MACHINE SAFEGUARDING

Workers Compensation Fund

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Case Study #1

- While using an unguarded, foot pedal-operated, full-revolution mechanical power press, an employee used his hands to feed and remove finished parts and scrap metal. He placed the completed part to the left side of the press, then turned to place the scrap metal in the bin behind him. As he turned back to face the press, he inadvertently stepped on the foot pedal and activated the press while his hands were in the die area. His left hand was amputated at the wrist.

Case Study #2

- A printing press operator lost his right hand while attempting to remove dried ink on a moving roller using a rag. The guard covering the lower ink train roller had been flipped up, exposing the rollers. The rag got caught in a nearby roller, pulling the employee's hand into the in-running nip-point. The operator immediately hit the press E-stop but the roller rotated one half turn before stopping. His hand was crushed as a result of the accident.

OSHA Requirements

Subpart O Machinery and Machine Guarding

- 1910.212-General Req. for all Machinery
- 1910.213-Woodworking Machinery
- 1910.215-Abrasive Wheel Machinery
- 1910.217-Mechanical Power Presses
- 1910.219-Mechanical Power Transmission Apparatus

OSHA Requirements

1910.212 (a) (1):

- Employer must protect operator & other employees in the machine area from hazards such as; **point of operation, ingoing nip points, rotating parts, flying chips & sparks**.
- "Catch all" for all machine guarding requirements.

OSHA Requirements

- 1910.212(a)(2): Guards shall be affixed to the machine where possible & secured elsewhere if for any reason attachment to the machine is not possible. The guard shall be such that it does not offer an accident hazard in itself.
- 1910.212(b): Machinery designed for a fixed location shall be securely anchored to prevent walking or moving.

Point of Operation

That point in which cutting, shaping, boring or forming is accomplished upon the stock.

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Point of Operation Example

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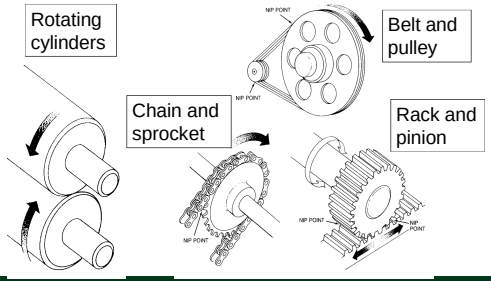
In-Running Nip Points



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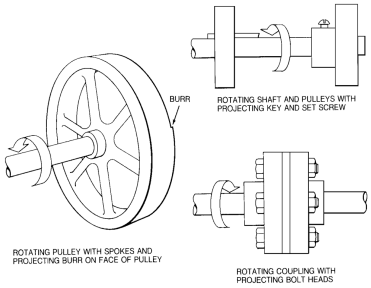
Rotating Parts



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Requirements for Safeguards

- 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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Methods of Machine Safeguarding

- Guards
  - fixed
  - interlocked
  - adjustable
  - self-adjusting
- Devices
  - presence sensing (pressure, light)
  - pullback
  - restraint
  - safety controls (tripwire cable, two-hand control, etc.)
  - gates
- Location/distance
- Feeding and ejection methods
  - automatic and/or semi-automatic feed and ejection
  - Robots
- Miscellaneous aids
  - awareness barriers
  - protective shields
  - hand-feeding tools

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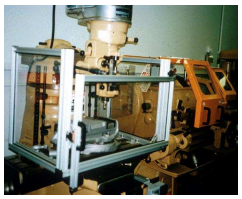
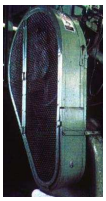
Fixed Guard





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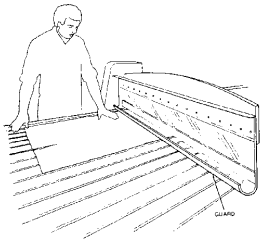
Fixed Guard



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Distance of opening from point of operation hazard	Maximum width of opening
1/2 to 1 1/2	1/4
1 1/2 to 2 1/2	3/8
2 1/2 to 3 1/2	1/2
3 1/2 to 5 1/2	5/8
5 1/2 to 6 1/2	3/4
6 1/2 to 7 1/22	7/8
7 1/2 to 12 1/2	1 1/4
12 1/2 to 15 1/2	1 1/2
15 1/2 to 17 1/2	1 7/8
17 1/2 to 31 1/2	2 1/8

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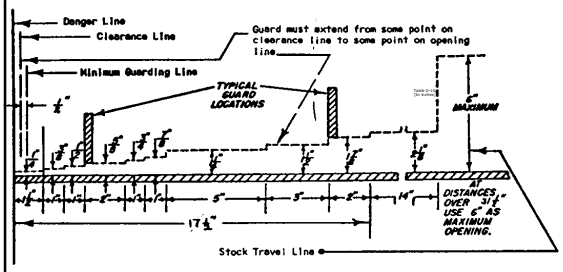


Interlocked Guard

Interlocked Guard

Adjustable Guard

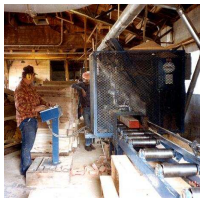
Bandsaw blade adjustable guard

Self-Adjusting Guard

Circular table saw self-adjusting guard

Safeguarding by 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



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Woodworking Machinery Controls

- Power cut off controls shall be located so that the operator does not have to leave his position at the Point of Operation to cut power.
- Power and operating controls so located to prevent having to reach over the cutter for adjustments.
- Foot treadles to be guarded.

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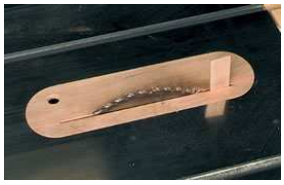
Circular saws to be provided with a spreader to prevent material from squeezing the blade and causing kickback.



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Bench Grinders 1910.215

- Bench and pedestal grinders should be permanently mounted or secured.
- The maximum RPM rating of each abrasive wheel must be compatible with the RPM rating of the grinder motor.
- Guards include spindle, nut, flange and tongue
- Tool rest for stones, not req. for wire wheels

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Precautions:

- The side of a wheel should not be used for grinding, unless it is a special type of wheel designed for that purpose.
- Defective abrasive wheels (cracked, broken, out of balance) should not be used.
- Never grind aluminum
- 1910.215(d) – Always ring test new wheels

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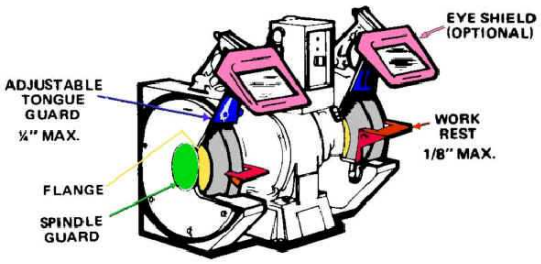

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1910.243 – Portable Powered Tools

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Mechanical Power Drives

- 1910.219(a)(1) - Belts/pulleys (not applicable if 250 feet per minute or less)
- Chains/sprockets
- 1910.219(c)(2)(i) - Shafts (all shafting 7 feet or less from floor shall be guarded)
  - 1910.219(c)(4)(i) - Shaft ends not to protrude beyond ½ the shaft diameter.
  - 1910.219(c)(4)(ii) - All keyways, set screws made flush or guarded.
- 1910.219(f) - Gears

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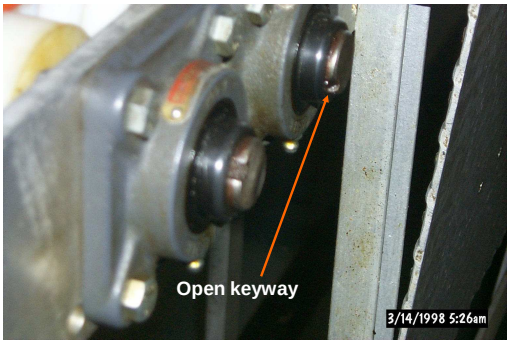

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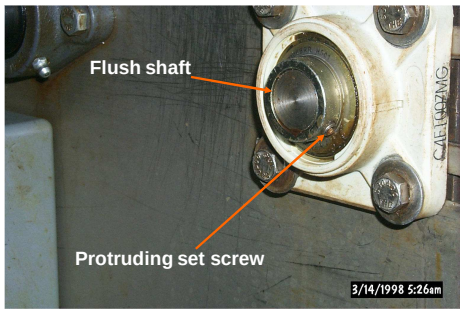

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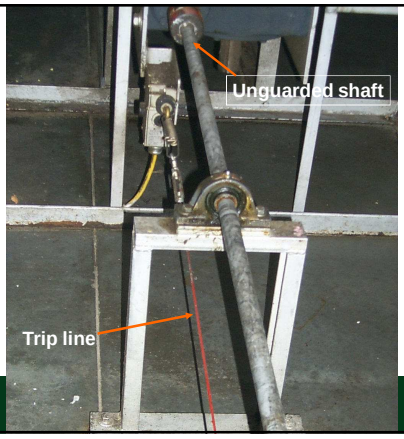


Power-Transmission Apparatus

Unguarded belt and pulley.
7 foot rule

Power transmission apparatus less than 7 feet from the floor or working platform must be guarded.

Pullback Device

- 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

Pullback Device (cont'd)

- Hands in die, feeding
- Point of operation exposed
- Pullback device

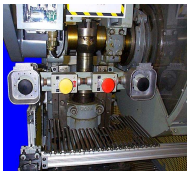
- Die closed
- Hands withdrawn from point of operation by pullback device

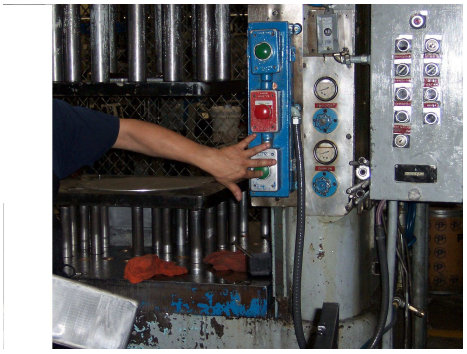
Safety Tripwire Cables

- Device located around the perimeter of or near the danger area
- Operator must be able to reach the cable to stop the

Two-Hand Control

- Requires constant, concurrent pressure to activate the machine
- The operator's hands are required to be at a safe location (on control buttons) and at a safe distance from the danger area while the machine completes its closing cycle





Gates

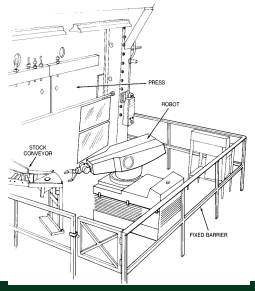
- Movable barrier device which protects the operator at the point of operation before the machine cycle can be started
  - Type A
  - Type B
- If the gate does not fully close, machine will not function

Gate Open

Gate Closed

Robots

- Machines that load and unload stock, assemble parts, transfer objects, or perform other tasks
- Best used in high-production processes requiring repeated routines where they prevent other hazards to employees



Machine Safety Responsibilities

- Management
  - Understand Risk (Tolerable Risk)
  - 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
  - Do not remove guards unless machine is locked and tagged.
  - Do not operate without guards in place.
  - Report machine guard problems to supervisors immediately

Machine Safeguarding Risk Assessment

based on ANSI B11 TR3-2000

The steps in the procedure to arrive at tolerable risk are:

a) **Determine** the limits of the machine;

b) **Identify** and document the hazards associated with the tasks to be performed over the life cycle of the machine;

c) **Analyze** the risk(s) associated with the identified individual tasks and related hazards for severity of injury/illness (harm) that can occur and the probability of such an occurrence

d) **Evaluate** each risk to determine whether or not it is tolerable.

Determine limits of the machine

- Intended use of the machine
  - Cycle times, production rates, speed, force.
- Space limits
  - Range of motion, installation space, maintenance.
- Time limits – maintenance
- Interface limits
  - energy source, other machines.

Identify and Document Hazards

- packing and transportation;
- unloading/packing;
- systems installation;
- start up commissioning;
- set up and try out;
- operation (all modes);
- planned maintenance;
- unplanned maintenance;
- recovery from crash;
- trouble shooting;
- housekeeping;
- decommissioning;
- disposal

Risk Assessment Exercise

- Single virtual barrier guard utilizing Cat 1 control systems.

Training

- Hazards associated with particular machines
- How the safeguards provide protection and the hazards for which they are intended
- How and why to use the safeguards
- How and when safeguards can be removed and by whom
- What to do if a safeguard is damaged, missing, or unable to provide adequate protection

Summary

- Safeguards are essential for protecting workers from needless and preventable machinery-related injuries
- The point of operation, as well as all parts of the machine that move while the machine is working, must be safeguarded
- A good rule to remember is: *Any machine part, function, or process which may cause injury must be safeguarded*