Machine Safeguarding

The purpose of machine safeguarding is to provide a means to protect employees from injuries caused by machinery hazards. A good rule of thumb is – any machine part, function, or process which many cause injury must be safeguarded. When the operation of a machine or contact with it can injure the operator or others in the area, the hazards must be controlled or eliminated.

Types of Machinery Hazards

- **Motions**
  - rotating (including in-running nip points)
  - reciprocating
  - transverse

- **Actions**
  - cutting
  - punching
  - shearing
  - bending

Safeguarding Terminology

- **Guarding:** Any means used to effectively prevent personnel from coming in contact with moving machinery or equipment parts, which could cause physical harm to the operator or passersby.
- **Enclosures:** Guarding by fixed physical barriers that are either mounted on or around the moving parts of the machine or equipment.
- **Fencing:** A locked fence or rail enclosure that restricts access to the machine, except by authorized personnel. The dangerous operation of the machinery must be at least 42 inches away from the fencing.
- **Location:** Guarding may be accomplished by the physical inaccessibility of a particular hazard under normal operating conditions or use.
- **Point of Operation:** Location on a piece of equipment where the material is positioned for processing or change by the equipment, and where the work is actually being performed on the material.
- **Power Transmission:** All mechanical components — such as gears, cams, shafts, pulleys, and belts — that transmit energy and motion from one power source to the point of operation.
- **Ingoing Nip Points:** The area created by two or more mechanical components rotating in opposite directions in the same plane and in close conjunction.
- **Shear Points:** The area created by the sliding motion of the mechanical component past a stationary point on the piece of equipment.

Machine Safeguarding Methods

There are many ways to safeguard machines. The type of operation, the size or shape of stock, the method of handling, the physical layout of the work area, the type of material, and production requirements will help to determine the appropriate safeguarding method for the individual machine. One must always choose the most effective and practical means available. Safeguards can be grouped under five general classifications.

- **Guards**
  - Fixed
  - Interlocked
  - Adjustable
  - Self-adjusting
- **Devices**
  - Presence Sensing
    - Photoelectrical (optical)
    - Radiofrequency (capacitance)
    - Electromechanical
  - Pullback
  - Restraint
  - Safety Controls
    - Safety trip control
      - Pressure-sensitive body bar
      - Safety tripod
      - Safety tripwire cable
    - Two-hand control
    - Two-hand trip
  - Gates
    - Interlocked
    - Other
- **Location/Distance**
- **Feeding and Ejection Methods**
  - Automatic feed
  - Semi-automatic feed
  - Automatic ejection
  - Semi-automatic ejection
  - Robot
- **Miscellaneous Aids**
  - Awareness barriers
  - Miscellaneous protective shields
  - Hand-feeding tools and holding fixtures

Types of Guards
Although there are many guard designs, the four general types are:

- **Fixed**
  This type of guard is a barrier or enclosure that permits material to enter into the operation zone, but not the operator's body or body parts. The guard may be constructed of sheet metal, screen, wire cloth, bars, plastic, or any other material that is strong enough to withstand impacts.
- **Interlocked**
  When this type of guard is opened or removed, the piece of equipment cannot operate or cycle until the guard is back in place. This type of guard may be electrical, mechanical, hydraulic, pneumatic power, or any combination of these.
- **Adjustable**
  This type of guard permits the opening size for stock feed to be adjusted based on stock size.
- **Self-adjusting**
  The opening of this guard type is determined by stock movement. As the stock is moved into the danger area, the guard is pushed up or away. This permits only the stock to enter.

Requirements for Safeguards
What must a safeguard do to protect workers against mechanical hazards? Safeguards must meet these minimum general requirements:

- **Prevent contact:** The safeguard must prevent hands, arms, and any other part of a worker'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 bodies near hazardous moving parts.
- **Secure:** Workers 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 material that will withstand the conditions of normal use. They must be firmly secured to the machine.
- **Protect 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 a worker from performing the job quickly and comfortably might soon be overridden or

disregarded. Proper safeguarding can actually enhance efficiency since it can relieve the worker'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 worker to enter the hazardous area.

References: Occupational Safety and Health Administration, “Concepts and Techniques of Machine Guarding” OSHA 3067 - www.osha.gov/Publications/Mach_SafeGuard/toc.html