



# National Institute for Occupational Safety and Health (NIOSH) Manufacturing



## Hazardous Energy Control Resource Guide

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For Everyone

### PURPOSE

This step-by-step guide offers sample materials and templates to help with the implementation of minimum required elements for a successful Hazardous Energy Control program. Our goal is that workers go home each day in the same condition as they came to work.

## Background

Members from the [National Occupational Research Agenda \(NORA\) Manufacturing Sector Council](#) reviewed, adapted and compiled resources to help companies start or improve and maintain their existing Lockout Program.

The resources provided are accompanied by templates that will work best if you customize images, text, and data to fit your facility's specific needs.

## Getting started

A successful program will consist of four main activities:

1. Energy control procedures
2. Employee training
3. Auditing or conducting periodic inspections
4. Designing, specifying and acquiring equipment that will accommodate lockout procedures.

These four components work best when they are documented in the form of a written procedure.

## Energy control procedures

Companies must have a program outlining the steps to de-energize machines and lock out sources of energy. The program will work best when it is recorded in a written procedure.

The section below provides sample written programs with different complexity levels. Once you decide which one suits your company needs, you can customize it.

## Sample written procedures

[OSHA example from the regulations](#)

The sample programs below were provided by NIOSH partners and may or may not work for you. These examples should prove helpful in deciding what aspects are needed at your facility. Other information on machine safety and hazardous energy control can be found at OSHA, in ANSI/ASSE Z244- 2016 The Control of Hazardous Energy Lockout, Tagout and Alternative Methods, ANSI/B11 B11.0, ANSI/B11 B11.19, machine specific standards and manufacturer literature.

[Sample Written Program A \[DOC – 90 KB\]](#) , [\[PDF – 243 KB\]](#)

A detailed program which details management's responsibility, including determining which applications require lockout and informing employees. Note that ANSI and industry standards recommend that a team should be involved in risk assessment, possibly including management, workers, manufacturers' representatives, and consultants. Workers and maintenance personnel have knowledge of machine

operations and work processes. Management and workers need to buy-in into the solution. If changes to the work process and procedures for control of hazardous energy are necessary, a rigorous management of change procedure must be followed to ensure the safety implications of the change are reviewed, addressed, and properly authorized before the change is implemented.

[Sample Written Program B \[DOC – 3 MB\] \[DOC\]](#), [\[PDF – 487 KB\] \[PDF\]](#)

A relatively simple program with group lockout, examples, and supervisory control.

[Sample Written Program C \[DOC – 55 KB\] \[DOC\]](#), [\[PDF – 163 KB\] \[PDF\]](#)

This policy puts the human resources officer in charge of LOTO supply dispensing. This policy mentions a Job Hazard Analysis which is a simple type of risk assessment. Assessments which include individual tasks are generally better than ones that only look at hazards. While this sample program does not mention outside contractors, consideration must be given to those.

[Brief Sample Written Program D \[DOC – 86 KB\] \[DOC\]](#), [\[PDF – 156 KB\] \[PDF\]](#) – Includes management and "outside personnel" such as contractors.

## Important characteristics and considerations

### Roadmap

Regardless of the level of complexity of your program, you will need to document each source of energy. The steps involved are described in this roadmap below.

#### Documenting Sources of Energy

Remember to assess the hazardous energy within a machine such as hydraulic pressure (tanks and lines) and compressed air. In addition, gasses which are pressurized, or are asphyxiants or poisons need to be controlled. Sources of Energy are (for example, but not limited to):

- Electrical
- Capacitors (ground out and drain)
- Pressurized or Pneumatic
- Chemical (Acids, Explosives)
- Explosive gases and dusts
- Asphyxiants (like Nitrogen)
- Heat/Cold sources
- Gravity (things fall from height or roll)
- Static Electricity – Can build up in processes especially with dust

- List what operations require lockout.
- Determine which employees are authorized to conduct lockout [ANSI/ASSE Z244.1-2016 \[PDF – 163 KB\] \[PDF\]](#)
- Determine training needs by:
  - Determining which employees need to be trained on lockout procedures. Temporary employees and external employees and contractors must be included.
  - Determining how frequently employees need trained and document all training. Training must be documented and verified, preferably by a person who does not perform lockout.
- Carefully select locks and tagging devices and demonstrating them to supervisors and affected employees. It is also imperative to ensure that tools are readily available and easily identifiable.
- Clearly label all lockout points for hazardous energy and communicating these locations to supervisors and affected employees. Plan to de-energize electrical circuits and block machine parts against motion and lockout against all forms of hazardous energy, including electrical breaker panels and control valves.
  - The following templates should be used after they are customized to your company needs:
    - [Create your signs Template \[DOC – 149 KB\] \[DOC\]](#), [\[PDF – 193 KB\] \[PDF\]](#)
    - [Create a machine-specific sign Template \[DOC – 182 KB\] \[DOC\]](#), [\[PDF – 118 KB\] \[PDF\]](#)
    - [Create a procedure sign Template \[PPT – 312 KB\] \[PPT\]](#), [\[PDF – 157 KB\] \[PDF\]](#)

- [Create an Area Diagram Template \[DOC – 145 KB\] \[DOC\]](#), [\[PDF – 119 KB\] \[PDF\]](#)
- Ensure the area or machine is in control and cleared prior to performing LOTO. This may require coordination of multiple people in multiple locations or it could be very simple.
  - All personnel in the area must be informed that LOTO will be initiated.
  - No operation which would put workers in harm's way during the LOTO procedure should be performed.
  - If for some reason the procedure is interrupted and the employee in control has lost control of the area, control of the area must be re-established and status of LOTO stage must be verified prior to continuing LOTO.
- Verify energy isolation. A [lockout permit form \[DOC – 71 KB\] \[DOC\]](#), [\[PDF – 85 KB\] \[PDF\]](#) should be used in conjunction with the lockout procedure and diagram provided above.
- The use of lock boxes for key control is recognized as a best practice.
  - Make sure that only one key exists for each assigned lock and that only the affected employee has the key. If more than one lock is required to effect a lockout, then the numbered keys should go into a lock box that the service/repair employees can put their personal lock on. The lock box can be secured by a numbered, tamper-proof seal to secure it after all the keys are in it. This allows a service/repair employee who puts his personal lock on the lock box to check the seal number on the Lockout Permit form and make sure the lock box has not been opened.
  - For service/repair work that involves more than one lock box, the employee can use the lock box number to make sure they are putting their personal lock on the right lock box.
- Within a plant or facility, the locks used for lockout should all be of the same type, and they should not be used for any purpose other than lockout. That way, employees can recognize easily that a lock is being used for lockout. Locks should not have the same key if everyone has access to the key. Each lock-and-key set should be unique. Multiple keys should not be issued for individual locks.
- Jointly review the completed work by the equipment owner/operator and the service/repair employee to ensure that it is safe to put the equipment back into operation.
  - A place for the equipment owner/operator and the service/repair employee to sign off that they jointly reviewed the lockout energy isolation devices, and that they are correct per the written procedure (2-person principle).
- Consider who will be using the procedure. It is necessary to take into account all types of employment arrangements, jobs and supervisory relationships, as today many workers are temporary, from another agency, an outside contractor or, only temporarily performing a job function that might require lockout. All workers must be protected; regardless of the perceived relationship. Not only is it important to make sure that the procedure takes this into account, it is imperative to ensure that the requisite safety procedure is communicated through all possible contract documents to the relevant agencies and workers.
- Create messages that can be understood by all. Today's workforce consists of many cultures and groups of workers from different agencies, companies, etc. Tags and training need to be provided in relevant languages.
- Remember the performance of lockout is an administrative procedure. It is therefore susceptible to non-compliance or mistakes by any of the involved, managers, workers, contractors, and others. Everyone is involved in its success and failure, and that makes it important to have an established team.
- Risk Assessment and Planning of Work: Make sure you have performed a risk assessment to determine the risk of various hazards and tasks. This need not be quantitative. It must be done as a team including management and workers. See ANSI Z244 or ANSI B11.0 for more information.

## When LOTO may not be needed

Minor tool changes and adjustments and other minor servicing activities are allowed without LOTO if:

- they take place during normal production operations
- they are routine, repetitive, and integral to the use of the equipment for production
- work is performed using alternative measures which provide effective protection, e.g., through guarding (Note to 29 CFR 1910.147(a)(2)(ii)).
  - This note specifically refers the employer to Subpart O – "Machinery and Machine Guarding."

The two OSHA policies on Lockout and machine Guarding intersect when an employee does "minor servicing" or jam-clearing and "bypasses" normal protections. This is addressed by

- [ANSI/ASSE Z244.1 – Control of Hazardous Energy Lockout/Tagout \[PDF\]](#)
- [Alternative Methods: Decision Matrix for Safeguarding Hazardous Energy \[PDF – 163 KB\] \[PDF\]](#).

Push-buttons, selector switches, safety interlocks and other control circuit type devices are generally NOT acceptable energy isolating devices. OSHA specifies energy control devices that are acceptable: most are manually actuated single control devices.

Identification of operations where you might want to use the exception needs to be done up-front (at design/installation phase, or through survey of all equipment). An effective risk assessment helps identify issues to be addressed (all energy source, particularly stored/potential energy).

### Bottom line

If you don't use full LOTO, you have to use an equally protective alternative, determined by a detailed and documented risk assessment. For clarification of Minor Servicing Lockout Alternatives: Standard Expectations, see example [minor servicing standard expectations \[DOC – 76 KB\]](#) [\[DOC\]](#), [\[PDF – 163 KB\]](#) [\[PDF\]](#) which, like the other materials in this resource guide, was compiled by practitioners, members of the NORA Manufacturing Sector Council.



## Employee training

One could have an excellent written procedure, sophisticated tools and machinery and still *not* prevent injuries or fatalities from failure to use these. On the other hand, one study that analyzed OSHA accident investigation reports from 1984–1997 found that in more than half of the 348 investigated cases, lockout procedures were "not even attempted." [\[1\]](#)

This demonstrates the importance of training on the use of lockout procedures and motivating employees to use them. Management needs to develop conduct training and audits and ensure that workers have not only the knowledge but skills and abilities to perform lockout duties. Training should involve workers that work close to the area where lockout procedures are to be implemented and not restricted to the machine operators.

It is also important to realize that the failure to use lockout procedures may not be a training issue. Sometimes poorly maintained machinery and equipment may be more difficult to set up, more likely to require significant repetitive adjustments or be prone to frequent jamming. This might trigger attempts to take shortcuts and the decision not to follow prescribed procedures. Audits of program implementation should reveal these types of problems and give management the insights needed to address the underlying issues (see Auditing of Work Process below).

## Training resources

- [Lockout-Tagout Interactive Training Program](#) [\[OSHA\]](#)
- [Small Business Handbook](#) (OSHA/NIOSH)
- [Safety and Health Topics: Control of Hazardous Energy](#) [\[OSHA\]](#)
- [Control of Hazardous Energy](#) [\[PDF\]](#) [\[OSHA\]](#)

## Templates

The links below are sample training resources which could be used *after they are customized to your company needs*.

- [LOTO Lesson Plan](#) [\[DOC – 62 KB\]](#) [\[DOC\]](#), [\[PDF – 188 KB\]](#) [\[PDF\]](#)
- [Sample PowerPoint Intro](#) [\[PPT – 3 MB\]](#) [\[PPT\]](#), [\[PDF – 192 KB\]](#) [\[PDF\]](#)

## Auditing of work

Understanding and just complying with the regulations will not guarantee success. Success is tied to your workforce. It is necessary to develop processes that are efficient and to communicate them clearly. Finally, it is necessary to audit both.

Lockout programs should be tailored to the people who use them every day. It is KEY to conduct periodic inspections/audits on the competency of employees likely to be involved. Both knowledge and performance of the lockout program should be audited. The audit needs to physically verify the procedures that exist for the equipment and that employees are able to properly follow them.

## Templates

Below are links to sample templates which could be used after they are customized to your company needs:

- [Periodic Inspection template](#) [\[DOC – 175 KB\]](#) [\[DOC\]](#), [\[PDF – 171 KB\]](#) [\[PDF\]](#)
- [Employee Verification](#) [\[DOC – 61 KB\]](#) [\[DOC\]](#), [\[PDF – 103 KB\]](#) [\[PDF\]](#)
- [School safety checklist: Control of Hazardous Energy](#)

## Prevention through Design

Important topics in Hazardous Energy Control and/or Lockout-Tagout, are the concepts of Risk Assessment and Prevention-through-Design (PtD). Risk Assessment is like planning ahead. It may be based on the hazards but is preferably based on a combination of the general hazards and the hazards specific to each task.

The team of users of a program should consider each task and hazard and determine what can be done to mitigate them to an acceptable level or eliminate them. This should be done throughout the lifecycle, birth-to-death, of the machine or system including but not limited to; concept, acquisition, design, installation, integration, operation, maintenance, reconstruction, dismantling, and discard.

While it is acceptable to prevent access to the hazard, the effective approach is to eliminate (design out) the hazard if possible. It is always better to have addressed the hazard as early as possible, which is why acquisition is considered part of the life-cycle.

Employers should seek out and specify features in new equipment purchases and new facility designs that will accommodate lockout procedures. OSHA 1910.147 (c)(2)(iii)] specifies that after January 2, 1990 *"Whenever replacement or major repair, renovation, or modification of a machine or equipment is performed, and whenever new machines or equipment are installed, energy isolating devices for such machine or equipment shall be designed to accept a lockout device."*

See the [NIOSH Prevention-through-Design web page](#) for information on this approach.

## Standards

### ANSI/B11 Standards Inc. B11.0-2015 Safety of Machinery; General Requirements and Risk Assessment

This standard, an A-type standard, covers the safety of most machinery and can be used in a variety of circumstances. It describes risk assessment and general requirements for safety of machinery and is especially useful when a lower level machine specific, C-type, standard does not apply. The 2015 document is a revision of the 2010 version.

### ANSI/B11 Standards Inc. B11.19-2010 Performance Requirements for Safeguarding

This standard is a B-type standard which focuses mainly on the application, specification, and use of safeguarding. It is useful in the adding safeguarding devices and is referenced by many standards. This standard is also under revision.

### ANSI/ASSE Z244.1- 2016

This standard addresses industry expectations for lockout, tagout, energy-control and alternative measures for hazardous energy control.

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#### SOURCES

##### CONTENT SOURCE:

[National Institute for Occupational Safety and Health](#)

#### REFERENCES

1. <https://pubmed.ncbi.nlm.nih.gov/18702095/>

#### SOURCES

- *DISCLAIMER: Information and materials included on the Hazardous Energy (Lockout Tagout) webpages were compiled from many sources and reviewed and adapted for use by the NORA Manufacturing Sector Council. As such, content presented does not necessarily represent the views of NIOSH. Additionally, mention of any company or product does not constitute endorsement by NIOSH.*