



## **SECTION 21–MACHINE GUARDING**

### **21.1 Machine Guarding Requirements**

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## 21.1 MACHINE GUARDING REQUIREMENTS

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### A. Objective

To protect employees and students from injury while operating machines with moving parts. Safeguards are essential for protecting operators from needless and preventable injuries.

### B. Scope

This procedure requires guarding for any machine where machine parts, functions, or processes may cause injury. The need for machine guarding may be found in machine shops in academic departments, maintenance shops, print shops, and other areas where mechanical equipment is used.

### C. References

Department of Labor, Occupational Health and Safety Administration (OSHA) 29 Code of Federal Regulations 1910 Subpart O Sections 211-219 and Illinois Department of Labor 820 ILCS 225 Health and Safety Act.

### D. Program Requirements

Any machine part, function, or process, which may cause injury, must be safeguarded. When the operation of a machine, or accidental contact with it, can injure the operator or others in the area, the hazards must be either controlled or eliminated.

#### Where Mechanical Hazards Occur

Dangerous moving parts in three basic areas require safeguarding:

- **The Point of Operation:** That point where work is performed on the material, such as cutting, shaping, boring, or forming of stock.
- **Power Transmission Apparatus:** All components of the mechanical system which transmit energy to the part of the machine performing the work. These components include flywheels, pulleys, belts, connecting rods, couplings, cams, spindles, chains, cranks, and gears.
- **Other Moving Parts:** All parts of the machine which move while the machine is working. These can include reciprocating, rotating, and transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine.

#### Hazardous Mechanical Motions and Actions

A wide variety of mechanical motions and actions may present hazards to the operator. These can include the movement of rotating members, reciprocating arms, moving belts, meshing gears, cutting teeth, and any parts that impact or shear. These different types of hazardous mechanical motions and actions are basic in varying combinations to nearly all machines, and recognizing them is the first step toward protecting operators from the danger they present.

**The basic types of hazardous mechanical motions and actions are:**

#### Motions:

- Rotating (including in-running nip points)
- Reciprocating
- Transferring

#### Actions:

- Cutting
- Punching
- Shearing
- Bending



## E. Requirements for Safeguards

Safeguards must meet these minimum general requirements:

- **Prevent Contact:** The safeguard must prevent hands, arms, and any other part of an operator's body from making contact with dangerous moving parts. A good safeguarding system eliminates the possibility of the operator or another worker placing parts of their body near hazardous moving parts.
- **Secure:** Operators should not be able to easily remove or tamper with the safeguard, because a safeguard that can easily be made ineffective is no safeguard at all. Guards and safety devices should be made of durable materials that will withstand the conditions of normal use. They must be firmly secured to the machine.
- **Protection from Falling Objects:** The safeguard should ensure that no objects can fall into moving parts. A small tool, which is dropped into a cycling machine, could easily become a projectile that could strike and injure someone.
- **Create No New Hazards:** A safeguard defeats its own purpose if it creates a hazard of its own such as a shear point, a jagged edge, or an unfinished surface which can cause a laceration. The edges of guards, for instance, should be rolled or bolted in such a way that they eliminate sharp edges.
- **Create No Interference:** Any safeguard, which impedes an operator from performing the job quickly and comfortably, might soon be overridden or disregarded. Proper safeguarding can actually enhance efficiency since it can relieve the operator's apprehensions about injury.
- **Allow Safe Lubrication:** If possible, one should be able to lubricate the machine without removing the safeguards. Locating oil reservoirs outside the guard, with a line leading to the lubrication point, will reduce the need for the operator or maintenance operator to enter the hazardous area.

## F. Protective Clothing and Personal Protective Equipment

Engineering controls that eliminate the hazard at the source, and do not rely on the operator's behavior for their effectiveness, offer the best and the most reliable means of safeguarding. Therefore, engineering controls are the first choice for eliminating machine hazards. But whenever engineering controls are not available or are not fully capable of protecting the operator (an extra measure of protection is necessary), operators must wear protective clothing or personal protective equipment (See *Section 6: Personal Protective Equipment*).

If it is to provide adequate protection for the user, the protective clothing and equipment selected must always be:

- Appropriate for the particular hazards
- Maintained in good condition
- Properly stored when not in use, to prevent damage or loss
- Kept clean, fully functional, and sanitary

Protective clothing is, of course, available for different parts of the body. Hard hats can protect the head from the impact of bumps and falling objects when the operator is handling stock; caps and hairnets can help keep the operator's hair from being caught in machinery. If machine coolants could splash or particles could fly into the operator's eyes or face, then face shields, safety goggles, glasses, or similar kinds of eye protection might be necessary. Hearing protection may be needed when operators operate noisy machines. To guard the trunk of the body from cuts or impacts from heavy or rough-edged stock, there are certain protective coveralls, jackets, vests, aprons, and full-body suits. Operators can protect their hands and arms from the same kinds of injury with special sleeves and gloves. Safety shoes and boots, or other acceptable foot guards, can shield the feet against injury in case the operator needs to handle heavy stock, which might drop.



It is important to note that protective clothing and equipment can create hazards. A protective glove, which can become caught between rotating parts, or a respirator face piece, which hinders the wearer's vision, for example, require alertness and continued attentiveness whenever they are used.

Other parts of the operator's clothing may present additional safety hazards. For example, loose-fitting shirts might possibly become entangled in rotating spindles or other kinds of moving machinery. Jewelry, such as bracelets and rings, can catch on machine parts or stock and lead to serious injury by pulling a hand into the danger area.

## **G. Training**

Even the most elaborate safeguarding system cannot offer effective protection unless the operator knows how to use it and why. Specific and detailed training is therefore a crucial part of any effort to provide safeguarding against machine-related hazards. Thorough operator training should be provided by the Supervisor or Instructor which should involve instructions or hands-on training in the following:

- A description and identification of the hazards associated with particular machines.
- The safeguards themselves, how they provide protection, and the hazards for which they are intended.
- How to use the safeguards and why.
- How and under what circumstances safeguards can be removed, and by whom (in most cases, repair or maintenance personnel only).
- What to do (e.g., contact the supervisor) if a safeguard is damaged, missing, or unable to provide adequate protection.

This kind of safety training is necessary for new operators and maintenance or setup personnel, when any new or altered safeguards are put in service, or when operators are assigned to a new machine or operation.