



# METHODS OF MACHINE SAFEGUARDING





GUARDS			
METHOD	SAFEGUARDING ACTION	ADVANTAGES	LIMITATIONS
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>



<b>DEVICES</b>			
<b>METHOD</b>	<b>SAFEGUARDING 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 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 work-space 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 work-space</li> <li>• Adjustments must be made for specific operations and each individual</li> <li>• Requires close supervision of the operator's use of the equipment</li> </ul>



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<b>METHOD</b>	<b>SAFEGUARDING ACTION</b>	<b>ADVANTAGES</b>	<b>LIMITATIONS</b>
<p>Safety trip controls:</p> <ul style="list-style-type: none"> <li>• Pressure-sensitive body bar</li> <li>• Safety triprod</li> <li>• Safety tripwire</li> </ul>	<p>Stops machine when tripped</p>	<p>Simplicity of use</p>	<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>
<p>Two-hand control</p>	<p>Concurrent use of both hands is required, preventing the operator from entering the danger area</p>	<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>
<p>Two-hand trip</p>	<p>Concurrent use of two hands on separate controls prevents hands from being in danger area when machine cycle starts</p>	<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>
<p>Gate</p>	<p>Provides a barrier between danger area and operator or other personnel</p>	<p>Can prevent reaching into or walking into the danger area</p>	<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>



## FEEDING AND EJECTION METHODS

METHOD	SAFEGUARDING ACTION	ADVANTAGES	LIMITATIONS
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>



## MACHINE SAFEGUARDING CHECKLIST

Answers to the following questions should help you to determine the safeguarding needs of your own workplace, by drawing attention to hazardous conditions or practices requiring correction.

### Requirements for All Safeguards

	Yes	No
1. Do the safeguards provided meet the minimum OSHA requirements?	<input type="checkbox"/>	<input type="checkbox"/>
2. Do the safeguards prevent workers' hands, arms, and other body parts from making contact with dangerous moving parts?	<input type="checkbox"/>	<input type="checkbox"/>
3. Are the safeguards firmly secured and not easily removable?	<input type="checkbox"/>	<input type="checkbox"/>
4. Do the safeguards ensure that no objects will fall into the moving parts?	<input type="checkbox"/>	<input type="checkbox"/>
5. Do the safeguards permit safe, comfortable, and relatively easy operation of the machine?	<input type="checkbox"/>	<input type="checkbox"/>
6. Can the machine be oiled without removing the safeguard?	<input type="checkbox"/>	<input type="checkbox"/>
7. Is there a system for shutting down the machinery before safeguards are removed?	<input type="checkbox"/>	<input type="checkbox"/>
8. Can the existing safeguards be improved?	<input type="checkbox"/>	<input type="checkbox"/>

### Mechanical Hazards

The point of operation:

1. Is there a point-of-operation safeguard provided for the machine?	<input type="checkbox"/>	<input type="checkbox"/>
2. Does it keep the operator's hands, fingers, body out of the danger area?	<input type="checkbox"/>	<input type="checkbox"/>
3. Is there evidence that the safeguards have been tampered with or removed?	<input type="checkbox"/>	<input type="checkbox"/>
4. Could you suggest a more practical, effective safeguard?	<input type="checkbox"/>	<input type="checkbox"/>
5. Could changes be made on the machine to eliminate the point-of-operation hazard entirely?	<input type="checkbox"/>	<input type="checkbox"/>



Power transmission apparatus:

- |  | Yes                      | No                       |
|--|--------------------------|--------------------------|
| 1. Are there any unguarded gears, sprockets, pulleys, or flywheels on the apparatus? | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Are there any exposed belts or chain drives?                                      | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Are there any exposed set screws, key ways, collars, etc.?                        | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Are starting and stopping controls within easy reach of the operator?             | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. If there is more than one operator, are separate controls provided?               | <input type="checkbox"/> | <input type="checkbox"/> |

Other moving parts:

- |  |                          |                          |
|--|--------------------------|--------------------------|
| 1. Are safeguards provided for all hazardous moving parts of the machine, including auxiliary parts? | <input type="checkbox"/> | <input type="checkbox"/> |
|--|--------------------------|--------------------------|

**Nonmechanical Hazards**

- |  |                          |                          |
|--|--------------------------|--------------------------|
| 1. Have appropriate measures been taken to safeguard workers against noise hazards?  | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Have special guards, enclosures, or personal protective equipment been provided, where necessary, to protect workers from exposure to harmful substances used in machine operation? | <input type="checkbox"/> | <input type="checkbox"/> |

**Electrical Hazards**

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|--|--------------------------|--------------------------|
| 1. Is the machine installed in accordance with National Fire Protection Association and National Electrical Code requirements? | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Are there loose conduit fittings?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Is the machine properly grounded?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Is the power supply correctly fused and protected?  | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Do workers occasionally receive minor shocks while operating any of the machines?   | <input type="checkbox"/> | <input type="checkbox"/> |



### Training

- |   | Yes                      | No                       |
|---|--------------------------|--------------------------|
| 1. Do operators and maintenance workers have the necessary training in how to use the safeguards and why?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Have operators and maintenance workers been trained in where the safeguards are located, how they provide protection, and what hazards they protect against? | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Have operators and maintenance workers been trained in how and under what circumstances guards can be removed?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Have workers been trained in the procedures to follow if they notice guards that are damaged, missing, or inadequate?  | <input type="checkbox"/> | <input type="checkbox"/> |

### Protective Equipment and Proper Clothing

- |  |                          |                          |
|--|--------------------------|--------------------------|
| 1. Is protective equipment required?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. If protective equipment is required, is it appropriate for the job, in good condition, kept clean and sanitary, and stored carefully when not in use? | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Is the operator dressed safely for the job (i.e., no loose-fitting clothing or jewelry)?  | <input type="checkbox"/> | <input type="checkbox"/> |

### Machinery Maintenance and Repair

- |   |                          |                          |
|---|--------------------------|--------------------------|
| 1. Have maintenance workers received up-to-date instruction on the machines they service?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Do maintenance workers lock out the machine from its power sources before beginning repairs?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Where several maintenance persons work on the same machine, are multiple lockout devices used?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Do maintenance persons use appropriate and safe equipment in their repair work?  | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Is the maintenance equipment itself properly guarded?  | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Are maintenance and servicing workers trained in the requirements of 29 CFR 1910.147, Lockout/tagout, and do the procedures for lockout/tagout exist <u>before</u> they attempt their tasks? | <input type="checkbox"/> | <input type="checkbox"/> |

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