

## **MACHINE SAFEGUARDING**

Moving machine parts have the potential for causing severe workplace injuries, such as crushed fingers or hands, amputations, burns, blindness, just to name a few. Safeguards are essential for protecting workers from these needless and preventable injuries. Any machine part, function or process which may cause injury must be safeguarded. Where the operation of a machine or accidental contact with it can cause injury, the hazard must be either controlled or eliminated.<sup>1</sup>

### **Safeguarding will be needed at:**

- the point of operation where the work is being performed on material, such as cutting or shaping
- power transmission apparatus, that is all parts of the system which transmit energy to the part of the machine performing the work
- other moving parts while the machine is working, such as rotating, moving parts as well as feed mechanisms

### **Safeguards must:**

- prevent any part of the worker's body from making contact with dangerous moving parts
- be firmly secured to the machine so that workers will not be able to easily remove or tamper with them
- create no new hazards by having such things as a jagged edge or an unfinished surface
- not impede a worker from performing the job quickly and comfortably
- allow safe lubrication of the machine, ideally without removing the safeguards

### **Training must be provided for the operator, such as:**

- a description and identification of the hazards associated with particular machines
- safeguards themselves, how they provide protection
- how to use the safeguards and why
- how and under what circumstances safeguards can be removed and by whom
- what to do if a safeguard is damaged or missing

OSHA has a web-page entitled "Machine Guarding" at [www.osha.gov/SLTC/machineguarding/index.html](http://www.osha.gov/SLTC/machineguarding/index.html) which will link you to additional resources to help you properly safeguard your equipment and train your employees.

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<sup>1</sup> Adapted from "Concepts and Techniques of Machine Safeguarding", OSHA Publication 3067, 1992.

## METHODS OF MACHINE SAFEGUARDING<sup>1</sup>

<b>GUARDS</b>			
<b>METHOD</b>	<b>GUARDING ACTION</b>	<b>ADVANTAGES</b>	<b>LIMITATIONS</b>
Fixed	Provides a barrier	<ul style="list-style-type: none"> <li>▪ Can be constructed to suit many specific applications</li> <li>▪ In-plant construction is often possible</li> <li>▪ Can provide maximum protection</li> <li>▪ Usually requires minimum maintenance</li> <li>▪ Can be suitable to high production, repetitive operations</li> </ul>	<ul style="list-style-type: none"> <li>▪ May interfere with visibility</li> <li>▪ Can be limited to specific operations</li> <li>▪ Machine adjustment and repair often require its removal, thereby necessitating other means of protection for maintenance personnel</li> </ul>
Interlocked	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 the danger area	<ul style="list-style-type: none"> <li>▪ Can provide maximum protection</li> <li>▪ Allows access to machine for removing jams without time-consuming removal of fixed guards</li> </ul>	<ul style="list-style-type: none"> <li>▪ Requires careful adjustment and maintenance</li> <li>▪ May be easy to disengage</li> </ul>
Adjustable	Provides a barrier which may be adjusted to facilitate a variety of production operations	<ul style="list-style-type: none"> <li>▪ Can be constructed to suit many specific applications</li> <li>▪ Can be adjusted to admit varying sizes of stock</li> </ul>	<ul style="list-style-type: none"> <li>▪ Hand may enter danger area - protection may not be complete at all times</li> <li>▪ May require frequent maintenance and/or adjustment</li> <li>▪ The guard may be made ineffective by the operator</li> <li>▪ May interfere with visibility</li> </ul>
Self-adjusting	Provides a barrier which moves according to the size of the stock entering danger area	Off-the-shelf guards are often commercially available	<ul style="list-style-type: none"> <li>▪ Does not always provide maximum protection</li> <li>▪ May interfere with visibility</li> <li>▪ May require frequent maintenance and adjustment</li> </ul>

<sup>1</sup>From U.S. Department of Labor, OSHA

<b>DEVICES</b>			
<b>METHOD</b>	<b>GUARDING ACTION</b>	<b>ADVANTAGES</b>	<b>LIMITATIONS</b>
Photoelectric (optical)	<ul style="list-style-type: none"> <li>▪ Machine will not start cycling when the light field is interrupted</li> <li>▪ When the light field is broken by any part of the operator's body during the cycling process, immediate machine braking is activated</li> </ul>	Can allow freer movement for the operator; simplicity of use; no adjustments required	<ul style="list-style-type: none"> <li>▪ Does not protect against mechanical failure</li> <li>▪ May require frequent alignment and calibration</li> <li>▪ Excessive vibration may cause lamp filament damage and premature burnout</li> <li>▪ Limited to machines that can be stopped</li> </ul>
Radiofrequency (capacitance)	<ul style="list-style-type: none"> <li>▪ Machine cycling will not start when the capacitance field is interrupted</li> <li>▪ When the capacitance field is disturbed by any part of the operator's body during the cycling process, immediate machine braking is activated</li> </ul>	Can allow freer movement for operator	<ul style="list-style-type: none"> <li>▪ Does not protect against mechanical failure</li> <li>▪ Antennae sensitivity must be properly adjusted</li> <li>▪ Limited to machines that can be stopped</li> </ul>
Electro-mechanical	<ul style="list-style-type: none"> <li>▪ Contact bar or probe travels a predetermined distance between the operator and the danger area</li> <li>▪ Interruption of this movement prevents the starting of machine cycle</li> </ul>	Can allow access at the point of operation	Contact bar or probe must be properly adjusted for each application; this adjustment must be maintained properly
Pullback	As the machine begins to cycle, the operator's hands are pulled out of the danger area	Eliminates the need for auxiliary barriers or other interference at the danger area	<ul style="list-style-type: none"> <li>▪ Limits movement of operator</li> <li>▪ May obstruct workspace around operator</li> <li>▪ adjustments must be made for specific operations and for each individual</li> <li>▪ Requires frequent inspections and regular maintenance</li> <li>▪ Requires close supervision of the operator's use of the equipment</li> </ul>
Restraint (holdback)	Prevents the operator from reaching into the danger area	Little risk of mechanical failure	<ul style="list-style-type: none"> <li>▪ Limits movements of operator</li> <li>▪ May obstruct workspace</li> <li>▪ Adjustments must be made for specific operations and each individual</li> <li>▪ Requires close supervision</li> </ul>

			of the operator's use of the equipment
Safety trip controls: Pressure-sensitive body bar; Safety triprod; Safety tripwire	Stops machine when tripped	Simplicity of use	<ul style="list-style-type: none"> <li>▪ All controls must be manually activated</li> <li>▪ May be difficult to activate controls because of their location</li> <li>▪ Only protects the operator</li> <li>▪ May require special fixtures to hold work</li> <li>▪ May require a machine brake</li> </ul>
Two-hand control	Concurrent use of both hands is required, preventing the operator from entering the danger area	<ul style="list-style-type: none"> <li>▪ Operator's hands are at a predetermined location</li> <li>▪ Operator's hands are free to pick up a new part after first half of cycle is completed</li> </ul>	<ul style="list-style-type: none"> <li>▪ Requires a partial cycle machine with a brake</li> <li>▪ Some two-hand controls can be rendered unsafe by holding with arm or blocking, thereby permitting one-hand operation</li> <li>▪ Protects only the operator</li> </ul>
Two-hand trip	Concurrent use of two hands on separate controls prevents hands from being in danger area when machine cycle starts	<ul style="list-style-type: none"> <li>▪ Operator's hands are away from danger area</li> <li>▪ Can be adapted to multiple operations</li> <li>▪ No obstruction to hand feeding</li> <li>▪ Does not require adjustment for each operation</li> </ul>	<ul style="list-style-type: none"> <li>▪ Operator may try to reach into danger area after tripping machine</li> <li>▪ Some trips can be rendered unsafe by holding with arm or blocking, thereby permitting one-hand operation</li> <li>▪ Protects only the operator</li> <li>▪ May require special fixtures</li> </ul>
Gate	Provides a barrier between danger area and operator or other personnel	Can prevent reaching into or walking into the danger area	<ul style="list-style-type: none"> <li>▪ May require frequent inspection and regular maintenance</li> <li>▪ May interfere with operator's ability to see the work</li> </ul>

<b>FEEDING AND EJECTION METHODS</b>			
<b>METHOD</b>	<b>GUARDING ACTION</b>	<b>ADVANTAGES</b>	<b>LIMITATIONS</b>
Automatic Feed	Stock is fed from rolls, indexed by machine mechanism, etc.	Eliminates the need for operator involvement in the danger area	<ul style="list-style-type: none"> <li>▪ Other guards are also required for operator protection--usually fixed barrier guards</li> <li>▪ Requires frequent maintenance</li> <li>▪ May not be adaptable to stock variation</li> </ul>
Semiautomatic Feed	Stock is fed by chutes, movable dies, dial feed, plungers or sliding bolster	Eliminates the need for operator involvement in the danger area	<ul style="list-style-type: none"> <li>▪ Other guards are also required for operator protection--usually fixed barrier guards</li> <li>▪ Requires frequent maintenance</li> <li>▪ May not be adaptable to stock variation</li> </ul>
Automatic Ejection	Work pieces are ejected by air or mechanical means	Eliminates the need for operator involvement in the danger area	<ul style="list-style-type: none"> <li>▪ May create a hazard of blowing chips or debris</li> <li>▪ Size of stock limits the use of this method</li> <li>▪ Air ejection may present a noise hazard</li> </ul>
Semiautomatic Ejection	Work pieces are ejected by mechanical means which are initiated by the operator	Operator does not have to enter danger area to remove finished work	<ul style="list-style-type: none"> <li>▪ Other guards are required for operator protection</li> <li>▪ May not be adaptable to stock variation</li> </ul>
Robots	They perform work usually done by operator	<ul style="list-style-type: none"> <li>▪ Operator does not have to enter danger area</li> <li>▪ Are suitable for operations where high stress factors are present such as heat and noise</li> </ul>	<ul style="list-style-type: none"> <li>▪ Can create hazards themselves</li> <li>▪ Require maximum maintenance</li> <li>▪ Are suitable only to specific operations</li> </ul>

