Machine Safeguarding

General
This document will provide you a high-level overview on some best practices pertaining to machine guarding and sample types of guards found in manufacturing settings.

The 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

Where Do Hazards Occur?
- All parts of the machine which move, such as:
  - Flywheels, pulleys, belts, couplings, chains, cranks, gears, etc.
  - Feed mechanisms and auxiliary parts of the machine
- In running nip points, such as:
  - Traverse Motion

The Primary Requirements for Safeguards include:
- Prevent contact – Prevent worker’s body or clothing from contacting hazardous moving parts.
- Secure – Firmly secured to machine and not easily removed.
- Protect from falling objects – Ensure that no objects can fall into moving parts.
- Create no new hazards – Must not have shear points, jagged edges or unfinished surfaces.
- Create no interference – Must not prevent worker from performing the job quickly and comfortably.
- Allow safe lubrication – If possible, be able to lubricate the machine without removing the safeguards.

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**Maximum Permissible Opening – Table O -10**

<table>
<thead>
<tr>
<th>Distance of opening from point of operation hazard</th>
<th>Maximum width of opening</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 to 1 1/2</td>
<td>1/4</td>
</tr>
<tr>
<td>1 1/2 to 2 1/2</td>
<td>3/8</td>
</tr>
<tr>
<td>2 1/2 to 3 1/2</td>
<td>1/2</td>
</tr>
<tr>
<td>3 1/2 to 5 1/2</td>
<td>5/8</td>
</tr>
<tr>
<td>5 1/2 to 6 1/2</td>
<td>3/4</td>
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<tr>
<td>6 1/2 to 7 1/2</td>
<td>7/8</td>
</tr>
<tr>
<td>7 1/2 to 12 1/2</td>
<td>1 1/4</td>
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<tr>
<td>12 1/2 to 15 1/2</td>
<td>1 1/2</td>
</tr>
<tr>
<td>15 1/2 to 17 1/2</td>
<td>1 7/8</td>
</tr>
<tr>
<td>17 1/2 to 31 1/2</td>
<td>2 1/8</td>
</tr>
</tbody>
</table>

**Guard Options**

*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.
Devices Used in Machine Safeguarding

- Presence sensing
  - Uses physical and non-physical barriers to detect objects in the “danger” zone of a machine.
  - 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

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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**

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- **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.

- **Other items**
  - **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**
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 1/2 inch.

Abrasive Wheel Machinery – Work rests on offhand grinding machines must be kept adjusted closely to the wheel with a maximum opening of 1/8-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 1/4-inch.

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
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