



## Machine Guarding

The operation of equipment such as a saw, press and plastics machinery present a potential point-of-operation hazards that can cause serious injury to personnel. The point of operation is the area on a machine where work is performed. The purpose of machine guarding is to protect the operator and other employees in the work area from hazards created by in-running nip points, rotating parts, flying chips and sparks. FFVA Mutual Safety Consultants can assist in evaluating machine guarding workplace exposures and provide appropriate loss control recommendations.

### Machine Guarding - Workplace Injury Exposures

- Amputations and Death
- Caught in Between and Crushing Injuries
- Lacerations and Abrasions

*Note: Amputation is one of the most severe and crippling type of injuries in the occupational work place and often results in permanent disability.*

### Developing a Loss Control Program

To successfully implement a machine guarding workplace safety program, management must maintain a focused effort that is directed towards reducing and eliminating machine workplace exposures. There has to be a 100% commitment to establish controls and procedures for machines that expose an employee to injury so the employer can create and provide an injury-free working environment.

### Most Common Types of Saws, Presses and Plastics Machinery Found In the Work Place

- Accident from these saws, presses or machinery equipment may occur if the operator is inexperienced, improperly trained or if the equipment is not properly guarded.
- Power presses are used in a wide variety of industries to punch, shear and form-work metal or other materials with cutting, shaping, or combination dies attached to plungers, platens, or slide rams. The most common type of power presses in the work place are Mechanical power presses, Pneumatic presses, Hydraulic presses and Powered press brakes. Plastics processing machines are complex pieces of equipment that require guards to protect employees from nip points, numerous moving parts, and exposure to high voltage and high temperature. The two most common Injection Molding machines are the Horizontal Injection Molding Machines and the Thermoforming Injection Molding Machines.
- Serious injuries can result from the use of portable and stationary power saws like.
  - Overhead swing cut-of saws, scroll saws and handheld saws.
  - Straight line/gang rips saws, radial saws and miter saws.
  - Table saws, band saws and chop saws.

### Guards Barriers That Prevent Access to Danger Area - Four General Types of Guards

- Adjustable Guards
- Fixed Guards
- Interlocking Guards
- Self-adjusting Guards

### Safeguarding Action, Advantages and Limitations

- Adjustable Guards - Provides a barrier that may be adjusted to facilitate a variety of production operations with advantages that can be constructed to suit many specific applications and can be adjusted to admit varying sizes of material stock. **Limitations:** hands may enter danger area and protection may not be complete at all times. May require frequent maintenance and or adjustment and the guard may be made ineffective by the operator or may interfere with visibility.
- Fixed Guards - Provides a barrier with advantages that can be constructed to suit many specific applications. In-plant construction is often possible. Can provide maximum protection. Usually requires minimum maintenance and can be suitable to high production, repetitive operations but limitations may interfere with visibility, can be limited to specific operations and machine adjustment and repairs often require its removal, thereby necessitating other means of protection for maintenance personnel.
  - Fixed guards are permanent part of the machine.
  - It is not dependent upon moving parts to function.
- Interlocked Guards - Shuts off or disengages power and prevents starting of machine when guard is open; should require the machine to be stopped before the worker can reach into danger area. **Advantages:** they can maximum protection and allows access to machine from removing jams without time-consuming removal of fixed guard. **Limitations:** requires careful adjustment and maintenance and may be easy to disengage by operator.
- Self-Adjusting Guards - Provides a barrier which moves according to the size of the stock entering danger area. **Limitations:** not always providing maximum protection may interfere with visibility and may require frequent maintenance and adjustment.

### Safeguarding Must Meet Minimum General Requirements

- Create no interference: Any safeguard which impedes a worker from performing the job quickly and comfortably might soon be overridden or disregarded. Safeguarding should also allow safe lubrication of equipment. If possible, one should be able to lubricate the machine without removing the safeguards.
- Create no new hazards: A safeguard defeats its own purpose if it creates a hazard of its own which can cause injuries.
- Prevent Contact: Safeguard must prevent hands, arms and any other part of the worker's body from making contact with moving parts of the machine or equipment.
- 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.
- Secure: Workers should not be able to easily remove or tamper with the safeguard. A safeguard that can easily be made ineffective is no safeguard at all.

### Presence Sensing Devices, Pullbacks, Restraints and Safety Controls Advantages and Limitations

- Electro-Mechanical safeguarding contact bar or probe travels a predetermined distance between the operator and the danger area. Any interruption of this movement prevents the starting of machine cycle. **Advantages:** can allow access at the point of operation. **Limitations:** requires contact bar or probe must be properly adjusted for each application and this adjustment must be maintained constantly.
- Photoelectric Optical safeguarding machine will not start cycling when the light field is interrupted or when the light field is broken by any part of the operator's body during the cycling process and immediate machine braking is activated. **Advantages:** can allow freer movement for operator, simplicity of use with no adjustment required. **Limitation:** does not protect against mechanical failure, may require frequent alignment and calibration, excessive vibration may cause lamp filament damage and premature burnout.

- Pullback safeguarding activates as the machine begins to cycle and the operator's hands are pulled out of the danger area. **Advantages:** eliminates the need for auxiliary barriers or other interference at the danger area. **Limitations:** limits movement of operator, may obstruct workspace around operator, adjustment must be made for specific operations and for each individual, and may also require frequent inspections, close supervision of the operator's use of the equipment and regular maintenance.
- Radio Frequency Capacitance safeguarding machine will not start when the capacitance field is interrupted or when the capacitance field is disturbed by any part of the operator's body during the cycling process. Immediate machine braking is activated. **Advantages:** can allow freer movement for operator limitations does not protect against mechanical failure and antennae sensitivity must be properly adjusted.
- Restrains Holdbacks prevents the operator from reaching into the danger area with an advantage of little risk of mechanical failure. **Limitations:** limits the movements of operator, may obstruct work-space and adjustment must be made for specific operations, each operator/use requiring close supervision while using the equipment.
  - Gates - Provides a barrier between the danger area and operator or other personnel, preventing reaching into or walking into the danger area. **Limitations:** requires frequent inspection and regular maintenance and may interfere with operator's ability to see the work.
  - Safety Trip Controls - Are pressure-sensitive body bars, safety trip-rods and safety tripwires that stop the machine when tripped. **Advantages:** simplicity of use. **Limitations:** all controls must be manually activated, may be difficult to activate controls because of their location. Only protects the operator, may require special fixture to hold work and require a machine brake.
  - Two-Hand Controls - The concurrent use of both hands is required, preventing operator from entering the danger area. **Advantages:** are that operator's hands are at a predetermined location and operator's hands are free to pick up a new part after first half of the cycle is completed. **Limitations:** requires a partial cycle machine with a brake, some two-handed controls can be rendered unsafe by holding with arm or blocking, thereby permitting one-handed operation.
  - Two-hand Trip - The concurrent use of two hands on separate controls prevents hands from being in danger area when machine cycle starts. **Advantages:** are operator's hands are away from danger area and can be adapted to multiple operations with no obstruction to hand feeding. It does not require adjustment for each operation. **Limitations:** operator may try to reach into danger area after tripping machine and some trips can rendered unsafe by holding with arm or blocking one-hand operation and may require special fixtures.

### Operator Training Should Involve Instruction and Hands-On Training

- 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 and how to use the safeguard.
- How and under what circumstances safeguards can be removed and by whom. In most cases, only repair or maintenance personnel should remove guards.
- When a Lock-out and Tag-out program is required.
- What to do if a safeguard is damaged, missing or unable to provide adequate protection (contact the supervisor).

*Note: This kind of safety training is necessary for new operator and maintenance or setup personnel when any new or altered safeguards are in service, or when workers are assigned to new machine or operations.*

### **Lock-Out/Tag-Out during Maintenance and Eye and Face Protection**

The employer must establish a lock-out and tag-out energy control program consisting of energy control procedures, employee training, and periodic inspection to ensure that before any employee performs any servicing or maintenance on machine or equipment, the machine or equipment is isolated from the energy source and rendered inoperative .

Eye and face protection must be provided to each employee when exposure to eye or face hazards from flying particles.

### **Guarding Barrels, Containers, Drums and Exposed Blades**

Revolving barrels, containers, and drums must be guarded by an enclosed interlocked with the drive mechanism so the barrel gun or container cannot revolve unless the guard enclosure is in place.

When the periphery of the blade of a fan is less than seven feet above the floor or working level, the blades must be guarded. The guard must not have openings larger than one –half inch.

### **Anchoring Fixed Machinery**

A machine designed for a fixed location must be securely anchored to prevent walking or moving.

### **Machinery Maintenance and Repairs**

In order to prevent hazards while servicing machines, each machine or piece of equipment should be safeguarded during servicing or maintenance.

- Isolating the machine or piece of equipment from its energy source.
- Locking out or tagging out the energy source.
- Notify all affected employees (equipment operators or equipment users) that the machine or equipment must be shut-down to perform some maintenance or servicing.
- Relieving any stored or residual energy.
- Stopping the machine in sequence.
- Verifying that the machine or equipment is isolated from the energy source.

When the servicing or maintenance is completed, there are specific steps which must be taken to return the machine or piece of equipment to service.

- Checking the area to ensure that energization and start-up of the machine or equipment will not endanger employees.
- Inspection of the machine or equipment to ensure that all guards and other safety devices are in place and functional.
- Notification of affected employees that the machine or equipment may be returned to service.
- Re-energization of the machine or equipment.
- Removal of the lockout or tag-out devices.

*Note: If it is necessary to perform minor maintenance while the machine is running, special safeguarding equipment may be needed solely to protect the employee from exposure to hazardous moving parts. Maintenance personnel must know which machines can be serviced while running and which are not. The danger of accident or injury is greatly reduced by shutting off and locking out all sources of energy.*