

UCSB Machine Safeguarding Written Program

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Introduction

The University of California, Santa Barbara (UCSB) EH&S/General Safety staff has developed this Machine Safeguarding Program for the protection of faculty, staff, researchers and students who work with or near machinery. A machine is defined as an apparatus using or applying mechanical power and having several parts, each with a definite function and together performing a particular task. This program is designed to apply to any piece of equipment on campus which may be defined as a machine.

Machinery can be dangerous. Much of the danger on most machines occurs at the point-of-operation, where the work is performed and where the machine cuts, shears, punches shapes, sands, bends or drills different materials. Many hazards exist on all types of machinery that can lead to serious and debilitating injuries – or even death. Machine safeguarding is the primary way to control hazards associated with machinery. Dangers include when machines are improperly used or do not comply with applicable regulations and standards. Cal/OSHA requires that any machine part, function, or process which may cause injury must be safeguarded. When the operation of a machine or accidental contact with it can injure the operator or others in the vicinity, the hazards must either be controlled or eliminated. All guards should be appropriate for the hazards involved, secured in place, constructed of substantial material, and have surfaces free of hazardous projections.

It is crucial to always use safeguards on machines to prevent workers from obtaining needless injuries which are often preventable. The most basic safety guideline for machine safeguarding is ‘every machine part, function or process which may cause injury must be safeguarded.’ If the operation of a machine can injure the operator, or other workers nearby, the hazard must be controlled or eliminated.

Examples of Guarded vs. Unguarded Machinery



Unguarded



Guarded



Guarded



Unguarded

Machine Safeguarding Written Program

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OSHA MACHINE GUARDING E-TOOL

Purpose

Machine Safeguarding Written Program **University of California Santa Barbara**

The University of California, Santa Barbara (UCSB) has machinery in many shapes and sizes. This Program assures compliance with Cal/OSHA regulations for machine safeguarding.

Applicability and Scope

This program applies to any persons using and/or overseeing the use of machines which are owned, operated, or under the control of UCSB (including: faculty, staff, student employees, volunteers, etc.).

Cal/OSHA requires adequate safeguards for all machines and equipment generating hazardous mechanical movement. Practical solutions for safeguarding moving machine parts may vary from machine to machine. The type of operation, the size or shape of stock, the method of handling, and the physical layout of the work area, the type of material and production requirements or limitations will help to determine the appropriate safeguarding method for the individual machine.

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Roles/Responsibilities

Machine Operators Responsibilities

Every employee who operates machinery:

- Is trained on and applies the use of machine safeguards
- Inspects the machines and safeguards prior to each use
- Always uses safeguards as required
- Alerts Owner Department Management when machines and/or safeguards need repair/replacement
- Assesses work to determine if machine safeguards cannot be used and work with the supervisor to provide administrative controls for safety.

Owner Department

The department owning the machinery:

- Inspect machines annually and repair as necessary
- Render unusable when in disrepair
- Provide training to all personnel as required by the “training” section of this program
- Keep and maintain attendance records of all training for a minimum of 3 years
- Provide alternative methods or administrative controls for protection when if/when safeguards restrict access to the ‘point of operation’.
- Consult EH&S if there are any questions about safeguards or administrative controls prior to using or allowing the use of a machine.

EH&S/General Safety Team

The EH&S Machine Safeguarding Program Manager:

- Works with UCSB Risk Management Department, Procurement Department and the Owner Department to determine proper ladder selection, stocking and safe-work practices unique to the Owner Department's work activities
- May provide training and periodic audits to assist Owner Departments in Ladder Safety Program compliance
- Maintains and updates this program as need dictates, or compliance codes change

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Types of Equipment and Their Components

The following list of machines includes many common types of machinery that require machine safeguarding. Other machine with exposed moving parts may be found in different industries or be for a specific application or task.

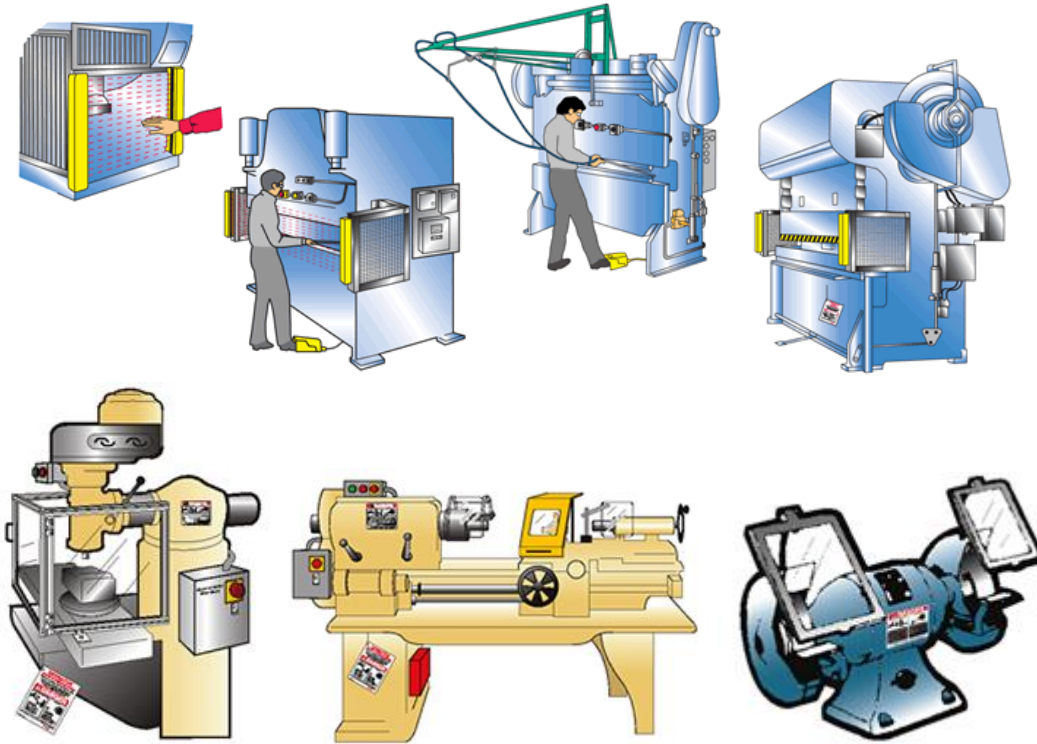
***PLEASE NOTE THE FOLLOWING ARE EXAMPLES ONLY.
NOT ALL MACHINES ARE LISTED:***

Band Saw, Chop Saw, Computer Numerical Control (CNC), Drill Press, Grinder, Bench Grinder, Belt Grinder, Horizontal Band Saw, Hydraulic Press, Iron Worker, Jointer, Mechanical Power Presses and Press Brakes, Metal Lathe, Mill, Miter Saw, Panel Saw, Planer, Radial Arm Saw, Router, Belt Sander, Disk Sander, Drum Sander, Oscillating Edge Sander, Combination Sander, Scroll Saw, Shaper, Shear, Table Saw, Sliding Table Saw, Wood Lathe, and more...

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Methods of Safeguarding

- **Guards:** A physical barrier that prevents access to hazardous areas of a machine.
- **Devices:** A safety device may perform one of several functions. It may: stop the machine if a hand or any part of the body is inadvertently placed in the danger area, restrain or withdraw the operator's hands from the danger area during operation, require the operator to use both hands on machine controls, thus keeping both hands and body out of danger, provide a barrier which is synchronized with the operating cycle of the machine in order to prevent entry to the danger area during the hazardous part of the cycle.



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Guard & Safeguarding Devices

Guards and safeguarding devices are meant to accomplish two things: to protect the operator from the hazardous moving parts of a machine and prevent injuries; and to offer protection to those in the general work area from being struck by flying parts or material, or inadvertently being caught by moving parts.

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3 Basic Safeguard Areas:

Point of Operation: This is the area where work is performed on the material. This work includes cutting, shaping, forming and any machinery in which the point in which the machine is used contains moving parts.

Power Transmission Apparatus: Components of the mechanical system which transmit energy to the machine part that is performing the work must be guarded. These components include pulleys, belts, connecting rods, flywheels, couplings, cams, chains, spindles, cranks and gears.

Other Moving Parts: Any part of the machine that may be in motion must be guarded. These include [rotating](#) and transverse moving parts, reciprocating parts and feed mechanisms of the machine.

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Engineering Controls

The first and best strategy is to control the hazard at its source. Engineering controls do this, unlike other controls that generally focus on the employee exposed to the hazard. The basic concept behind engineering controls is that, to the extent feasible, the work environment and the job itself should be designed to eliminate hazards or reduce exposure to hazards.

Engineering controls can be simple in some cases. They are based on the following principles:

- If feasible, design the facility, equipment, or process to remove the hazard or substitute something that is not hazardous.
- If removal is not feasible, enclose the hazard to prevent exposure in normal operations.
- Where complete enclosure is not feasible, establish barriers or local ventilation to reduce exposure to the hazard in normal operations.

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Administrative Controls

OSHA uses the term administrative controls to mean using measures beyond safe work practices to reduce employee exposure to hazards. These measures include additional using relief workers, administrating exercise breaks and rotating workers. These types of controls are often used in conjunction with other controls that more directly prevent or control exposure to the hazard.

When neither Engineering Controls nor Administrative Controls are possible or they do not provide adequate protection, **personal protective equipment (PPE)** must be provided as a supplement. Departments must institute all feasible engineering and administrative controls to eliminate or reduce hazards before using PPE to protect employees from injury.

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Safeguarding Devices

Criteria for Safeguards

- Prevent Contact: The safeguard must prevent hands, arms, and any other part of a worker's body from making contact with dangerous moving parts.

- **Secure:** Safeguards should not be easy to remove or tamper with and must be firmly secured to the machine. Guards and safety devices should be made of durable material that will withstand the conditions of normal use.
- **Protect from Falling Objects:** The safeguard should ensure that no objects could fall into moving parts and become a projectile while the machine is being operated.
- **Create no new Hazards:** A safeguard defeats its purpose if it creates a hazard of its own.
- Any safeguard that impedes a worker from performing the job quickly, comfortably and safely may soon be overridden or disregarded. A guard must allow maximum visibility of the point-of-operation.
- **Allow Safe Lubrication:** Machines should have the capability of being safely lubricated without the safeguards removed.

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Location/Distance

A thorough hazard analysis of each machine and particular situation is essential before attempting to safeguard. The following examples show how to apply the principle of safeguarding by location:

- The machine or its dangerous moving parts must be positioned so that hazardous areas are not accessible to a worker during the normal operation of the machine. This may be accomplished by locating a machine so that a plant design feature, such as a wall, protects the worker and other personnel. Another possible solution is to have dangerous parts located high enough to be out of the normal reach of any worker
- The feeding process can be safeguarded by location if a safe distance can be maintained to protect the worker's hands. The dimensions of the stock being worked on may provide adequate safety. For instance, if the stock is several feet long, and work is being performed only on one end, the operator may be able to hold the opposite end while the work is accomplished. An example would be a single-end punching machine. However, protection might still be required for other personnel
- The positioning of the operator's control station provides another potential approach to safeguarding by location. Operator controls may be located at a safe distance from the machine if there is no reason for the operator to tend to it.

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Presence-Sensing

Photoelectric –The photoelectric (optical) presence-sensing device uses a system of light sources and controls which can interrupt the machine's operating cycle. If the light field is broken, the machine stops and will not cycle. This device must only be used on machines which can be stopped before the worker can reach the danger area.

Radio frequency – The radio frequency (capacitance) presence-sensing device uses a radio beam that is part of the machine control circuit. When the capacitance field is broken, the machine will stop or will not activate. Like the photoelectric device, this device is only used on machines which can be stopped before the worker can reach the danger area. This requires the machine to have a friction clutch or other reliable means for stopping.

Electromechanical – The electromechanical sensing device has a probe or contact bar which descends to a predetermined distance when the operator initiates the machine cycle. If there is an obstruction preventing it from descending its full predetermined distance, the control circuit does not actuate the machine cycle.

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Potential Feeding and Ejection Methods to Improve Safety for the Operator

- Automatic Feed
- Semi-Automatic Feed
- Automatic Ejection
- Semi-automatic ejection
- Robot

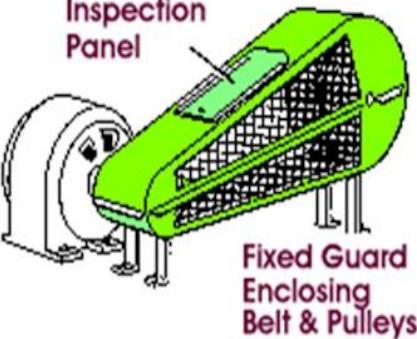
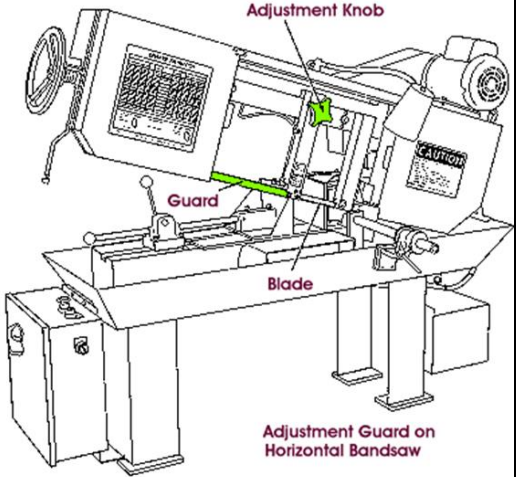
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Miscellaneous Aids

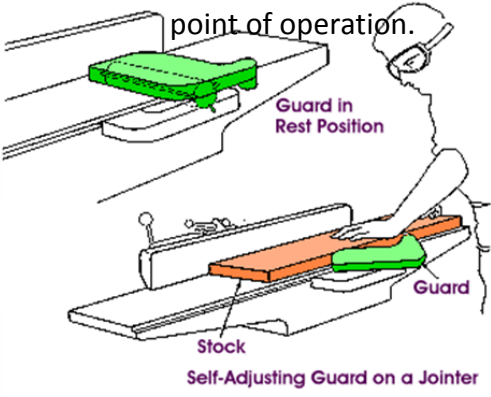
- Awareness Barriers
- Miscellaneous Protective Shields
- Hand-feeding Tools and Holding Fixtures

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Types of Machine Guards:

Type	Safeguard Action	Advantages	Limitations	Examples
Fixed	<p>Provides a barrier and is a permanent part of machine.</p>  <p>Inspection Panel</p> <p>Fixed Guard Enclosing Belt & Pulleys</p>	<p>Can be constructed to suit many specific applications. Can provide Maximum protection. Usually requires little maintenance. Suitable to high production, repetitive operations.</p>	<p>May interfere with visibility. Machine adjustment and repair often require removal of guard. Other means of protecting maintenance personnel often required (i.e., lockout)</p>	<p>For use on: In-running rolls. Belts and Pulleys Power transmission apparatus. Cutting Heads of Planers and other automatic-feed equipment</p>
Adjustable	<p>Provides a barrier that may be adjusted to facilitate a variety of production operations.</p>  <p>Adjustment Knob</p> <p>Guard</p> <p>Blade</p> <p>Adjustment Guard on Horizontal Bandsaw</p>	<p>Can be constructed to suit many specific applications. Can be adjusted to admit varying sizes of stock.</p>	<p>Hands may enter danger area. Protection may not be complete at all times. May require frequent maintenance or adjustment. Operator may make guard ineffective. May interfere with visibility.</p>	<p>Used on woodworking machinery, such as: Table saws Routers. Shapers. Band saws</p>

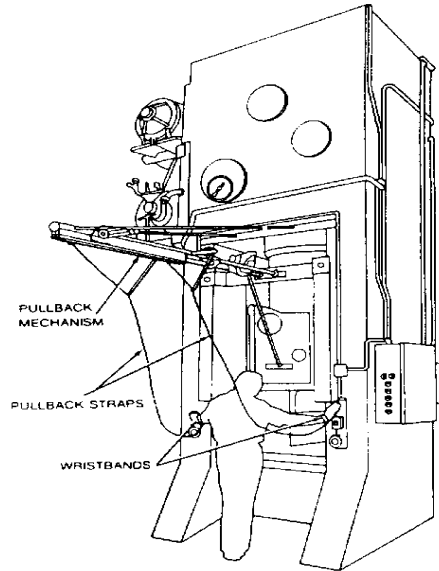
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<p>Self-adjusting</p>	<p>Provides a barrier that moves according to the size of the stock entering the point of operation. Guard is in place when machine is at rest. Guard pushes away when worker moves stock into point of operation.</p>  <p>Self-Adjusting Guard on a Jointer</p>	<p>Off-the-shelf guards are often commercially available. Do not require manual adjustments.</p>	<p>Does not provide maximum protection. May interfere with visibility. May require frequent maintenance and adjustment.</p>	<p>Used on woodworking machinery, such as: Table saws Radial saws Band saws Jointers</p>
<p>Source and for more information: Adapted from <i>Concepts and Techniques of Machine Safeguarding</i>, U.S. Department of Labor, OSHA- https://www.osha.gov/Publications/Mach_SafeGuard/toc.html and www.slosipe.org.</p>				

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Pullback

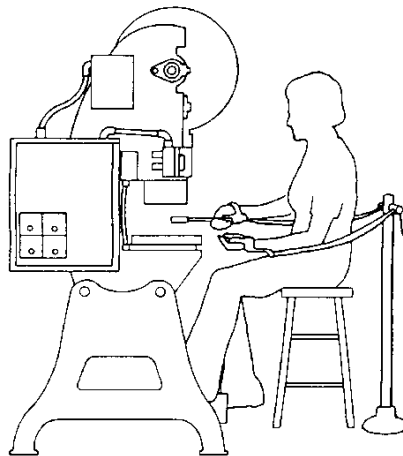
Pullback devices use a series of cables attached to the operator’s hands, wrists, and/or arms. This type of device is primarily used on machines with a stroking action. When the slide/ram is up, the operator is allowed access to the point of operation. When the slide/ram begins to descend, a mechanical linkage automatically assures withdrawal of the hands from the point of operation.



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Restraint

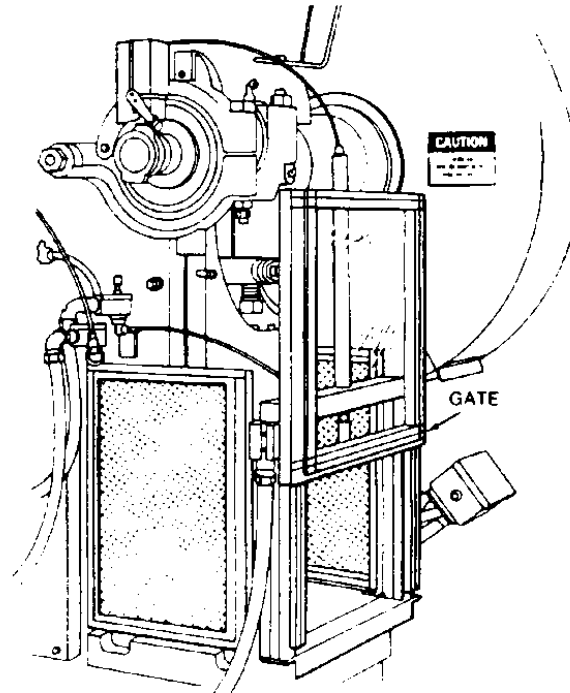
The restraint (holdout) device uses cables or straps that are attached to the operator’s hands and a fixed point. The cables or straps must be adjusted to let the operator’s hands travel within a predetermined safe area. There is no extending or retracting action involved.



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Gate or Barrier

A gate is a movable barrier which protects the operator at the point of operation before the machine cycle can be started. Most gates are designed to be operated with each machine cycle. If the gate is not permitted to descend to the fully closed position, the press will not function. Another potential application of this type of guard is where the gate is a component of a perimeter safeguarding system.



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Safety Control

Safety control devices are designed to provide a quick means for deactivating a machine. Safety control devices include:

- Safety trip control
- Pressure-sensitive body bar
- Safety tripod
- Safety tripwire cable
- Two-hand control
- Two-hand trip

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Program Requirements and Procedures

Safeguards Minimum Requirements:

Prevent Contact: The safeguard must prevent hands, arms, or any part of a worker's body or clothing from making contact with dangerous moving parts. A good safeguarding system eliminates the possibility of the operator or other workers 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 could fall into moving parts. A small tool that is dropped into a cycling machine could easily become a projectile that could strike and injure someone.

Create 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 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.

OSHA - CFR (Code of Federal Regulations) 1910.212. applies to all machines not specifically addressed elsewhere, in the code. It states: "One or more methods of machine guarding shall be provided to protect employees in the machine area from hazards such as those created by point of operation, ingoing nip points, rotating parts, flying chips and sparks.

Guards shall be affixed to the machine where possible and secured elsewhere if not possible and shall present an accident hazard in itself.

The 'Point of Operation' of machines whose operation exposes an employee to injury shall be guarded.

Revolving drums, barrels, and containers shall be guarded by an enclosure which is interlocked with the drive mechanism.

When the periphery of the blades of a fan is less than 7 feet above the floor or working level, the blades shall be guarded with a guard having openings no larger than ½ inch.

Machines designed for a fixed location shall be securely anchored to prevent walking or moving."

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Administrative Requirements

Operator Safe Work Practices

- Practice good housekeeping – avoid crowded, cluttered conditions
- Make sure combustible and flammable material is located away from spark-producing operations
- Provide adequate ventilation to reduce dust and other air contaminants
- Monitor noise levels and provide hearing protection when necessary
- Identify hazards related to their assigned job task
- Follow the equipment manufacturer’s recommendations
- Use equipment only for the purpose for which its design is intended
- Operate the tool at the speed and tension specified by the manufacturer
- Inspect the equipment visually before use
- Remove defective equipment from service
- Maintain sharp and clean parts
- Ensure dust collection system is on and properly functioning
- Check to see that guards and guides are properly adjusted and functional
- Work Practices
- Make sure hands are kept at a safe distance
- Follow safe procedures, as outlined in the operator’s manual
- Always wear eye and face protection and other appropriate personal protective equipment
- Do not wear loose clothing or long hair
- Follow proper lockout/tagout procedures during service, repair or during unusual circumstances
- Never remove a guard
- Never reach into areas of the equipment where you cannot see clearly
- Direct the operation away from your body

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Hazard Evaluation and Control

Hazardous Actions

Cutting actions: involve rotating motion, reciprocating motion, and transverse motion. The danger of cutting action exists at the point of operation where finger, head, and arm injuries can occur, and where flying chips or scrap material can strike the eyes or face. Such hazards are present at the point of operation in cutting wood, metal, or other materials. Typical examples of mechanisms involving cutting hazards include band-saws, circular saws, boring or drilling machines, turning machines (lathes), or milling machines.

Punching actions: result when power is applied to a slide (ram) for the purpose of blanking, drawing, or stamping metal or other materials. The danger of this type of action occurs at the point of operation where the stock is inserted, held, and withdrawn by hand. Typical machinery used for punching operations are power presses and iron workers.

Shearing actions : involve applying power to a slide or knife in order to trim or shear metal or other materials. A hazard occurs at the point of operation where the stock is actually inserted, held, and withdrawn. Typical examples of machinery used for shearing operations are mechanically, hydraulically, or pneumatically powered shears."

Bending actions : result when power is applied to a slide in order to draw or stamp metal or other materials. A hazard occurs at the point of operation where stock is inserted, held, and withdrawn. Equipment that uses a bending action includes power presses, press brakes, and tubing benders.

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Hazardous Activities include:

Machine Setup, Normal Operation, Clearing Jams, Machine Adjustments, Cleaning Machines, Lubricating Machine Parts, Scheduled and Unscheduled Maintenance, Unusual Occurrences, and more.

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Other Hazards Include:

Kickbacks (a sudden forceful recoil), Flying Chips or Materials, Tool or Parts Projection, Electrical, Noise, Vibration, Shop Temperature – Cold or Hot, Insufficient Illumination, Poor Housekeeping, Pressure (Air or Hydraulic), and more.

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Hazardous Mechanical Motions and Actions:

- ***Rotating Motion:*** Even smooth, slowly rotating shafts can grip clothing, and through mere skin contact can force an arm or hand into a dangerous position. Collars, couplings, cams, clutches, flywheels, shaft ends, spindles, and horizontal or vertical shafting are some examples of common rotating mechanisms which may be hazardous. There is added danger when bolts, nicks, abrasions, and projecting keys or set screws are exposed on rotating parts on machinery.
- ***In-Running Nip Point:*** These are hazardous places on the machine where parts move toward each other or when one part moves past a stationary object. Loose clothing or body parts may become caught between or drawn into the nip point.
- ***Reciprocating motions:*** may be hazardous because of the back-and-forth or up-and-down motion. A worker may be struck by, or caught between a moving and a stationary part.

- ***Transverse Motion:*** Mechanical Waves are waves which propagate through a material medium (solid, liquid, or gas) at a wave speed which depends on the elastic and inertial properties of that medium.

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Grinders

Grinding Machines have special safety precautions that must be observed include machine guarding, personal protective equipment (PPE) and inspection (including ring test). For specific information about grinders please [click here](#), or visit the web at <http://www.longwood.edu/assets/chemphys/ch5.pdf>.

One method of grinding wheel inspection is called ring testing. OSHA, ANSI and the grinding wheel manufacturers require this method of grinding wheel inspection. It must be performed BEFORE the wheel is mounted on a grinding machine. Ring testing depends on the damping characteristics of a cracked wheel to alter the sound emitted when the wheel is tapped lightly. To perform the ring test, wheels should be tapped gently with a light nonmetallic implement, such as the handle of a screw driver for light wheels, or a wooden mallet for heavier wheels.

- Tap wheels about 45 degrees each side of the vertical line and about 1" or 2" from the periphery. Rotate the wheel 45 degrees and repeat the test.
- Large and thick wheels may be given the ring test by striking the wheel on the periphery rather than the side of the wheel.
- A sound and undamaged wheel will give a clear tone. If cracked, there will be a dead sound and not a clear ring and the wheel must not be used.
- Wheels must be dry and free of sawdust when applying the ring test, otherwise the sound may be deadened. The ring test is not applicable to certain wheels because of their size, shape or composition.

Watch a video demonstration of a ring test [HERE](#), or by visiting the web at https://www.youtube.com/watch?v=52n8_-6cooY.

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Training Requirements

It is very important that machine operators are properly trained in order to recognize and identify hazardous mechanical components and motion related to a particular machine. Even the most elaborate safeguarding system cannot offer effective protection unless the worker knows how to use it and why. Specific and detailed training is therefore a crucial part of any effort to provide safeguarding against machine related hazards. This kind of safety training is necessary for new operators and maintenance or setup personnel, when any new or altered safeguards are put in service, or when workers are assigned to a new machine or operation.

Even though OSHA does not specifically require the employer to train each employee on each machine, it is generally accepted that thorough operator training should involve instruction or hands-on training in the following:

- 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
- How to use the safeguards and why
- How and under what circumstances safeguards can be removed, and by whom (in most cases, repair or maintenance personnel only) and
- What to do (e.g. contact the supervisor) if a safeguard is damaged, missing or unable to provide adequate protection.

Even the most elaborate safeguarding system cannot offer effective protection unless the employees know how to use their equipment and when to remove safeguards. Specific and detailed training is a crucial part of any effort to protect against machine-related hazards. Thorough operator training involves instruction or hands-on training. Training should include:

- 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
- Proper operation, adjustment, placement and use of safeguards
- How and under what circumstances safeguards can be removed, and by whom
- What to do if a safeguard is damaged, missing, or unable to provide adequate protection
- Appropriate personal protective equipment
- Health hazards associated with using machines (air quality, noise and vibration)
- Maintenance and care
- Inspections
- Training is necessary for new operators and maintenance or setup personnel when:
 - New or altered safeguards are put in service
 - Workers are assigned to a new machine or operation
- Basic Safety Principles Equipmt

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Inspection Requirements

Inspections & Evaluation Criteria

All machines should be visually inspected by the operator before their use each day. Visual inspections may reveal hazards such as loose or broken parts, frayed electrical cords, loose or missing guards or improperly adjusted parts. Any one of these items could lead to an injury if not corrected.

Machines that are missing guards or in substandard condition should be immediately removed from service until appropriate repairs are made or guards are affixed.

Bi-annually, a thorough inspection and corrective action must be completed, using the Machine Safeguarding Checklist provided. Documentation for these inspections must be kept onsite for a minimum of 3 years.

Many machines purchased by businesses from various equipment suppliers do not come equipped with the proper guards and safeguarding devices, and therefore do not comply with the applicable regulations and standards. Machines like this are common in most businesses that utilize machines for woodworking and metalworking, and require a varying number of upgrades. High-end machines are designed and built to comply with the regulations and standards and usually don't require many upgrades, if any.

The Machine Safeguarding Checklist is a good way to help determine if machines require a more thorough evaluation, and whether or not procedures and policies need to be developed to fulfill administrative requirements. To help determine the upgrades required to bring a piece of machinery into compliance, click on the Machine Safeguarding Evaluation Form and print a copy.

Rockford Systems, LLC. Has a tool on their website to aid in the selection of machine safeguards. For more information please visit [Machine Safeguarding](http://www.rockfordsystems.com/) (<http://www.rockfordsystems.com/>).

Machine Safeguarding Checklist – [Click Here](#)

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Regulations and Standards

The use of proper safeguarding methods, safety devices and equipment is required by the applicable regulations and standards, but more importantly it makes good sense to provide a safe and healthy working environment. The OSHA standard states that any machine that creates a hazard must be safeguarded to protect the operator and other employees. Below are some of the applicable regulations and standards for machine safeguarding.

U.S. Department of Labor General Duty Clause – OSHA
General Duty Clause, Section 5(a)(1) OSH Act
California OSHA (CalOSHA)
§3328. Machinery and Equipment
Article 37. Purpose, Definitions and Standards (Sections 3940–3945) §4001
Machine Power Control §4002
Moving Parts of Machinery or Equipment
Article 54. Scope and General Definitions (Sections 4184–4188)
Article 56. Metal Working Machines (Sections 4225–4243)
Article 59. Woodworking Machines and Equipment (Sections 4296–4325)
Federal Occupational Safety and Health Act (OSHA)
1910 Subpart O – Machinery and Machine Guarding
1910.211 – Definitions 1910.212 – General requirements for all machines
1910.213 – Woodworking machinery requirements
1910.215 – Abrasive wheel machinery
1910.219 – Mechanical power-transmission apparatus
1910.147 – The control of hazardous energy (lockout/tagout)

In addition to Federal OSHA and CalOSHA, other organizations provide information on proper machine guarding. ANSI publishes the B11 standards for the construction, care and use of machine tools, and certain standards have been developed for specific types of machine tools. ANSI standards may also provide guidance for complying with the OSHA performance-based standards outlined above. ANSI standards are often incorporated into Federal or State OSHA regulations, and in these cases, employers are accountable for complying with the specific version referenced. ANSI standards are routinely revised, so always check to be sure that the most recent version is followed. ANSI standards are copyrighted material and are not available on-line, but can be purchased through www.ansi.org or other publishing companies found on the Internet.

American National Standards Institute (ANSI)
ANSI B11.19, Performance Criteria for Safeguarding
ANSI 01.1 – 1992 Woodworking Machine Safety Requirements
ANSI B7.1, Abrasive Wheels
ANSI B11.4, Safety Requirements for Shears
ANSI B11.5, Iron Workers
ANSI B11.6, Manual Turning Machines – Lathes

[Machine Safeguarding Written Program](#)
[University of California Santa Barbara](#)

[ANSI B11.8, Manual Milling, Drilling and Boring Machines](#)
[ANSI B11.9, Grinding Machines](#)
[ANSI B11.10, Sawing Machines](#)
[ANSI Z535.1 – 2002, Safety Color Code](#)

[Machine Guarding, Safety and Health Topics – OSHA](#)

[E Tools – Machine Guarding – OSHA](#)

[Machine Safeguarding at the Point of Operation – A Guide for Finding Solutions to Machine Hazards](#)

[A Guide for Protecting Workers from Woodworking Hazards \(OSHA 3157\)](#)

[Safeguarding Equipment and Protecting Workers from Amputations \(OSHA 3170\)](#)

[Concepts and Techniques of Machine Safeguarding \(OSHA 3067\)](#)

[A Guide to Machine Safeguarding](#)

Supporting information:

[OSHA Machine Guarding](#)

[1910 Subpart O - Machinery and Machine Guarding](#)

[1910.211 - Definitions.](#)

[1910.212 - General requirements for all machines.](#)

[1910.213 - Woodworking machinery requirements.](#)

[1910.214 - Cooperage machinery. \[Reserved\]](#)

[1910.215 - Abrasive wheel machinery.](#)

[1910.216 - Mills and calenders in the rubber and plastics industries.](#)

[1910.217 - Mechanical power presses.](#)

[1910.217 App A - Mandatory requirements for certification/validation of safety systems for presence sensing device initiation of mechanical power presses](#)

[1910.217 App B - Nonmandatory guidelines for certification/validation of safety systems for presence sensing device initiation of mechanical power presses](#)

[1910.217 App C - Mandatory requirements for OSHA recognition of third-party validation organizations for the PSDI standard](#)

[1910.217 App D - Nonmandatory supplementary information](#)

[1910.218 - Forging machines.](#)

[1910.219 - Mechanical power-transmission apparatus.](#)

[NIOSH - Machine Related Injury Research](#)

[MIT – Introduction to Machine Tools](#)

[Princeton Machine Guarding Requirements](#)

Resources provided by:

-University of California San Diego – OSHA Extension

-Occupational Safety and Health Administration (OSHA)

-Schools Insurance Program for Employees

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Attachments

[Machine Safeguarding Checklist – Click Here](#)

[FAQ - EH&S Fact Sheet for the Machine Safeguarding Written Program – Click Here](#)

[OSHA MACHINE GUARDING E-TOOL](#)

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