portion of the U.S. workers who were killed by contact with uncontrolled hazardous energy.

According to OSHA, approximately 39 million workers are protected by this rule. (The 3 million workers who actually service equipment—i.e., craft workers, machine operators, and laborers—face the greatest risk). OSHA estimates that compliance with the standard prevents about 122 fatalities, 28,400 lost workday injuries and 31,900 non-lost workday injuries each year.

OSHA estimates that adherence to the requirements of this standard can eliminate nearly 2 percent of all workplace deaths in establishments affected by this rule and can have a significant impact on worker safety and health in the United States.

Scope and Application

The lockout/tagout standard applies to general industry employment and covers the servicing and maintenance of machines and equipment in which the unexpected startup or the release of stored energy could cause injury to employees. The standard applies to any source of mechanical, hydraulic, pneumatic, chemical, thermal or other energy, but does not cover electrical hazards. Subpart S of 29 CFR Part 1910 covers electrical hazards, and 29 CFR Part 1910.333 contains specific lockout/tagout provisions for electrical hazards. (If employees are performing service or maintenance tasks that do not expose them to the unexpected startup of machines or equipment, energization, or release of hazardous energy, the standard does not apply.)

The standard establishes minimum performance requirements for the control of hazardous energy. The standard does not apply in the following situations:

- While servicing or maintaining cord and plug connected electrical equipment, provided that the equipment is unplugged from the energy source and the plug remains under the exclusive control of the employee performing the servicing and/or maintenance; and
- During hot tap operations that involve transmission and distribution systems for gas, steam, water or petroleum products when they are performed on pressurized pipelines provided that continuity of service is essential, shutdown of the system is impractical, and employees are provided with alternative protection that is equally effective.

Forms of Hazardous Energy

Workers may be exposed to hazardous energy in several forms and combinations during installation, maintenance, service or repair work. A comprehensive hazardous energy control program should address all forms of hazardous energy [NIOSH 1983]:

- ***Kinetic (mechanical) energy*** in the moving parts of mechanical systems

- **Potential energy** stored in pressure vessels, gas tanks, hydraulic or pneumatic systems, and springs (potential energy can be released as hazardous kinetic energy)
- **Electrical energy** from generated electrical power, static sources or electrical storage devices (such as batteries or capacitors)
- **Thermal energy** (high or low temperature) resulting from mechanical work, radiation, chemical reaction or electrical resistance

Servicing and/or Maintenance Operations

If a servicing activity—such as lubricating, cleaning or unjamming the production equipment—takes place during production, the employee performing the servicing may be subjected to hazards that are not encountered as part of the production operation itself. Workers engaged in these operations are covered by lockout/tagout when any of the following conditions occur:

- The employee must either remove or bypass machine guards or other safety devices, resulting in exposure to hazards at the point of operation;
- The employee is required to place any part of his or her body in contact with the point of operation of the operational machine or piece of equipment; or
- The employee is required to place any part of his or her body into a danger zone associated with a machine operating cycle.

In the above situations, the equipment must be de-energized and locks or tags must be applied to the energy-isolation devices. In addition, when other servicing tasks occur—such as setting up equipment or making significant adjustments to machines — employees performing such tasks are required to lock out or tag out if they can be injured by unexpected energization or startup of the equipment.

OSHA also recognizes that some servicing operations must be performed with the power on. Making many types of fine adjustments, such as centering the belt on conveyors, is one example. Certain aspects of troubleshooting, such as identifying the source of the problem as well as checking to ensure that it has been corrected, is another. OSHA requires the employer to provide effective protection when employees perform such operations. Although, in these cases, a power-on condition is essential either to accomplish the particular type of servicing or to verify that it was performed properly, lockout or tagout procedures are required when other service or maintenance occurs and power is not required.

Provision of the Standard

The standard requires employers to establish procedures for isolating machines or equipment from their source of energy and affixing appropriate locks or tags to energy-isolating devices to prevent any unexpected energization, startup or release of stored energy that could injure workers. When tags are used on energy-isolating devices not capable of being locked out, the employer must provide additional means to ensure a level of protection equivalent to that of locks. The standard also requires the training of employees and periodic inspections of the procedures to maintain or improve their effectiveness.

Energy Control Program

The lockout/tagout rule requires that the employer establish an energy control program that includes 1. documented energy control procedures, 2. an employee training program, and 3. periodic inspections of the use of the procedures. The standard requires employers to establish a program to ensure that machines and equipment are isolated and inoperative before any employee performs servicing or maintenance when the unexpected energization, startup or release of stored energy could occur and cause injury.

The purpose of the energy control program is to ensure that whenever the possibility of unexpected machine or equipment startup or energization exists or when the unexpected release of stored energy could occur and cause injury during servicing and maintenance, the equipment is isolated from its energy source(s) and rendered inoperative prior to servicing or maintenance. Employers have the flexibility to develop programs and procedures that meet the needs of their particular workplace and the particular types of machines and equipment being maintained or serviced.

Energy Control Procedure

This standard requires that energy control procedures be developed, documented and used to control potentially hazardous energy whenever workers perform activities covered by the standard. The written procedures must identify the information that the authorized employees must know to control hazardous energy during servicing or maintenance. If this information is the same for various machines or equipment or if other means of logical grouping exists, then a single energy control procedure may be sufficient. If there are other conditions—such as multiple energy sources, different connecting means or a particular sequence that must be followed to shut down the machine or equipment—then the employer must develop separate energy control procedures to protect employees.

The energy control procedures must outline the scope, purpose, authorization, rules and techniques that will be used to control hazardous energy sources as well as the means that will be used to enforce compliance. At a minimum, they should include, but not be limited to, the following elements:

- A statement on how the procedures will be used;
- The procedural steps needed to shut down, isolate, block and secure machines or equipment;
- The steps designating the safe placement, removal and transfer of lockout/tagout devices and who has the responsibility for them;
- The specific requirements for testing machines or equipment to determine and verify the effectiveness of locks, tags and other energy control measures; and
- The employer or an authorized employee must notify affected employees before lockout or tagout devices are applied and after they are removed from the machine or equipment.

The procedures must include the following steps: 1. preparing for shutdown, 2. shutting down the machine or equipment, 3. isolating the machine or equipment from the energy source(s), 4. applying the lockout or tagout device(s) to the energy-isolating device(s), 5. safely releasing all potentially hazardous stored or residual energy, and 6. verifying the isolation of the machine or equipment prior to the start of servicing or maintenance work.

In addition, before lockout or tagout devices are removed and energy is restored to the machines or equipment, certain steps must be taken to reenergize equipment after servicing is completed, including: 1. ensuring that machines or equipment components are operationally intact; 2. ensuring that all employees are safely positioned or removed from equipment; and 3. ensuring that lockout or tagout devices are removed from each energy-isolating device by the employee who applied the device. (See sections 6(e) and 6(f) of 29 CFR Part 1910.147 for specific requirements of the standard.)

Energy-Isolating Devices

The employer's primary tool for providing protection under the standard is the energy-isolating device, which is the mechanism that prevents the transmission or release of energy and to which locks or tags are attached. (See Glossary for a more complete definition.) This device guards against accidental startup or the unexpected re-energization in machines or equipment during servicing or maintenance. There are two types of energy-isolating devices: those capable of being locked and those that are not. The standard differentiates between the existence of these two conditions and the use of tagout when either condition exists.

When the energy-isolating device cannot be locked out, the employer must use tagout. Of course, the employer may choose to modify or replace the device to make it capable of being locked out. When using tagout, the employer must comply with all tagout-related provisions of the standard and, in addition to the normal training required for all employees, must train his or her employees in the following limitations of tags:

- Tags are essentially warning devices affixed to energy-isolating devices and do not provide the physical restraint of a lock.
- When a tag is attached to an isolating means, it is not to be removed except by the person who applied it, and it is never to be bypassed, ignored or otherwise defeated.

- Tags must be legible and understandable by all employees.
- Tags and their means of attachment must be made of materials that will withstand the environmental conditions encountered in the workplace.
- Tags may evoke a false sense of security. They are only one part of an overall energy control program.
- Tags must be securely attached to the energy-isolating devices so that they cannot be detached accidentally during use.

If the energy-isolating device is lockable, the employer must use locks unless he or she can demonstrate that the use of tags would provide protection at least as effective as locks and would ensure “full employee protection.”

Full employee protection includes complying with all tagout-related provisions plus implementing additional safety measures that can provide the level of safety equivalent to that obtained by using lockout. This might include removing and isolating a circuit element, blocking a controlling switch, opening an extra disconnecting device, or removing a valve handle to reduce the potential for any inadvertent energization while tags are attached.

Although OSHA acknowledges the existence of energy-isolating devices that cannot be locked out, the standard clearly states that whenever major replacement, repair, renovation or modification of machines or equipment is performed and whenever new machines or equipment are installed, the employer must ensure that the energy-isolating devices for such machines or equipment are lockable. Such modifications and new purchases are most effectively and efficiently made as part of the normal equipment replacement cycle. All newly purchased equipment must be lockable.

Requirements for Lockout/Tagout Devices

When attached to an energy-isolating device, both lockout and tagout devices used in accordance with the requirements of the standard help protect employees from hazardous energy. A lockout device provides protection by preventing the machine or equipment from becoming energized. A tagout device does so by identifying the energy-isolating device as a source of potential danger; it indicates that the energy-isolating device and the equipment being controlled may not be operated while the tagout device is in place. Whichever devices are used, they must be singularly identified, must be the only devices used for controlling hazardous energy, and must meet the following requirements:

- **Durability**—**lockout** and **tagout** devices must withstand the environment to which they are exposed for the maximum duration of the expected exposure. Tagout devices must be constructed and printed so that they do not deteriorate or become illegible, especially when used in corrosive (acid and alkali chemicals) or wet environments.
- **Standardized**—Both **lockout** and **tagout** devices must be standardized according to either **color, shape or size**. **Tagout** devices must also be standardized according to **print and format**.
- **Substantial**—Lockout and tagout devices must be substantial enough to minimize early or accidental removal. Locks must be substantial to prevent removal except by excessive force of special tools such as bolt cutters or other metal cutting tools. Tag means of attachment must be nonreusable, attachable by hand, self-locking and nonreleasable, with a minimum unlocking strength of no less than 50 pounds. The device for attaching the tag also must have the general design and basic characteristics equivalent to a one-piece nylon cable tie that will withstand all environments and conditions.
- **Identifiable**—Locks and tags must clearly identify the employee who applies them. Tags must also warn against hazardous conditions if the machine or equipment is energized and must include a legend such as the following: **DO NOT START, DO NOT OPEN, DO NOT CLOSE, DO NOT ENERGIZE, DO NOT OPERATE**.

Employee Training

The employer must provide effective initial training and retraining as necessary and must certify that such training has been given to all employees covered by the standard. The certification must contain each employee's name and dates of training.

For the purposes of the standard, there are three types of employees—authorized, affected and other. The amount and kind of training that each employee receives is based upon 1. the relationship of that employee's job to the machine or equipment being locked or tagged out and 2. the degree of knowledge relevant to hazardous energy that he or she must possess. For example, the employer's training program for authorized employees (those who are charged with the responsibility for implementing the energy control procedures and performing the servicing or maintenance) must cover, at a minimum, the following areas:

- recognition of applicable hazardous energy sources,
- details about the type and magnitude of the hazardous energy sources present in the workplace, and
- the methods and means necessary to isolate and control those energy sources (i.e., the elements of the energy control procedures).

By contrast, affected employees (usually the machine operators or users) and all other employees need only be able to 1. recognize when the control procedure is being used and 2. understand the purpose of the procedure and the importance of not attempting to start up or use the equipment that has been locked or tagged out.

Because an "affected" or "other" employee is not performing the servicing or maintenance, that employee's responsibilities under the energy control program are simple: Whenever there is a lockout or tagout device in place on an energy-isolating device, the affected or other employee must leave it alone and not attempt to energize or operate the equipment.

Every employee training program must ensure that all employees understand the purpose, function and restrictions of the energy control program and that authorized employees possess the knowledge and skills necessary for the safe application, use and removal of energy controls.

Training programs for authorized employees to comply with this standard, which is performance-oriented, should deal with the equipment, type(s) of energy, and hazard(s) specific to the workplace being covered.

Retraining must be provided, as required, whenever there is a change in job assignments, a change in machines, equipment or processes that present a new hazard, or a change in energy control procedures. Additional retraining must be conducted whenever a periodic inspection reveals, or whenever the employer has reason to believe, that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedure.

Periodic Inspections

A periodic inspection of each procedure, when usage is at least once a year, must be performed at least annually to ensure that the energy control procedures continue to be implemented properly and that the employees are familiar with their responsibilities under those procedures. The periodic inspections must be designed to correct any deviations or inadequacies observed. An authorized employee other than the one(s) using the energy control procedure must perform the periodic inspections. In addition, the employer must certify that the periodic inspections have been performed. The certification must identify the machine or equipment on which the energy control procedure was used, the date of the inspection, the employees included in the inspection, and the name of the person performing the inspection. For a lockout procedure, the periodic inspection must include a review, between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected. When a tagout procedure is inspected, a review on the limitation of tags, in addition to the above requirements, must also be included with each affected and authorized employee.

Application of Controls and Lockout/Tagout Devices

The established procedure of applying energy controls includes the specific elements and actions that must be implemented in sequence.(3) These are briefly identified as follows:

1. Prepare for shut down,
2. Shut down the machine or equipment,
3. Disconnect the energy isolating device,
4. Apply the lockout or tagout device,
5. Render safe all stored or residual energy, and
6. Verify the isolation and deenergization of the machine or equipment.

Removal of Locks and Tags

Before lockout or tagout devices are removed and energy is restored to the machine or equipment, the authorized employee(s) must take the following actions or observe the following procedures:

1. Inspect the work area to ensure that non-essential items have been removed and that machine or equipment components are intact and capable of operating properly;
2. Check the area around the machine or equipment to ensure that all employees have been safely positioned or removed;
3. Make sure that locks or tags are removed **only** by those employees who attached them. (In the very few instances when this is not possible, the device may be removed under the direction of the employer provided that he or she strictly adheres to the specific procedures outlined in the standard); and
4. Notify affected employees after removing locks or tags and before starting equipment or machines.

Additional Safety Requirements

Special circumstances exist when 1. machines need to be tested or repositioned during servicing, 2. outside (contractor) personnel are at the worksite, 3. servicing or maintenance is performed by a group (rather than one specific person), and 4. shifts or personnel changes occur during servicing or maintenance.

- **Testing or positioning of machines.** OSHA allows the temporary removal of locks or tags and the re-energization of the machine or equipment only when necessary under special conditions—for example, when power is needed for the testing or positioning of machines, equipment or components. The reenergization must be conducted in accordance with the sequence of the following steps:
 1. Clear the machines or equipment of tools and materials,
 2. Remove employees from the machines or equipment area,
 3. Remove the lockout or tagout devices as specified,
 4. Energize and proceed with testing or positioning, and
 5. De-energize all systems, isolate the machine or equipment from the energy source, and reapply lockout or tagout devices as specified.
- **Outside personnel (contractors).** The onsite employer and the outside employer must inform each other of their respective lockout or tagout procedures. Each employer must ensure that its personnel understand and comply with all restrictions and/or prohibitions of the other employer's energy control program.
- **Group lockout or tagout.** When servicing or maintenance is performed by a crew, craft, department or other group, they must utilize a procedure that affords the employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device.

- **Shift operations.** During shift operations, either maintain continuous control of the energy-isolating devices or require that the oncoming shift verify de-energization and lockout/tagout. The following figures illustrate lockout/tagout applications.

Figure 1

Multiple Lockout/Tagout of Energy Isolating Devices on Electrical Control Boxes

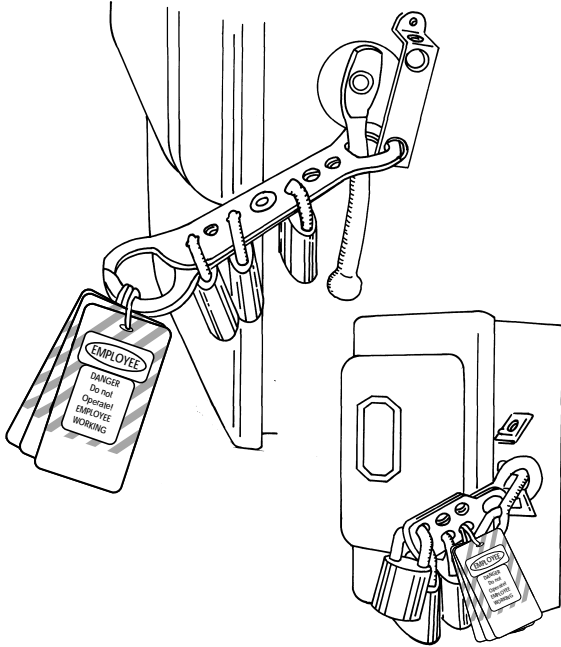


Figure 2

Lockout Box for Group Lockout. Key to Single Machine Locking Device Is Inside Box and Multiple Locks Secure the Box

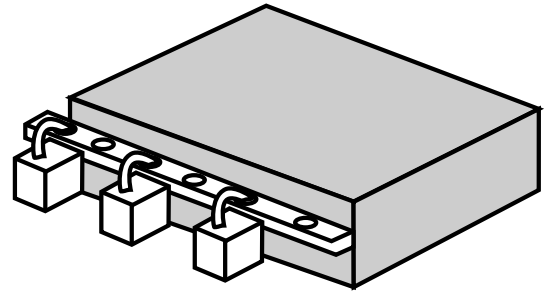


Figure 3

Cable or Chain Used for Lockout of Valve That Does Not Have a Locking Provision

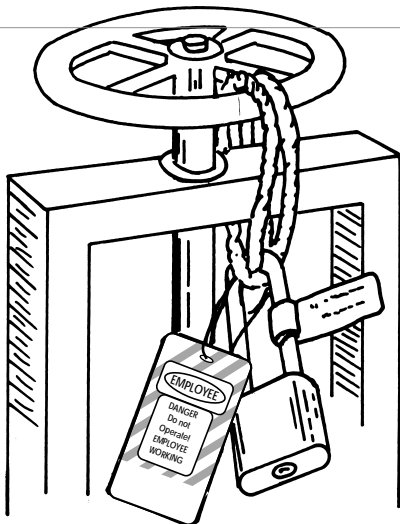
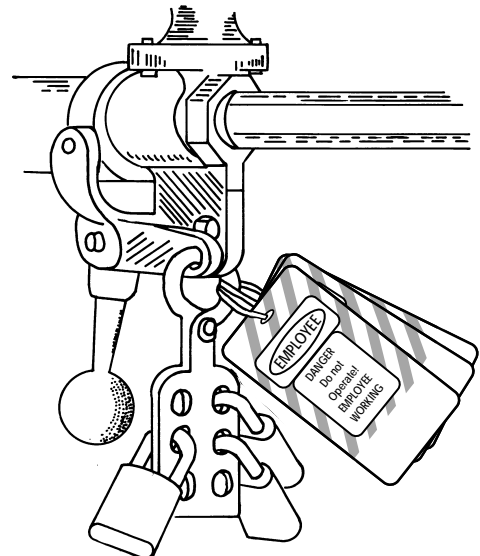


Figure 4

Multiple Locks and Tags on a Pneumatic Valve



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A Summary of 29 CFR 1910.147

The standard was published on September 1, 1989, and amended on September 20, 1990. The effective date in North Carolina was July 5, 1990. The summary below offers a quick integrated grasp of the standard, but it is not a substitute for the standard.

29 CFR 1910.147(a)—*Scope, application, and purpose*

(1) *Scope*

- (i) *Covers*: the servicing and maintenance of machines and equipment in which the unexpected energization or start up of the machines or equipment or the release of stored energy could cause injury to employees.
- (ii) *Does not cover*: (A) construction, agriculture and maritime employment; (B) electric utilities; (C) electrical exposures covered by Subpart S; and (D) oil and gas well drilling and servicing.

(2) *Application*

- (i) *Applies*: during servicing and/or maintenance.
- (ii) *Does not apply*: to normal production operations.
Servicing and/or maintenance that takes place during normal production operations is covered only if (A) an employee is required to remove or bypass a guard or other safety device or (B) an employee is required to place any part of his or her body in a danger zone.
- (iii) *Does not apply*: to (A) work on cord and plug connected equipment that is unplugged and under control of an employee; (B) gas, steam, water or petroleum hot tap operations under specified circumstances.

(3) *Purpose*

- (i) *Requires employers*: to establish a program and use procedures for affixing appropriate lockout devices or tagout devices to energy isolating devices and to disable machines or equipment to prevent unexpected energization, start-up, or release of stored energy in order to prevent injury to employees.

29 CFR 1910.147(b)—*Definitions*

- *Affected employee*: An employee who performs the duties of his or her job in an area in which the energy control procedure is implemented and servicing or maintenance operations are performed. An affected employee does not perform servicing or maintenance on machines or equipment and, consequently, is not responsible for implementing the energy control procedure. An affected employee becomes an “authorized” employee whenever he or she performs servicing or maintenance functions on machines or equipment that must be locked or tagged.
- *Authorized employee*: An employee who performs servicing or maintenance on machines and equipment. Lockout or tagout is used by these employees for their own protection.
- *Capable of being locked out*: energy isolating device designed for attachment of a lock or has a locking mechanism built into it.
- *Energized*: connected to an energy source or containing residual or stored energy.
- *Energy-isolating device*: mechanical device which physically prevents the transmission or release of energy (does not include a push button, selector switch and other control devices).
- *Energy source*: any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other energy.
- *Hot tap*: procedure used in repair, maintenance and service involving welding on pipelines, vessels or tanks under pressure in order to install connections or appurtenances.
- *Lockout*: placement of a lockout device on an energy-isolating device to prevent operation.
- *Lockout device*: device that uses a positive means, such as a lock, to hold an energy-isolating device in the safe position.
- *Servicing and/or maintenance*: workplace activities such as adjusting; cleaning; constructing; inspecting; installing; lubricating; maintaining and/or servicing machines or equipment; modifying; setting up; and tool changing.

- *Tagout*: placement of a tagout device on an energy-isolating device to inform that the equipment may not be operated.
 - *Tagout device*: prominent warning device, such as a tag and a means of attachment.
- 29 CFR 1910.147(c)—*General*
- (1) *Energy control program*. A program including an energy control procedure and employee training is required.
 - (2) *Lockout/tagout*
 - (i) A tagout system shall only be used if the isolating device *cannot* be locked out.
 - (ii) If the isolating device can be locked out, a lockout shall be used, unless the employer can demonstrate that a tagout system provides full employee protection.
 - (iii) When machinery is replaced or undergoes major repair or renovation, equipment-isolating devices shall be designed to accept a lockout device.
 - (3) *Full employee protection*
 - (i) When a tagout device is used on an isolating device capable of being locked out, the tagout device shall be placed at the same location where the lockout device would have been placed and the employer must demonstrate that the tagout system provides safety equivalent to the lockout program.
 - (ii) In demonstrating that tagout provides safety equivalent to lockout, the employer shall show full compliance with all tagout-related provisions and such additional elements as are necessary to provide equivalent safety, such as the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device or removal of a valve handle.
 - (4) *Energy control procedure*
 - (i) Procedures shall be developed, documented and utilized. *Exception*: The employer need not document if *all* of the following exist:
 - (1) the machine has no potential to release or store energy
 - (2) the machine has a single energy source, readily identified and isolated
 - (3) isolation and lockout completely de-energize and deactivate the machine
 - (4) the machine is isolated from that energy source and locked out during servicing or maintenance
 - (5) a single lockout device will achieve lockout
 - (6) the lockout device is under control of the authorized employee servicing or maintaining the machine
 - (7) the servicing or maintenance does not create hazards for others
 - (8) the employer has had no accidents from the release of energy while servicing or maintaining equipment.
 - (ii) The procedures shall specify the scope, purpose, authorization, rules and techniques for controlling hazardous energy, and the means of enforcing compliance, including but not limited to:
 - (A) intended use of the procedure
 - (B) steps for shutting down, isolating, blocking and securing equipment to control its energy
 - (C) steps for placement, removal and transfer of lockout/tagout devices and the responsibility for them
 - (D) requirements for testing to determine and verify effectiveness of lockout/tagout devices and other measures.
 - (5) *Protective materials and hardware*
 - (i) Locks, tags, chains, wedges, key blocks, adaptor pins, self-locking fasteners or other hardware shall be provided by the employer.
 - (ii) Lockout/tagout devices shall be singularly identified, be the only devices used for controlling energy, not be used for other purposes, and shall be:
 - (A) Durable: (1) able to withstand the environment to which they are exposed for as long as they are exposed; (2) tagout devices shall be constructed and printed so that exposure will not cause the message to become illegible from deterioration; (3) tags shall not deteriorate when used in a corrosive environment.
 - (B) The color, shape or size of lockout/tagout devices and the print and format of tagout devices shall be standardized.

(C) Substantial: (1) removal of lockout devices shall necessitate excessive force or unusual techniques; (2) tagout devices shall be: substantial enough to prevent inadvertent removal; of a non-reusable type; attachable by hand; self-locking; 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.

(D) Identifiable: Lockout and tagout devices shall indicate the identity of the employee applying the device(s).

(iii) Tagout devices shall warn against hazardous conditions by legends such as: DO NOT START, DO NOT OPEN, DO NOT CLOSE, DO NOT ENERGIZE, DO NOT OPERATE.

(6) *Periodic inspections*

(i) The employer shall, at least annually, inspect for compliance with this standard. The inspection shall: (A) be performed by an authorized employee other than the employee using the procedure being inspected; (B) be designed to correct any deviations or inadequacies observed; (C) review with employees who lock out equipment their responsibilities for lockout; (D) review with employees who tag out equipment their responsibilities for tagout.

(ii) The employer shall certify that the periodic inspections have been performed and such certification shall: identify the subject machinery, the date of inspection, employees included and the person who performed the inspection.

(7) *Training and communication*

(i) The employer shall provide training to ensure employees understand the purpose and function of the program and have the knowledge and skills for safe implementation of the program. The training shall include: (A) (for authorized employees) recognition of all hazardous energy sources, the type and magnitude of energy in the workplace, and the methods and means for isolating and controlling it; (B) (for affected employees) purpose and use of the procedure; (C) (for other employees) the procedure and prohibitions against attempting to restart locked/tagged equipment.

(ii) When tagout systems are used employees shall be trained in these limitations: (A) tags are warning devices rather than restraining devices; (B) a tag must not be bypassed, ignored or defeated and must only be removed by the authorized person using it; (C) a tag must be legible and understandable; (D) tags and their means of attachment must withstand the environment; (E) a tag may create a false sense of security and is only part of the overall program; (F) a tag must be securely attached.

(iii) Employee retraining: (A) retraining shall be provided when there is a change in: job assignment; machines, equipment or process that presents a new hazard; or energy control procedures; (B) additional retraining shall be provided when the periodic inspection reveals a need or whenever the employer has reason to believe the need exists; (C) retraining shall reestablish proficiency and introduce new or revised control methods.

(iv) The employer shall certify that employee training has been accomplished and kept up to date.

(8) *Energy isolation.* The program shall be implemented by an authorized employee.

(9) *Notification of employees.* The employer or authorized employee shall notify affected employees before application and after removal of a lockout or tagout device.

29 CFR 1910.147(d)—*Application of control.* The established procedure shall include the following elements in the following sequence:

(1) *Preparation for shutdown.* Before shutdown, the authorized employee shall know the type and magnitude of the energy hazards and the methods and means of control.

(2) *Machine or equipment shutdown.* Shutdown shall follow the procedures of this standard.

(3) *Machine or equipment isolation.* All energy isolation devices shall be physically located and operated.

(4) *Lockout/tagout device application*

(i) Lockout/tagout devices shall be affixed by an authorized employee.

(ii) Lockout devices shall hold the energy isolating device in a *safe* or *off* position.

(iii) Tagout devices shall be affixed so as to prohibit moving the energy isolating device from its *safe* or *off* position.

(A) if the energy isolating device could be locked out but tagout is used, the tag shall be located where the lock would be attached;

(B) if the tag cannot be affixed to the energy isolating device, it must be located as close by as safely possible and where it is obvious.

(5) *Stored energy*

- (i) After applying the lockout/tagout devices, all potentially hazardous stored or residual energy shall be relieved or rendered safe.
- (ii) Absence of the reaccumulation of energy shall be continually verified.

(6) *Verification of isolation.* Isolation/de-energization shall be verified prior to working on a locked/tagged machine.

29 CFR 1910.147(e)—*Release from lockout or tagout.* Before removing lockout/tagout devices and restoring energy:

(1) *Machine or equipment.* The work area shall be inspected for removal of nonessential items and assurance that equipment is operationally intact.

(2) *Employees*

- (i) Employees shall be safely positioned or removed.
- (ii) Employees shall be notified of the intended removal of lockout/tagout devices.

(3) *Lockout/tagout devices removal.* Each lockout/tagout device shall be removed by the employee who applied it. *EXCEPTION:* When that employee is not available, the lockout/tagout device may be removed under the employer's direction if procedures and training for such removal were documented as part of the program and it is documented that the procedures provide equivalent safety. The procedures shall: (i) verify that the employee who applied the lockout/tagout device is not at the facility; (ii) make all reasonable effort to contact the employee who applied the lockout/tagout device; (iii) ensure the employee knows the lockout/tagout device was removed before he or she resumes work.

29 CFR 1910.147(f)—*Additional requirements*

(1) *Testing or positioning of machines, equipment or components thereof.* Before the temporary removal of lockout/tagout devices:

- (i) Clear the machine of tools and materials.
- (ii) Remove employees from the area.
- (iii) Remove the lockout/tagout devices.
- (iv) Energize and proceed with testing.
- (v) De-energize and reapply lockout/tagout devices to continue servicing and/or maintenance.

(2) *Outside personnel (contractors, etc.)*

- (i) The employer and contractor shall inform each other of their lockout/tagout procedures.
- (ii) The employer shall ensure that personnel comply with the contractor's procedures.

(3) *Group lockout or tagout*

- (i) Group lockout/tagout procedure must provide equivalent safety.
- (ii) Group lockout/tagout devices shall be used in accordance with the standard including, but not limited to: (A) vesting primary responsibility in an authorized employee; (B) providing for the authorized employee to ascertain the exposure status of group members; (C) assignment of coordination responsibility to one authorized employee when more than one group is involved; (D) ensuring that each employee affixes a personal lockout/tagout device to a group lockout device, group lockout box or comparable mechanism before work and removes it after work.

(4) *Shift or personnel changes.* Procedures for shift or personnel changes shall use procedures to ensure the continuity of lockout/tagout protection, including provision for orderly transfer between off-going and on-coming employees.

3

Employee Training Program: Lockout/Tagout Procedure

This part uses information in appendix A of 29 CFR 1910.147 to offer one possible plan for training management and employees about the standard's requirements. The company name in this part is fictitious. The plan should be customized to the needs of a particular company, to train for simple lockout/tagout operations.

Lockout/Tagout Training Procedure for Alpha-Omega Inc.

I. Purpose

Each employee shall be informed that the purpose of the Alpha-Omega Inc. lockout/tagout procedure is to provide a system for the lockout and/or tagout of energy isolating devices and thereby protect employees from potentially hazardous energy. Wherever possible, energy-isolating devices should be locked out.

Before employees service, repair or perform maintenance, the machine or equipment must be isolated from all potentially hazardous energy, and the isolating energy device(s) for the machine or equipment must be locked out or tagged out.

II. Types and Magnitude of Energy and Hazards

Each employee must be instructed in the types and magnitude of energy used by Alpha-Omega, Inc. The following types of energy are used:

(a) _____ (b) _____

The magnitude of energy (a) (_____ energy) used by Alpha-Omega Inc. is: _____; the magnitude of hazards presented by the _____ energy is: _____.

The magnitude of energy (b) (_____ energy) used by Alpha-Omega, Inc., is: _____; the magnitude of hazards presented by the _____ energy is: _____.

III. Training and Retraining of Affected and Authorized Employees

Each employee must be thoroughly trained with respect to lockout/tagout procedure used by Alpha-Omega Inc. Each employee must know that lockout/ tagout is used to protect employees against hazardous energy from inadvertent operation of equipment or machinery. Each employee must understand that he or she is never to attempt to operate an energy-isolating device when it is locked or tagged.

Each employee must be *retrained* if there is: a change in the employee's job assignment, a change in machinery or equipment that presents a new hazard, a change in energy control procedures, or the management of Alpha-Omega Inc. considers that retraining is necessary.

Training or retraining must include:

- how to recognize hazardous energy sources
- type and magnitude of energy used by Alpha-Omega Inc., especially with respect to the machinery or equipment to which the employee will be exposed
- purpose of the lockout/tagout procedure
- steps for shutting down, isolating, blocking and securing equipment to which the employee will be exposed
- steps for placement, removal and transfer of lockout/tagout devices and the division of responsibility for accomplishing those tasks

- requirements for testing to determine and verify effectiveness of lockout/tagout devices
- the proper use and limitations of tags

Employees who will use (actually implement) the lockout/tagout procedure must receive written authorization from supervision.

Training and retraining must be documented for each employee. Documentation must be maintained in the department where the employee currently works and must at all times be available to supervision and other employees. A separate copy of form B will be used to document training and retraining for each employee. Form B concludes this training procedure.

IV. Energy-Isolating Device(s)

Each employee must be instructed that every department has conducted a survey of *all* machinery, equipment and processes that possess potentially hazardous energy. The survey located all equipment and identified all isolating devices that must be locked or tagged to render the equipment safe for service, maintenance or repair and described applicable lockout/tagout procedure. The information for each item of machinery or equipment was recorded on a separate form A, which is maintained in the respective department and is readily available for use in conjunction with the lockout/tagout procedure. An example form A follows:

Form A

Types/Locations of Energy-Isolating Devices Alpha-Omega Inc.

1. Name of department: _____
2. Name of equipment or machine: _____
3. Serial number of equipment or machine: _____
4. Location of equipment or machine: _____
5. Each type of energy used by the equipment or machine:
 - a. _____
 - b. _____
6. Magnitude of each source of energy:
 - a. _____
 - b. _____
7. Hazards to be expected from each source of energy:
 - a. _____
 - b. _____
8. Type and location of each device for isolating energy to the machine or equipment and the method of lockout/tagout to be used (use an additional form, if needed):

	Type	Location	Method of lockout/tagout
a.	_____	_____	_____
b.	_____	_____	_____
c.	_____	_____	_____
d.	_____	_____	_____

9. Identification of each device and manner by which energy can be stored in the machine or equipment and identification of the procedure for dissipating or restraining the stored energy (use an additional form, if needed):

	Device/Manner	Procedure
a.	_____	_____
b.	_____	_____

V. Sequence of Lockout/Tagout System—Procedure and Form

Each employee will be informed of the lockout/tagout sequence used by Alpha-Omega Inc. That sequence includes the following steps:

Step 1. The authorized employee (designated by supervision to implement lockout/tagout) will notify all affected employees (operators and others in the area) that lockout/tagout is to be used and the reason for its use. (Form A for the respective machine or equipment lists all pertinent information, including the magnitude of energy and the hazards to be expected.)

Step 2. The machine must be shut down by normal procedure.

Step 3. Each energy-isolating device must be located. (See form A for the respective machine or equipment.) Each device must be operated to isolate the equipment from the energy source(s).

Step 4. Each device or manner by which energy can be stored must be located. (See form A for the respective machine or equipment.) Dissipate or restrain all stored energy.

Step 5. After responding to *Important Notes* (below), each energy isolating device (see form A for the respective machine or equipment) must now be locked or tagged with assigned individual locks or tags.

Important Notes:

1. If a lock can be used and you choose to use a tag, complete part VI before going to step 6.

2. If more than one authorized employee is required to affix a lockout/tagout device (see part X), the designated group coordinator must have each authorized employee who affixes a lockout/tagout device sign his/her name and enter the job title. Use a separate sheet, if needed:

Name _____ Job title _____
Name _____ Job title _____

Step 6. a. Ensure that personnel are not exposed; b. attempt to start the equipment with the normal operating controls to ensure that lockout/tagout has been effective; c. *return the operating control(s) to "neutral" or "off."* The equipment is now locked or tagged out.

VI. Tagout Justification System

If the machine, equipment or process can be locked out and/or tagged out and you choose to tagout, respond to parts 1 and 2 of the following tagout justification system, then return to part V, step 6.

Requirement 1

A. *Full Employee Protection.* If you cannot indicate a "yes" answer by checking each of the following items, do not use the tagout system.

- Tagout system provides full employee protection
- Tagout devices placed at the same location where the lockout device would have been placed
- Tagout system provides safety equivalent to the lockout program
- Employees can fully comply with all tagout-related provisions

B. *Additional Safety Measures.* Check the measure(s) used to provide equivalent protection and/or state any other alternative used.

- Isolating circuit element removal
- Control switches blocked
- Extra disconnecting device opened
- Removal of valve handles
- Alternative measures used to provide equivalent protection: _____

C. *Tagout Devices.* Check the tagout device against each criterion listed below. The tagout device should satisfy each criterion.

- Singularly identified
- Device used only for controlling energy

- Not used for other purposes
- Durable/substantial
- Able to withstand its intended environment
- Non-reusable
- Attachable by hand
- Self-locking
- Indicates employee identity
- Exposure will not cause deterioration
- Does not deteriorate in corrosive environment
- Standardized as to: ___color; ___shape and size; ___print and format
- Minimum unlocking strength of no less than 50 pounds
- Equivalent to a one-piece, all environment-tolerant nylon cable tie

D. *Warning Message.* Ensure that the tagout device:

- Warns against hazardous conditions
- Includes “Do Not Start (Open, Close, Energize, Operate, etc.)”

E. *Training.* Be certain that the employees have been trained that:

- Tags are simply warning devices
- Tags do not provide physical restraint
- Tags must never be removed without authorization
- Tags may evoke a false sense of security
- Tags are only part of the overall program
- Tags must be securely attached
- Tags must never be ignored or bypassed

Requirement 2

A. State your reasons for using the tagout system:

B. State how equivalent employee protection was provided:

C. Describe the training provided to employees:

At which location was the training provided:

Provide the date of the employee training:

Include the signature of the person who performed the training:

Include the signature of the person who authorized the use of the tagout system:

Date of authorization: _____

VII. Restoring Machines or Equipment to Normal Production Operations—Procedure and Form

1. When servicing, maintenance or repair is complete and the equipment or machine is ready to be started up, the authorized employee will ensure that:

- a. No one is exposed to the equipment or machine to be started or operated.
- b. All tools have been removed from the machine or equipment.
- c. Guards have been reinstalled.
- d. There are no exposed electrical wires.
- e. And that he or she is satisfied that it is otherwise safe to start the machine or equipment.

2. After responding to *Important Notes* (below), remove all lockout or tagout devices.

Important Notes:

1. If the authorized employee is not available to remove the lockout/tagout device(s), the device(s) may only be removed by or under the direction of the supervisor who responds to the following:

a. Identify the authorized employee whose device is being removed:

_____ (name) _____ (job title)

b. Describe all reasonable efforts made to locate the employee. (You may, for example, have telephoned the employee's home.)

c. Describe the action taken to ensure that, prior to his/her resumption of work, the authorized employee knows that his device was removed:

d. Enter your signature and the date to certify to the above steps:

_____ (name of supervisor) _____ (date)

2. If more than one authorized employee is required to remove a lockout/tagout device (see parts V and X), the designated group coordinator must have each authorized employee who removes a lockout/tagout device sign his/her name and enter the job title. Use a separate sheet, if needed:

Name _____ Job title _____

Name _____ Job title _____

3. Operate the energy isolating devices to restore energy to the machine or equipment.

VIII. Temporary Removal of Lockout/Tagout Devices

When testing, the positioning of machines or equipment, or other requirements demand the temporary removal of lockout/tagout device(s), the authorized employer or supervisor must:

- a. Follow the steps in part VII, 1-3.
- b. Conduct the tests or position the equipment.
- c. De-energize all systems and reapply energy control measures in accordance with part V.

IX. Outside Contractors

If the maintenance, service or repair is performed by an outside contractor, the Alpha-Omega Inc. supervisor must appoint an Alpha-Omega Inc. employee to serve as the outside contractor's authorized employee for the purposes of parts V, VII and VIII.

X. Group Lockout or Tagout

When group-lockout/tagout is required or when more than one group is involved, a group coordinator must be designated by supervision. The designated group coordinator must seek agreement from the other authorized employee(s) and must ensure that each authorized employee:

- a. Places his or her personal lockout or tagout device on the energy isolating device(s).
- b. Or places the lockout/tagout device on a multiple lockout/tagout device (hasp), if the energy isolating device cannot accept multiple locks or tags.
- c. Or secures the personal *lock* to a multiple-lock lockout box or cabinet which holds the key to the single lock on the energy isolating device.
- d. And signs and enters his/her job title at the time of affixing and removing the device.

XI. Documentation of Employee Training

Form B must be completed for each employee following each training or retraining session.

Form B

Documentation of Training/Retraining Lockout/Tagout Procedure—Alpha-Omega Inc.

Employee's name: _____

Employee's address: _____

Employee's home telephone number: _____

Current job title: _____

Department: _____

Date of training/retraining: _____

Signature of employee: _____

Signature of trainer (supervisor): _____

If the employee received authorization to implement the lockout/tagout system, check here (___)

Date authorized: _____

Authorizing supervisor's signature: _____

4

OSHA Lockout/Tagout Standard Implementation Plan

(29 CFR 1910.147)

Step	Description	Responsibility	Target Completion Date
1.	Standard reviewed with top management:	<hr/>	<hr/>
2.	Standard reviewed with safety and health committee:	<hr/>	<hr/>
3.	Lockout/tagout procedure prepared per 1910.147:	<hr/>	<hr/>
4.	Lockout/tagout materials such as locks, tags, chains, provided:	<hr/>	<hr/>
5.	Energy-isolating devices checked throughout the facility to ensure needed isolation devices provided:	<hr/>	<hr/>
6.	Authorized and affected employees trained:	<hr/>	<hr/>
7.	Retraining provided when changes in jobs, machinery or processes present a new hazard or procedure:	<hr/>	<hr/>
8.	Retraining provided when inspections reveal a need or supervisor sees a need:	<hr/>	<hr/>
9.	Energy control procedure inspected at least annually:	<hr/>	<hr/>
10.	Records maintained of all inspections and training:	<hr/>	<hr/>

Appendix A

Other Standards Related to Lockout/Tagout or the Control of Hazardous Energy

The standard, 29 CFR 1910.147, was never intended to invalidate other specific lockout and/or tagout provisions. Rather, the standard was intended to supplement and support the other provisions with requirements for using a written procedure, for training employees and for periodic inspections.

The information below was *adapted* from standards promulgated under the federal Occupational Safety and Health Act. The information relates each standard as it applies to lockout/tagout or the control of hazardous energy during maintenance (it does not attempt to quote each standard verbatim or relate each standard in its entirety). Consult the standard for specific language.

The standards can be found in *OSH Standards for General Industry* and *OSH Standards for the Construction Industry*. For copies of the standards, consult the Bureau of Education, Training and Technical Assistance, Division of Occupational Safety and Health, N.C. Department of Labor (see the inside back cover of this publication for the address and telephone number).

General Industry

Accident Prevention Signs and Tags

[29 CFR 1910.145(f)(1)] The tags are a temporary means of warning all concerned of a hazardous condition, defective equipment, radiation hazards, etc. The tags are not to be considered as a complete warning method, but should be used until a positive means can be employed to eliminate the hazard; for example, a “Do Not Start” tag on power equipment must be used for a few moments or a very short time until the switch in the system can be locked out; a “Defective Equipment” tag shall be placed on a damaged ladder and immediate arrangements made for the ladder to be taken out of service and sent to the repair shop.

[29 CFR 1910.145(f)(3)] “Use.” Tags shall be used as a means to prevent accidental injury or illness to employees who are exposed to hazardous or potentially hazardous conditions, equipment or operations that are out of the ordinary, unexpected or not readily apparent.

[29 CFR 1910.145(f)(5)] “Danger” tags should be used only where an immediate hazard exists. There should be no variation in the type of design of tags posted or hung to warn of specific dangers.

[29 CFR 1910.145(f)(6)] “Caution” tags should be used only to warn against potential hazards or to caution against unsafe practices.

[29 CFR 1910.145(f)(7)] “Out of Order” tags should be used only for the specific purpose of indicating that a piece of equipment, machinery, etc., is out of order and to attempt to use it might present a hazard.

Powered Industrial Trucks

[29 CFR 1910.178(q)(4)] Trucks in need of repairs to the electrical system shall have the battery disconnected prior to such repairs.

Overhead and Gantry Cranes

[29 CFR 1910.179(g)(5)(i)] The power supply to the runway conductors shall be controlled by a switch or circuit breaker located on a fixed structure, accessible from the floor and arranged to be locked in the open position.

[29 CFR 1910.179(g)(5)(ii)] On cab-operated cranes a switch or circuit breaker of the enclosed type, with provision for locking in the open position, shall be provided in the leads from the runway conductors. A means of opening this switch or circuit breaker shall be located within easy reach of the operator.

[29 CFR 1910.179(g)(5)(iii)] On floor-operated cranes, a switch or circuit breaker of the enclosed type, with provision for locking in the open position, shall be provided in the leads from runway conductors. This disconnect shall be mounted on the bridge or footwalk near the runway collectors. (See the provision for acceptable types of floor-operated disconnects.)

[29 CFR 1910.179(l)(2)(i)] Before adjustments and repairs are started on a crane, the following precautions shall be taken:

(b) All controllers shall be at the off position.

(c) The main or emergency switch shall be open and locked in the open position.

(d) Warning or "out of order" signs shall be placed on the crane, also on the floor beneath or on the hook where visible from the floor.

Derricks

[29 CFR 1910.181(f)(2)(i)(c)] The main or emergency switch shall be locked in the open position, if an electric hoist is used.

[29 CFR 1910.181(f)(2)(i)(d)] "Warning" or "Out of Order" signs shall be placed on the derrick and hoist.

Woodworking Machinery Requirements

[29 CFR 1910.213(a)(10)] It is recommended that each power-driven wood working machine be provided with a disconnect switch that can be locked in the off position.

[29 CFR 1910.213(b)(3)] On applications where injury to the operator might result if motors were to restart after power failures, provision shall be made to prevent machines from automatically restarting upon restoration of power.

[29 CFR 1910.213(b)(5)] On each machine operated by electric motors, positive means shall be provided for rendering such controls or devices inoperative while repairs or adjustments are being made to the machines they control.

Mechanical Power Presses

[29 CFR 1910.217(b)(8)(i)] A main power disconnect switch capable of being locked only in the off position shall be provided with every power press control system.

[29 CFR 1910.217(d)(9)(iv)] The employer shall provide and enforce the use of safety blocks for use whenever dies are being adjusted or repaired in the press.

Forging Machines

[29 CFR 1910.218(a)(3)(iii)] Means shall be provided for disconnecting the power to the machine and for locking out or rendering cycling controls inoperable.

[29 CFR 1910.218(a)(3)(iv)] The ram shall be blocked when dies are being changed or other work is being done on the hammer. Blocks or wedges shall be made of material the strength and construction of which should meet or exceed the specifications and dimensions shown in Table O-11.

[29 CFR 1910.218(d)(2)] Shutoff valve. Steam hammers shall be provided with a quick closing emergency valve in the admission pipeline at a convenient location. This valve shall be closed and locked in the off position while the hammer is being adjusted, repaired or serviced or when the dies are being changed.

[29 CFR 1910.218(e)(1)(ii)] Air-lift hammers shall have an air shutoff valve as required in paragraph (d)(2) of this section and should be conveniently located and distinctly marked for ease of identification.

[29 CFR 1910.218(e)(1)(iii)] Air-lift hammers shall be provided with two drain cocks: one on main head cylinder and one on clamp cylinder.

[29 CFR 1910.218(f)(1)] Mechanical forging presses. When dies are being changed or maintenance is being performed on the press, the following shall be accomplished:

- (i) The power to the press shall be locked out.
- (ii) The flywheel shall be at rest.
- (iii) The ram shall be blocked with a material the strength of which shall meet or exceed the specifications or dimensions shown in Table O-11.

[29 CFR 1910.218(f)(2)] Hydraulic forging presses. When dies are being changed or maintenance is being performed on the press, the following shall be accomplished:

- (i) The hydraulic pumps and power apparatus shall be locked out.

[29 CFR 1910.218(g)(1)] Hot trimming presses. The requirements of paragraph (f)(1) of this section shall also apply to hot trimming presses.

[29 CFR 1910.218(h)(2)] Lockouts. Upsetters shall be provided with a means for locking out the power at its entry point to the machine and rendering its cycling controls inoperable.

[29 CFR 1910.218(h)(5)] Changing dies. When dies are being changed, maintenance performed or any work done on the machine, the power to the upsetter shall be locked out, and the flywheel shall be at rest.

[29 CFR 1910.218(i)(1)] Boltheadings. The provisions of paragraph (h) of this section shall apply to bolt-heading.

[29 CFR 1910.218(i)(2)] Rivet making. The provisions of paragraph (h) of this section shall apply to rivet making.

[29 CFR 1910.218(j)(1)] Billet shears. A positive-type lockout device for disconnecting the power to the shear shall be provided.

Resistance Welding

[29 CFR 1910.255(a)(1)] Installation. All equipment shall be installed by a qualified electrician in conformance with subpart S of this part. There shall be a safety-type disconnecting switch or a circuit breaker or circuit interrupter to open each power circuit to the machine, conveniently located at or near the machine, so that the power can be shut off when the machine or its controls are to be serviced.

[29 CFR 1910.255(b)(2)] Capacitor welding. Stored energy or capacitor discharge type of resistance welding equipment and control panels involving high voltage (over 550 volts) shall be suitably insulated and protected by complete enclosures, all doors of which shall be provided with suitable interlocks and contacts wired into the control circuit (similar to elevator interlocks). Such interlocks or contacts shall be so designed as to effectively interrupt power and short circuit all capacitors when the door or panel is open. A manually operated switch or suitable positive device shall be installed, in addition to the mechanical interlocks or contacts, as an added safety measure assuring absolute discharge of all capacitors.

Pulp, Paper and Paperboard Mills

[29 CFR 1910.261(b)(1)] Lockouts. Devices such as padlocks shall be provided for locking out the source of power at the main disconnect switch. Before any maintenance, inspection, cleaning, adjusting or servicing of equipment (electrical, mechanical or other) that requires entrance into or close contact with the machinery or equipment, the main power disconnect switch or valve, or both, controlling its source of power or flow of material shall be locked out or blocked off with padlock, blank flange, or similar device.

[29 CFR 1910.261(e)(2)] Slasher tables. Saws shall be stopped and power switches shall be locked out and tagged whenever it is necessary for any person to be on the slasher table.

[29 CFR 1910.261(e)(10)] Stops. All control devices shall be locked out and tagged when knives are being changed.

[29 CFR 1910.261(e)(12)(iii)] Whenever it becomes necessary for a workman to go within a drum, the driving mechanism shall be locked and tagged, at the main disconnect switch, in accordance with paragraph (b)(4) of this section. (Note: Refer to paragraph (b)(1) of this section; paragraph (b)(4) removed from this section of standard.)

[29 CFR 1910.261(e)(13)] Intermittent barking drums. In addition to motor switch, clutch, belt shifter or other power disconnecting device, intermittent barking drums shall be equipped with a device that may be locked to prevent the drum from moving while it is being emptied or filled.

[29 CFR 1910.261(f)(6)(i)] When cleaning, inspection or other work requires that persons enter rag cookers, all steam and water valves, or other control devices, shall be locked and tagged in the closed or *off* position. Blank flanging of pipelines is acceptable in place of closed and locked valves.

[29 CFR 1910.261(g)(4)(ii)] A man shall be stationed outside to summon assistance if necessary. All intake valves to a tank shall be blanked off or disconnected.

[29 CFR 1910.261(g)(15)(i)] Valves controlling lines leading into a digester shall be locked out and tagged. The keys to the locks shall be in the possession of a person or persons doing the inspecting or making repairs.

[29 CFR 1910.261(g)(16)(i)] Safety regulations governing inspection and repairing of pressure tanks-accumulators (acid) shall be the same as those specified in subparagraph (15) of this paragraph.

[29 CFR 1910.261(g)(19)(iii)] When blow lines from more than one digester lead into one pipe, the cock or valve of the blow line from the tank being inspected or repaired shall be locked or tagged out, or the line shall be disconnected and blocked off.

[29 CFR 1910.261(g)(21)] Inspection and repair of tanks. All piping leading to tanks shall be blanked off or valved and locked or tagged. Any lines to sewers shall be blanked off to protect workers from air contaminants.

[29 CFR 1910.261(j)(1)(iii)] Repairs for cleaning of blockage shall be done only when the shredder is shut-down and control devices locked.

[29 CFR 1910.261(j)(4)(ii)] When cleaning, inspecting or other work requires that persons enter the beaters, all control devices shall be locked or tagged out, in accordance with paragraph (b)(4) of this section. (Note: Refer to paragraph (b)(1) of this section; paragraph (b)(4) removed from this section of standard.)

[29 CFR 1910.261(j)(5)(iii)] When cleaning, inspecting or other work requires that persons enter pulpers, all steam, water or other control devices shall be locked or tagged out. Blank flanging and tagging of pipe lines are acceptable in place of closed and locked or tagged valves. Blank flanging of steam and water lines shall be acceptable in place of valve locks.

[29 CFR 1910.261(j)(6)(i)] All control devices shall be locked or tagged out when persons enter stock chests, in accordance with paragraph (b)(4) of this section. (Note: Refer to paragraph (b)(1) of this section; paragraph (b)(4) removed from this section of standard.)

[29 CFR 1910.261(k)(2)(ii)] All drives shall be provided with lockout devices at the power switch that interrupts the flow of current to the unit.

Textiles

[29 CFR 1910.262(c)(1)] Means of stopping machines. Every textile machine shall be provided with individual mechanical or electrical means for stopping such machines. On machines driven by belts and shafting, a locking-type shifter or an equivalent positive device shall be used. On operations where injury to the operator might result if motors were to restart after power failures, provision shall be made to prevent machines from automatically restarting upon restoration of power.

[29 CFR 1910.262(n)(2)] Protection for loom fixer. Provisions shall be made so that every loom fixer can prevent the loom from being started while he is at work on the loom. This may be accomplished by means of a lock, the key to which is retained in the possession of the loom fixer, or by some other effective means to prevent starting the loom.

[29 CFR 1910.262(p)(1)] J-box protection. Each valve controlling the flow of steam, injurious gases or liquids into a J-box shall be equipped with a chain, lock and key, so that any worker who enters the J-box can lock the valve and retain the key in his possession. Any other method that will prevent steam, injurious gases or liquids from entering the J-box while the worker is in it will be acceptable.

[29 CFR 1910.262(q)(2)] Kier valve protection. Each valve controlling the flow of steam, injurious gases or liquids into a kier shall be equipped with a chain, lock and key, so that any worker who enters the kier can lock the valve and retain the key in his possession. Any other method which will prevent steam, injurious gases or liquids from entering the kier while the worker is in it will be acceptable.

Bakery Equipment

[29 CFR 1910.263(k)(12)(i)] Where pan cooling towers extend to two or more floors, a lockout switch shall be provided on each floor in order that mechanics working on the tower may positively lock the mechanism against starting. Only one start switch shall be used in the motor control circuit.

[29 CFR 1910.263(l)(3)(iii)(b)] Main shutoff valves shall be locked in the closed position when men must enter the oven or when the oven is not in service.

[29 CFR 1910.263(l)(8)(iii)] A main disconnect switch or circuit breaker shall be provided. This switch or circuit breaker shall be so located that it can be reached quickly and safely. The main switch or circuit breaker shall have provisions for locking it in the open position if any work on the electrical equipment or inside the oven must be performed.

Sawmills

[29 CFR 1910.265(c)(13)] Hydraulic systems. Means shall be provided to block, chain or otherwise secure equipment normally supported by hydraulic pressure so as to provide for safe maintenance.

[29 CFR 1910.265(c)(26)(iii)] Blocking hoisting platform. Means shall be provided to positively block the hoisting platform when employees must go beneath the stacker or unstacker hoist.

[29 CFR 1910.265(c)(26)(v)] Locking main control switches. Main control switches shall be so designed that they can be locked in the open position.

[29 CFR 1910.265(e)(1)(iv)] Carriage control. A positive means shall be provided to prevent unintended movement of the carriage. This may involve a control locking device, a carriage tie-down or both.

Telecommunications

[29 CFR 1910.268(l)(2)] Before the voltage is applied, cable conductors shall be isolated to the extent practicable. Employees shall be warned, by such techniques as briefing and tagging at all affected locations, to stay clear while the voltage is applied.

[29 CFR 1910.268(m)(7)(i)] Prior to grounding a radio transmitting station antenna, the employer shall insure that the rigger in charge: (A) prepares a danger tag signed with his signature, (B) requests the transmitting technician to shutdown the transmitter and to ground the antenna with its grounding switch, (C) is notified by the transmitting technician that the transmitter has been shutdown, and (D) tags the antenna ground switch personally in the presence of the transmitting technician after the antenna has been grounded by the transmitting technician.

Construction Industry

General Safety and Health Provisions

[29 CFR 1926.20(b)(3)] The use of any machinery, tool, material or equipment that is not in compliance with any applicable requirement of this part is prohibited. Such machine, tool, material or equipment shall either be identified as unsafe by tagging or locking the controls to render them inoperable or shall be physically removed from its place of operation.

Nonionizing Radiation

[29 CFR 1926.54(e)] Beam shutters or caps shall be utilized, or the laser turned off, when laser transmission is not actually required. When the laser is left unattended for a substantial period of time, such as during lunch hour, overnight or at change of shifts, the laser shall be turned off.

Accident Prevention Signs and Tags

[29 CFR 1926.200(h)(1)] Accident prevention tags shall be used as a temporary means of warning employees of an existing hazard, such as defective tools, equipment, etc. They shall not be used in place of, or as a substitute for, accident prevention signs.

Woodworking Tools

[29 CFR 1926.304(a)] All fixed power driven woodworking tools shall be provided with a disconnect switch that can either be locked or tagged in the *off* position.

Welding and Cutting

[29 CFR 1926.352(g)] For the elimination of possible fire in enclosed spaces as a result of gas escaping through leaking or improperly closed torch valves, the gas supply to the torch shall be positively shut off at some point outside the enclosed space whenever the torch is not to be used or whenever the torch is left unattended for a substantial period of time, such as during the lunch period. Overnight and at the change of shifts, the torch and hose shall be removed from the confined space. Open end fuel gas and oxygen hoses shall be immediately removed from enclosed spaces when they are disconnected from the torch or other gas-consuming device.

Lockout and Tagging of Circuits

[1926.417(a)] **Control.** Controls that are to be deactivated during the course of work on energized or de-energized equipment or circuits shall be tagged.

[1926.417(b)] **Equipment and circuits.** Equipment and circuits that are de-energized shall be rendered inoperative and shall have tags attached at all points where such equipment or circuits can be energized.

[1926.417(c)] **Tags.** Tags shall be placed to identify plainly the equipment or circuits being worked on.

Base-Mounted Drum Hoists

[29 CFR 1926.553(a)(3)] Electric motor operated hoists shall be provided with:

- (i) A device to disconnect all motors from the line upon power failure and not permit any motor to be restarted until the controller handle is brought to the off position.
- (iii) A means whereby remotely operated hoists stop when any control is ineffective.

Conveyors

[29 CFR 1926.555(a)(7)] Conveyors shall be locked out or otherwise rendered inoperable and tagged out with a "Do Not Operate" tag during repairs and when operation is hazardous to employees performing maintenance work.

Motor Vehicles, Mechanized Equipment and Marine Operations

[29 CFR 1926.600(a)(3)(i)] Heavy machinery, equipment or parts thereof that are suspended or held aloft by use of slings, hoists or jacks shall be substantially blocked or cribbed to prevent falling or shifting before employees are permitted to work under or between them. Bulldozer and scraper blades, end-loader buckets, dump bodies, and similar equipment, shall be either fully lowered or blocked when being repaired or when not in use. All controls shall be in a neutral position, with the motors stopped and brakes set, unless work being performed requires otherwise.

[29 CFR 1926.600(a)(3)(ii)] Whenever the equipment is parked, the parking brake shall be set. Equipment parked on inclines shall have the wheels chocked and the parking brake set.

[29 CFR 1926.601(b)(10)] Trucks with dump bodies shall be equipped with positive means of support, permanently attached and capable of being locked in position to prevent accidental lowering of the body while maintenance or inspection work is being done.

[29 CFR 1926.601(b)(11)] Operating levers controlling hoisting or dumping devices on haulage bodies shall be equipped with a latch or other device that will prevent accidental starting or tripping of the mechanism.

[29 CFR 1926.603(a)(5)] A blocking device, capable of safely supporting the weight of the hammer, shall be provided for placement in the leads under the hammer at all times while employees are working under the hammer.

Initiation of Explosive Charges—Electric Blasting

[29 CFR 1926.906(j)] In underground operations when firing from a power circuit, a safety switch shall be placed in the permanent firing line at intervals. This switch shall be made so it can be locked only in the *off* position and shall be provided with a short-circuit arrangement of the firing lines to the cap circuit.

[29 CFR 1926.906(l)] When firing from a power circuit, the firing switch shall be locked in the open or *off* position at all times, except when firing. It shall be so designed that the firing lines to the cap circuit are automatically short-circuited when the switch is in the *off* position. Keys to this switch shall be entrusted only to the blaster.

Power Transmission and Distribution

[29 CFR 1926.950(d)(1)] When de-energizing lines and equipment operated in excess of 600 volts and the means of disconnecting from electric energy is not visibly open or visibly locked out, the provisions of subdivisions (i) through (vii) of this subparagraph shall be complied with.

[29 CFR 1926.950(d)(1)(i)] The particular section of line or equipment to be de-energized shall be clearly identified, and it shall be isolated from all sources of voltage.

[29 CFR 1926.950(d)(1)(ii)] Notification and assurances from the designated employee shall be obtained that:

- (a) All switches and disconnectors through which energy may be supplied to the particular section of line or equipment to be worked have been de-energized.
- (b) All switches and disconnectors are plainly tagged indicating that men are at work.
- (c) And that where design of such switches and disconnectors permits, they have been rendered inoperable.

[29 CFR 1926.950(d)(1)(iii)] After all designated switches and disconnectors have been opened, rendered inoperable and tagged, visual inspection or tests shall be conducted to insure that equipment or lines have been deenergized.

[29 CFR 1926.950(d)(1)(iv)] Protective grounds shall be applied on the disconnected lines or equipment to be worked on.

[29 CFR 1926.950(d)(1)(v)] Guards or barriers shall be erected as necessary to adjacent energized lines.

[29 CFR 1926.950(d)(1)(vi)] When more than one independent crew requires the same line or equipment to be de-energized, a prominent tag for each such independent crew shall be placed on the line or equipment by the designated employee in charge.

[29 CFR 1926.950(d)(1)(vii)] Upon completion of work on de-energized lines or equipment, each designated employee in charge shall determine that all employees in his crew are clear, that protective grounds installed by his crew have been removed, and he shall report to the designated authority that all tags protecting his crew may be removed.

[29 CFR 1926.950(d)(2)] When a crew working on a line or equipment can clearly see that the means of disconnecting from electric energy are visibly open or visibly locked out, the provisions of subdivisions (i) and (ii) of this subparagraph shall apply.

[29 CFR 1926.950(d)(2)(i)] Guards or barriers shall be erected as necessary to adjacent energized lines.

[29 CFR 1926.950(d)(2)(ii)] Upon completion of work on deenergized lines or equipment, each designated employee in charge shall determine that all employees in his crew are clear, that protective grounds installed by his crew have been removed, and he shall report to the designated authority that all tags protecting his crew may be removed.

Construction in Energized Substations

[29 CFR 1926.951(c)(1)] **Ladders.** Portable metal or conductive ladders shall not be used near energized lines or equipment except as may be necessary in specialized work such as in high voltage substations where nonconductive ladders might present a greater hazard than conductive ladders. Conductive or metal ladders shall be prominently marked as conductive and all necessary precautions shall be taken when used in specialized work.

[29 CFR 1926.957(b)] De-energized equipment or lines. When it is necessary to de-energize equipment or lines for protection of employees, the requirements of paragraph 1926.950(d) shall be complied with.

References

- Boylston, Raymond P. August 1982. *Locking and Tagging Guide for Industrial Operations*. Professional Safety. pp. 21–25.
- National Safety Council. 1981. Principles of Guarding. *Accident Prevention Manual Manual for Industrial Operations—Engineering and Technology*. 8th ed. Chapter 8.
- NIOSH (1999). NIOSH Alert: Preventing Worker Deaths From Uncontrolled Release of Electrical, Mechanical and Other Types of Hazardous Energy; U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute of Occupation Safety and Health; DHHS (NIOSH) Publication No. 99-110.
- U.S. Department of Labor, OSHA 3120, 1997 (Revised), Control of Hazardous Energy (Lockout/Tagout).

Additional Help

OSHA Instruction STD 1-7.3. September 11, 1990. Directorate of Compliance Programs. 29 CFR 1910.147, the Control of Hazardous Energy (Lockout/Tagout)—Inspection Procedures and Interpretive Guidance. Occupational Safety and Health, U.S. Department of Labor, Washington, D.C.

OSHA Instruction STD 1-7.3 is a public document. It can be obtained by writing to the U.S. Department of Labor. It is also published by Commerce Clearing House Inc. in the *Employment Safety and Health Guide*, at 10,655, ¶13,566 *et seq.*

OSHA Instruction STD 1-7.3 addresses: periodic inspections by the employer, required by the standard, and equipment testing or positioning. Appendix C of OSHA Instruction STD 1-7.3 discusses at length group lockout/tagout, including simple and complex operations.

The following industry guides are available from the N.C. Department of Labor's Division of Occupational Safety and Health:

- #1. A Guide to Safety in Confined Spaces*
- #2. A Guide to Procedures of the Safety and Health Review Board of North Carolina*
- #3. A Guide to Machine Safeguarding*
- #4. A Guide to OSHA in North Carolina*
- #5. A Guide for Persons Employed in Cotton Dust Environments*
- #6. A Guide to Lead Exposure in the Construction Industry*
- #7. A Guide to Bloodborne Pathogens in the Workplace*
- #8. A Guide to Voluntary Training and Training Requirements in OSHA Standards*
- #9. A Guide to Ergonomics*
- #10. A Guide to Farm Safety and Health*
- #11. A Guide to Radio Frequency Hazards With Electric Detonators*
- #12. A Guide to Forklift Operator Training*
- #13. A Guide to the Safe Storage of Explosive Materials*
- #14. A Guide to the OSHA Excavations Standard*
- #15. A Guide to Developing and Maintaining an Effective Hearing Conservation Program*
- #17. A Guide to Asbestos for Industry*
- #18. A Guide to Electrical Safety*
- #19. A Guide to Occupational Exposure to Wood and Wood Dust*
- #20. A Guide to Crane Safety*
- #21. A Guide to School Safety and Health*
- #23. A Guide to Working With Electricity*
- #25. A Guide to Personal Protective Equipment*
- #26. A Guide to Manual Materials Handling and Back Safety*
- #27. A Guide to the Control of Hazardous Energy (Lockout/Tagout)*
- #28. A Guide to Eye Wash and Safety Shower Facilities*
- #29. A Guide to Safety and Health in Feed and Grain Mills*
- #30. A Guide to Working With Corrosive Substances*
- #31. A Guide to Formaldehyde*
- #32. A Guide to Fall Prevention in Industry*
- #33. A Guide to Office Safety and Health*
- #34. A Guide to Safety and Health in the Poultry Industry*
- #35. A Guide to Preventing Heat Stress*
- #36. A Guide to the Safe Use of Escalators and Elevators*
- #37. A Guide to Boilers and Pressure Vessels*
- #38. A Guide to Safe Scaffolding*
- #39. A Guide to Safety in the Textile Industry*
- #40. A Guide to Emergency Action Planning*
- #41. A Guide to OSHA for Small Businesses in North Carolina*

Occupational Safety and Health (OSH)

Sources of Information

You may call 1-800-NC-LABOR (1-800-625-2267) to reach any division of the N.C. Department of Labor; or visit the NCDOL home page on the World Wide Web, Internet Web site address: <http://www.nclabor.com>.

N.C. Division of Occupational Safety and Health

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Local Telephone: (919) 807-2900 Fax: (919) 807-2856

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 3rd Floor)

For information concerning education, training and interpretations of occupational safety and health standards contact:

Bureau of Education, Training and Technical Assistance

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2875 Fax: (919) 807-2876

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 4th Floor)

For information concerning occupational safety and health consultative services and safety awards programs contact:

Bureau of Consultative Services

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2899 Fax: (919) 807-2902

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 3rd Floor)

For information concerning migrant housing inspections and other related activities contact:

Agricultural Safety and Health Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2923 Fax: (919) 807-2924

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 2nd Floor)

For information concerning occupational safety and health compliance contact:

Safety and Health Compliance District Offices

Raleigh District Office (313 Chapanoke Road, Raleigh, NC 27603)
Telephone: Safety (919) 662-4597 Fax: (919) 662-4709
Health (919) 662-4711

Asheville District Office (204 Charlotte Highway, Suite B, Asheville, NC 28803-8681)
Telephone: (828) 299-8232 Fax: (828) 299-8266

Charlotte District Office (901 Blairhill Road, Suite 200, Charlotte, NC 28217-1578)
Telephone: Safety (704) 342-6163 Fax: (704) 342-5919

Winston-Salem District Office (4964 University Parkway, Suite 202, Winston-Salem, NC 27106-2800)
Telephone: Safety (336) 776-4420 Fax: (336) 767-3989
Health (336) 776-4420 Fax: (336) 767-3989

Wilmington District Office (1200 N. 23rd St., Suite 205, Wilmington, NC 28405-1824)
Telephone: (910) 251-2678 Fax: (910) 251-2654

To make an OSHA Complaint, **OSH Complaint Desk:** (919) 807-2796

For statistical information concerning program activities contact:

Planning, Statistics and Information Management

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2950 Fax: (919) 807-2951

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For information about books, periodicals, vertical files, videos, films, audio/slide sets and computer databases contact:

N.C. Department of Labor Library

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