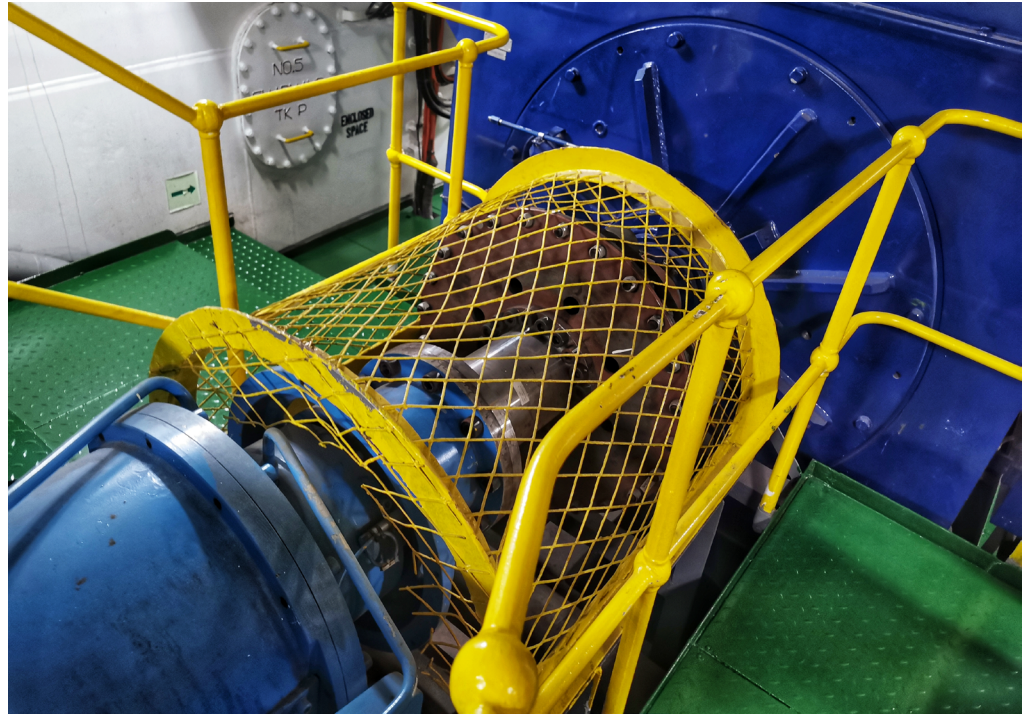


**M**oving machine parts have the potential to cause severe workplace injuries. The Occupational Safety and Health Administration (OSHA) reports that workers who operate and maintain machinery suffer approximately 18,000 amputations, lacerations, crushing injuries, abrasions, and over 800 deaths per year.<sup>1</sup> These injuries most often occur when workers operate unguarded or inadequately safeguarded machinery.



## General Requirements

Amputation is one of the most severe and crippling types of injuries in the workplace, often resulting in permanent disability.<sup>2</sup> Because of this, OSHA has established a set of standards around machine guarding to protect the equipment operator and other employees in the work area. When the operation of a machine or accidental contact with it could injure the operator or others, the hazards must be either controlled or eliminated. OSHA's requirements for machine guarding are found in [29 Code of Federal Regulations \(CFR\) 1910 Subpart O](#).

## Types of Hazards

Machines – such as mechanical power presses, power press brakes, powered and non-powered conveyors, printing presses, roll-forming and roll-bending machines, food

slicers, meat grinders, meat-cutting band saws, drill presses, milling machines, and more -- can cause injuries when workers are:

- **caught in** (and cut, crushed, or mangled by) moving parts;
- **pinned or crushed** by a machine that vibrates or falls over;
- **shocked or electrocuted** by contact with live electrical parts; or
- **hit** by material or debris ejected by the machine.

## Location of Hazards

Dangerous moving parts require safeguarding. The three basic locations for hazardous mechanical motions and actions are:

- **the point of operation** where work is performed on the material, such as cutting, shaping, boring, or forming of stock;

- **pinch points and shear points** where a part of the body or clothing could be caught between a moving part and a stationary object. This would include power transmission apparatuses including flywheels, pulleys, belts, connecting rods, couplings, cams, spindles, chains, cranks, gears, and other machine components that transmit energy.
- **other moving parts** that create reciprocating motions (sliding or up/down motions) and transverse motions (materials moving in a continuous line).

- **safeguarding devices** that limit or prevent accidental access to hazards. They can be two-handed controls, gates, presence-sensing devices, or pullback or restraint straps;
- **automated feeding and ejection mechanisms** that eliminate the operator's exposure to the point of operation while handling stock (materials);
- **electronic presence-sensing devices**, which can be used when fixed barrier guards are impractical such as when operators need access to the machine to load parts or to perform routine maintenance. These electronic guards stop the machine in the presence of a person's body, arm, hands, or fingers. Typically found around robots and stationary equipment, presence-sensing devices come in a variety of applications including:

- **safety light curtains** that use parallel light beams to detect a person or object in the sensing field, usually at the point of operation;
- **safety mats**, which are pressure-sensitive floor mats that detect the presence of a person or object on the sensing surface; and
- **safety area laser scanners**, which use light pulses to detect movement around a machine or inside a work cell.

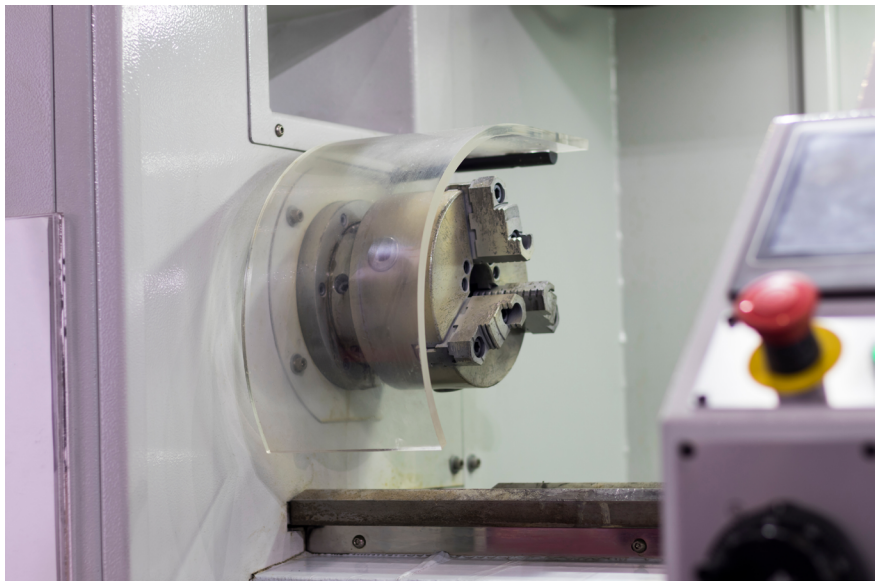
## Methods of Safeguarding

Machine safeguards that can be used to protect employees in the work area include:

- **hard guards**, which are physical barriers that prevent contact. They can be fixed, interlocked, adjustable, or self-adjusting;



- **machine location or distance** to remove the hazard from the operator's work area; and
- **miscellaneous aids** that can protect operators and people in the work area from operating machinery such as:
  - **shields** to contain chips, sparks, sprays, or other forms of flying debris;
  - **protective guide tools** that an operator can use when pushing or pulling materials into the point of operation; and
  - **awareness barriers** to warn people about hazards in the area.



## Preventing Injury

These guidelines must be followed to lessen the chance of injury.

### Machine guards must:

- **prevent contact** between dangerous moving mechanical parts and the hands, arms, or any other part of the worker's body or clothing;
- **remain firmly secured** to the machine so it will not be easily removed or tampered with by operators. Guards and safety devices should be made of durable material that will withstand the conditions of normal use;
- **protect from falling objects** that can become deadly projectiles if dropped into moving parts;
- **create no new hazards** and be free of jagged edges, shear points, and other hazards;

- **not interfere with work** or stop workers from doing their jobs. Guards must keep workers safe; and
- **allow for safe lubrication**, and, if possible, operators should be able to lubricate the machine without removing the guards.

### Employees must:

- **keep at a distance** if they are not the ones operating the machinery. All employees should stay out of the swing radius of the equipment;
- **avoid loose-fitting clothes and jewelry** that could hang down and get caught in moving parts;
- **use eye contact and hand gestures** when approaching equipment. If an employee who is not the machine operator needs to approach a piece of equipment, they should make eye contact with the operator and use clear hand signals to indicate they are approaching;
- **wear personal protective equipment (PPE)** as recommended by the manufacturer; and

- **de-energize equipment** when not in use to keep the machine from accidentally starting. This is especially important when doing any kind of work on the equipment such as repairs, changing accessories, or performing routine maintenance.

## Provide Training

Even the most well-designed safeguarding system cannot offer effective protection unless the worker knows how to use it and why. Ensure new operators and maintenance or setup personnel receive safety training anytime new or altered safeguards are put in service or when workers are assigned to new machines or operations. Provide hands-on training in:

- **identifying the hazards of each machine;**
- **knowing how and why machine guards provide protection;**
- **understanding when safeguards can be removed and by whom;**
- **knowing when a lockout/tagout program is required;**
- **being aware of what PPE is needed and how to effectively wear it;** and
- **knowing who to contact if a safeguard is damaged, missing, or unable to provide protection.**



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## References

<sup>1</sup> Occupational Safety and Health Administration, "Machine Guarding eTool," Website. <https://www.osha.gov/etools/machine-guarding>. Accessed May 5, 2022.

<sup>2</sup> Occupational Safety and Health Administration, "Machine Guarding eTool," Website. <https://www.osha.gov/etools/machine-guarding>. Accessed May 5, 2022.



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