Machine Safeguarding and Lockout/Tagout Practices

On a daily basis, manufacturing employees may be asked to work with or interact with a wide variety of machinery and equipment. Some machines can be very basic in function and task; others very complex. The mechanical motions and actions produced are basic to nearly all machines. Recognizing this can help manufacturers in protecting their employees from the potential hazards they present. Some steps that can be taken include:

- Safeguarding any machine part, function or process that may cause injury to an employee.
- Eliminating or controlling any hazard that can injure the operator or other nearby employees while a machine is in operation.

Federal requirements specific to this subject are covered in the Occupational Safety and Health Regulations for general industry (29 CFR 1910 Subpart O-Machinery and Machine Guarding: https://www.osha.gov/pls/oshaweb/owastand.display_standard_group?p_toc_level=1&p_part_number=1910).

UnitedHeartland.com
1-800-258-2667

UnitedHeartland

Machine Guarding OSHA Violations Make Top 10 List

Machine guarding and related machinery violations continuously rank among the top 10 of OSHA citations issued. Two of them made the top 10 between October 2014 and September 2015:

- No. 5 "Lockout/Tagout (1910.147)" - 3,308 citations
- No. 9 "Machine Guarding (1910.212)" - 2,540 citations

Main Causes of Machine-Related Accidents

- Reaching in to "clear" equipment
- Not using lockout/tagout
- Unauthorized persons doing maintenance or using the machines
- Missing or loose machine guards

Guarding Machinery and Equipment

There are a number of areas that need to be evaluated when examining the effectiveness of machinery and equipment safeguards. Three common machine hazards requiring safeguarding include:

- **The point of operation** – The point where work is performed on the material, such as cutting, shaping, boring or forming of stock; typically, this is the point where material is in contact with the cutting tool, blade, bit, etc.
- **Power transmission components** – These are the components of the mechanical system that transmit energy to the part of the machine performing the work. These include flywheels, belts, pulleys, cams, couplings, connecting rods, chains, spindles, cranks and gears.
- **Other moving parts** – These include any parts that move while the machine is in operation. These can be reciprocating, rotating and transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine.

Protecting Against Machine Hazards

Next, a means of protecting those machine hazards must be developed. Safeguards must meet minimum requirements to be effective in protecting your employees. These include:

- **Prevent contact** – The safeguard must be designed, constructed, adjusted and maintained to prevent an employee from reaching under, over, around or through the guard and making contact with dangerous moving parts. The best practice is to interlock any adjustable or movable guards into the machine cycle so the machine is inoperable unless guards are in place.
- **Be secured to the machine** – Workers should not be able to remove or tamper easily with the safeguard. Guards secured with wing nuts or quick release fasteners encourage quick and easy removal, increasing the chances for removal by the employee. Any guard removal should require the use of a tool. Guards and safety devices should be made of durable material that will withstand normal use. They must be firmly secured to the machine, i.e., bolts, rivets, etc.
- **Protection from falling objects** – The guard should ensure no objects can come into contact with the moving parts of the machine. A small tool or object which falls into a cycling machine could easily become a projectile that could strike someone.
- **Guard should be safe by design** – The guard should create no hazard of its own by construction (sharp edges, unfinished surfaces) and through its own action create no pinch points or other potential hazards.
- **Should not interfere with job tasks** – Any guard whose design impedes the employee from performing their job tasks quickly and comfortably will likely be removed or overridden. A properly designed guard can actually improve employee efficiency by eliminating apprehensions about injury when completing job tasks on certain machines.
- **Allow for safe lubrication of machine** – All machines require periodic maintenance and repair. During routine maintenance and lubrication, it is preferable to fashion guards so that tasks can be performed from outside of the guarded area. Locating oil reservoirs, oil lines, lubrication fittings outside the guarded areas will reduce the need for operators or maintenance personnel to enter hazardous work areas.

This process also ensures guards are always in place after routine maintenance operations.

Types of Safeguards

- **Fixed** – Provides a barrier as a permanent part of the machine, and is preferable to all other types of guards.
- **Interlocked** – When this type of guard is opened or removed, the tripping mechanism and/or power automatically shuts off or disengages, and the machine cannot cycle or be started until the guard is back in place.
- **Adjustable** – Provides a barrier which may be adjusted to facilitate a variety of production operations.
- **Self-adjusting** – Provides a barrier which moves according to the size of the stock entering the danger area.

Machine Safety Responsibilities

Management

- Ensure all machinery is properly guarded.

Supervisors

- Train employees on specific guard rules in their areas.
- Ensure machine guards remain in place and are functional.
- Immediately correct machine guard deficiencies.

Employees

- Do not remove guards unless machine is locked and tagged.
- Report machine guard problems to supervisors immediately.
- Do not operate equipment unless guards are in place.

Devices Used in Machine Safeguarding

Presence sensing

- Uses physical and non-physical barriers to detect objects in the "danger" zone of a machine. There are three general types:
  - Photoelectrical (Optical) – Uses a light source
  - Radio frequency (Capacitance) - Uses a radio beam that is part of the machine control circuit
  - Electromechanical - Uses a contact bar or a probe

Pullback

- Utilizes a series of cables attached to the operator's hands, wrists and/or arms.
- Primarily used on machines with stroking action.
- Allows access to the point of operation when the slide/ram is up.
- Withdraws hands when the slide/ram begins to descend.

Restraint

- Uses cables or straps attached to the operator's hands and a fixed point.
- Must be adjusted to let the operator's hands travel within a predetermined safe area.
- Hand-feeding tools are often necessary if the operation involves placing material into the danger area.

Safety controls (tripwire cable, two-hand control, etc.)

- Device located around the perimeter of or near the danger area.
- Operator must be able to reach the cable to stop the machine.

Two-hand control

- Requires constant, concurrent pressure to activate the machine.
- The operator's hands are required to be at a safe location (on control buttons) and at a safe distance from the danger area while the machine completes its closing cycle.

Gates

- Movable barrier device which protects the operator at the point of operation before the machine cycle can be started.
- If the gate does not fully close, machine will not function.

Safeguarding Resources from OSHA and CDC

- **Machine Guarding:** https://www.osha.gov/SLTC/machineguarding/
- **Safeguarding Equipment and Protecting Employees from Amputations:** https://www.osha.gov/Publications/osha3170.pdf
- **Machine Guarding eTool:** https://www.osha.gov/SLTC/etools/machineguarding/
- **Machine Safety:** http://www.cdc.gov/niosh/topics/machine/
- **Machine Guarding Checklist:** https://www.osha.gov/Publications/Mach_SafeGuard/checklist.html

Other Factors Regarding Safeguarding

Location/distance

- Locate the machine or its dangerous moving parts so that they are not accessible or do not present a hazard to a worker during normal operation.
- Maintain a safe distance from the danger area.

Protective shields

- These do not give complete protection from machine hazards, but do provide some protection from flying particles, splashing cutting oils or coolants.

Hand tools

- Used to place and remove stock in the danger area.
- Not to be used instead of other machine safeguards, but as a supplement.

Guarding fan blades

- When the periphery of the blades of a fan is less than 7 feet above the floor or working level, the blades must be guarded with a guard having openings no larger than half-inch.

Abrasive wheel machinery

- Work rests on offhand grinding machines must be kept adjusted closely to the wheel with a maximum opening of ⅛-inch to prevent the work from being jammed between the wheel and the rest, which may result in wheel breakage.
- The distance between the wheel periphery and the adjustable tongue must never exceed ¼-inch.

Ensuring Safeguarding Effectiveness

The most effective safeguarding system is rendered ineffective if it is not used properly. Employees who use machinery that is provided with safeguards must be trained and educated as to the purpose of the guards, how they are to be used and what the hazards of the machine are that they are protecting. Training should detail:

- Identification of the hazards of the machines that the employees use.
- The location of each safeguard on the machine, how they provide protection and the hazard that they are intended to guard.
- Action to take when a guard is not functioning properly or if it is removed from the machine.
- The importance of not removing guards under any circumstances (unless receiving proper authorization and training on machine hazards).

What is Lockout/Tagout?

Lockout/Tagout is the process of removing the energy source from a piece of machinery and then locking and tagging it. This procedure ensures that no one reconnects the energy source while a person is conducting maintenance or doing repairs. When lockout/tagout procedures are not adhered to, accidents can be catastrophic.

Energy sources that require lockout can be:

- Chemical
- Electrical
- Gas/steam
- Gravitational
- Hydraulic
- Pneumatic

Lockout of a Device
A device utilizing a lock, either key or combination-type, to hold an energy-isolating device in the safe position, preventing the energizing of equipment.

Tagout of a Device
A warning device, such as a tag, that is securely fastened to an energy-isolating device indicating that the energy-isolating device and the equipment being controlled cannot be operated until the tag is removed.

Preparing for Shutdown

Before servicing powered equipment, an authorized employee with knowledge of power sources and controls must follow these steps:

- Alert employees that equipment will be turned off and locked out.
- Turn off the machine or equipment and its energy control device.
- Lock the energy control switch in the “off” or “safe” position.
- Release or block any stored energy. Before maintenance or servicing work can begin, equipment must be at zero energy state (ZES).
- Check that power is off by turning controls “on” and trying to start the equipment.
- Return controls to the “off” position.

After performing the required service or maintenance, employees should take the following steps:

- Remove tools or other materials from the area.
- Replace machine guards and test that equipment is ready to operate.
- Tell employees to stay a safe distance away while locks or tags are removed.
- Remove the locks or tags.
- Turn on the equipment and make sure it operates properly.
- Inform employees that the equipment is ready to use.

Requirements for an Effective Lockout/Tagout Policy

- Establish a written, documented lockout/tagout procedure.
- Make sure that all personnel are properly trained. Clearly indicate which employees are authorized to lockout/tagout and which aren't.
- Identify all machinery and equipment that needs lockout/tagout.
- Identify all energy sources on every single piece of equipment and machinery.
- Identify the best way to lockout each of the energy sources.
- Tagout ONLY those energy sources that cannot be locked out.
- Make sure that all locks and tags clearly identify the worker who put them on.
- Make sure that only the employee who put the lock or tag on is allowed or able to remove it.

Key Aspects of Lockout/Tagout

- The machine or equipment has no potential for stored or residual energy or the re-accumulation of stored energy after shut down.
- The machine or equipment has a single energy source readily identified and isolated.
- The isolation and locking out of the energy source will completely deactivate the machine or equipment.
- The machine or equipment is isolated from the energy source and locked out during maintenance.
- A single lockout device will achieve a locked-out condition.
- The lockout device is under the exclusive control of the authorized employee performing the maintenance.
- Maintenance does not create hazards for other employees.
- There have been no accidents during maintenance activities as a result of the failure to properly deactivate a machine.

How to Get Started

United Heartland Loss Control can assist you in reviewing your machine safeguarding and lockout/tagout practices and direct you to additional training resources. Contact your United Heartland Loss Control representative to discuss your current needs or explore the United Heartland Toolbox at www.unitedheartland.com/united-heartland-toolbox/ to find more loss control resources.

AF Group
AFGroup.com