Machinery and Machine Guarding

- 29 CFR 1910.211–219
- 29 CFR 1910.241–244
Objectives

To enable students to understand the following:

- Basic concepts of machine guarding
- How to identify machine guarding hazards
- Machine guarding abatement methods
- Have a familiarity with OSHA standards
MACHINE SAFETY
Machinery and Machine Guarding

- 1910.211 – Definitions
- 1910.212 – General requirements for all machines
- 1910.213 – Woodworking machinery requirements
- 1910.215 – Abrasive wheel machinery
- 1910.217 – Mechanical power presses
- 1910.219 – Mechanical power-transmission apparatus
Hand and Portable Powered Tools

- **1910.241** – Definitions
- **1910.242** – Hand and portable powered tools/equipment
- **1910.243** – Guarding of portable powered tools
- **1910.244** – Other portable tools and equipment
## Where Mechanical Hazards Occur

<table>
<thead>
<tr>
<th>Motions</th>
<th>Actions</th>
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<tr>
<td>Rotating</td>
<td>Cutting</td>
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<tr>
<td>In-running nip points</td>
<td>Punching</td>
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Rotating Motion

- Collars, couplings, cams, clutches, flywheels, shaft ends, spindles, meshing gears, and horizontal or vertical shafting
In-Running Nip Points Motion

- Caused by the rotating parts on machinery
Reciprocating Motion

- Movement in straight, continuous line
  - Struck or caught in pinch point or shear point by moving part
Transverse Motion

- Movement in straight, continuous line
Cutting Action

- Cutting action involves rotating, reciprocating or transverse motion.
Punching Action

- Power is applied to a slide (ram) for the purpose of blanking, drawing, or stamping metal or other materials.
Shearing Action

- Applying power to a slide or knife in order to trim or shear metal or other materials.
Bending Action

- Power is applied to a slide in order to draw or stamp metal or other materials.
Methods of Guarding

- Guards
- Devices
- Location/distance
- Feed mechanisms
- Miscellaneous aids
Guards are barriers that prevent access to danger areas

- Fixed guards
- Interlocks
- Adjustable
- Self-adjusting
Safeguarding Devices

- Photoelectric presence-sensing
- Radiofrequency
- Electromechanical sensing device
- Pullbacks
- Restraints
- Safety trip controls
- Two-hand controls
- Two-hand trip
- Gates
Location/Distance

- Hazard analysis
- Hazards are not accessible
- Walls
- Fences
- Height
- Stock dimension
- Operator’s station
Feed Mechanisms

- Automatic feeding
- Semi-automatic feed
- Automatic ejection
- Semi-automatic ejection
- Robots

Automatic feed - shown on power press
Miscellaneous Aids

- Awareness barriers
- Shields
- Holding tools
- Push stick or block

Source: Concepts and Techniques of Machine Safeguarding, OSHA
Requirements of Safeguards

- Prevent contact
- Properly secured
- Protect from falling objects
- Create no hazards
- Create no interference (greater hazard)
- Allow safe lubrication (removal of guards)
Guarding provided to protect employees from hazards created by:

- Point of operation
- Ingoing nip points
- Rotating parts
- Flying chips and sparks

Machine Guarding

1910.212(a)(1)
Machine Guarding

- Barrier guards
Machine Guarding

- Adjustable barrier guards
Machine Guarding

- Two-hand tripping devices

1910.212(a)(1)
Machine Guarding

- A holdout or restraint device
Machine Guarding

- Presence sensing device
Machine Guarding

- Presence sensing device
Machine Guarding

- Adjustable guard
Machine Guarding

- Pull-out device
General Requirements 1910.212(a)(2)

- Guards affixed to machine where possible
  - Guard shall not offer an accident hazard in itself.
General Requirements

- Machine guarding for all machines - point of operation
  - *Point of operation* of machines whose operation exposes an employee to injury, shall be guarded.
  - Special handtools for placing and removing material must permit easy handling of material.
    » Without the operator placing a hand in the danger zone
Exposure of blades

- Blades of fans less than 7 feet above floor must be guarded.
- Guard openings shall be no larger than $\frac{1}{2}$ inch.
Fan Blades Not Properly Guarded

Corrective Action

- Install proper guard over fan blades with opening no larger than ½ inch.
General Requirements

- Anchoring fixed machinery
  - Machines designed for a fixed location must be anchored to prevent walking or moving.
Woodworking Machinery

− Machine controls and equipment
  − Mechanical or electrical power control provided for operator to cut off power.
  − Located on machine where operator does not have to leave his position at the point of operation.
Machine controls and equipment

- Provision to prevent machines from automatically restarting upon restoration of power.
Hand-fed ripsaw

- Provided with a hood guard
- Provided with a spreader
- Provided with non-kickback fingers or dogs
Woodworking Machinery

- Hand-fed ripsaw
  - Hood guard must automatically adjust itself to thickness of material being cut.
  - Remain in contact with material
Woodworking Machinery Requirements
Woodworking Machinery

Radial saws

- Upper hood must completely enclose upper portion of blade.
  - Must include the end of the saw arbor.
Radial saws

- Lower portion of blade must be guarded on both sides.
  » Guarded to the full diameter of the blade.
  » Will adjust itself to the thickness of the stock.
Woodworking Machinery  

- **Radial saws**
  - Saw used for ripping provided with non-kickback fingers or dogs.
  - Ripping shall be against the direction which the saw turns.
Woodworking Machinery

- Radial saws
  - Adjustable stops preventing forward travel of blade beyond position necessary to complete cut.
Woodworking Machinery

- Radial saws
  - Cutting head must return to starting position when released.
Bandsaws and band resaws

- All portions of saw blade must be enclosed or guarded.
  - Except working portion between guide rollers and the table.
Bandsaws and band resaws

- Bandsaw wheels must be fully encased.
Jointers

- Hand-fed jointer with horizontal cutting head must have an automatic guard.
  - Must cover the working side of the fence or gage.
  - Automatically adjust and cover the unused portion of the head.
Jointers

- Hand-fed jointer with horizontal cutting head must have a guard.
  » Must cover the section of head back of the gage or fence.
Disk sanding machine

- Exhaust hood or guard arranged to enclose revolving disk.

» Except portion above table
Belt sanding machines

- Guards provided at each nip point where sanding belt runs on to a pulley.
Work rests must be adjusted closely to the wheel with a *maximum opening of $\frac{1}{8}$ inch.*
The distance between the wheel periphery and the adjustable tongue **must not exceed** \( \frac{1}{4} \) inch.
Corrective Action

- Properly adjust the work rest and tongue guard to allowable openings.
Abrasive Wheel Machinery

- Adjustable Tongue Guard: ¼” Max.
- Flange
- Spindle Guard
- Work Rest: 1/8” Max.
- Eye Shield (Optional)
# Checklist for Abrasive Wheel Grinders

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<td>Does each grinder have an individual on and off control switch?</td>
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Bench and floor stands

- The angular exposure of the grinding wheel periphery and sides for safety guards used on machines should not exceed 90 degrees or 1/4 of the periphery.
Inspection

- All abrasive wheels must be closely *inspected and ring-tested* before mounting to ensure that they are free from cracks and defects.
Abrasive Wheel Machinery
Mechanical Power Presses

SAFEGUARDED FULL REVOLUTION CLUTCH PRESS (INCLUDES SINGLE STROKE TRIP CONTROL SYSTEM)

Right Side of Press
Foot pedals (treadle)

- Pedal mechanism shall be protected to prevent unintended operation
  - From falling or moving objects
  - Accidental stepping onto the pedal
Safeguarding the point of operation

- Point of operation must be provided with guards or point of operation devices.

Mechanical Power Presses

Part revolution mechanical press
Presence sensing point of operation device

- Must be interlocked into the control circuit to prevent or stop slide motion if part of operator’s body is within sensing field during downstroke of press slide.
Presence sensing point of operation device

- Presence sensing devices cannot be used on machines using full revolution clutches.
Pull-out device shall include attachments for each of operator’s hands.

- Connected to and operated only by press slide of upper die
- Properly adjusted
- Visually inspected and properly adjusted at start of each operator shift
Mechanical Power Presses  1910.217(c)(3)(vi)

- Restraint devices
- Device must protect operator
- Attachments for each hand
- Adjusted to restrain operator from reaching into point of operation
Prime-mover guards

- Flywheels with any part 7 feet or less above floor or platform must be guarded.
Shafting

- Exposed parts of horizontal shafting 7 feet or less from floor or working platform must be guarded.
Projecting shaft ends
  - Must not project more than \( \frac{1}{2} \) the diameter of the shaft
  » Unless guarded by non-rotating caps or safety sleeves
Mechanical Power-Transmission Apparatus 1910.219(d)(1)

- Pulleys
  - Any parts of pulleys which are 7 feet or less from floor or working platform must be guarded
Where both runs of horizontal belts are 7 feet or less from floor level must be guarded.

- Guard must extend at least 15 inches above the belt.
Horizontal belt with both runs **42 inches or less** from floor must be fully enclosed.
Vertical and inclined belts must be enclosed by a guard.
Gears must be guarded by complete enclosures or standard guard.
Sprockets and chains

- Sprocket wheels and chains located *7 feet or less* above the floor or platform must be enclosed.

Roller conveyor with unguarded chain and sprocket drives
Exposed Sprocket and Chain Drive

- Corrective Action
  - Enclose the sprocket and chain drive to avoid contact with moving parts and ingoing nip points.
Keys, setscrews, and other projections

- Projecting keys, setscrews, and other projections in revolving parts must be removed, made flush, or guarded.
Shaft couplings must be constructed as to present no hazard from bolts, nuts, setscrews, or revolving surfaces.

- Permitted where they are covered with safety sleeves or countersunk and do not extend beyond the flange of the coupling.
Portable Powered Tools

- Portable circular saws
  - Must be equipped with guards above and below the base plate or shoe.
  - The lower guard must cover the saw to the depth of the teeth.
Portable circular saws

- The lower guard must automatically return to the covering position over the blade teeth.
  
  » When tool is withdrawn from the work
Portable Powered Tools

Switches and controls

- All hand-held powered circular saws must be equipped with a constant pressure switch or control.
  » Will shut off the power when the pressure is released.
Electric tools must be equipped with switches that must be equipped with a constant pressure switch, or

Turnoff can be accomplished by a single motion of same finger or fingers that turn it on.
Portable Powered Tools

- Portable belt sanding machines
  - Must have guards at nip points where belt runs onto a pulley
  - Unused portion of the belt must be guarded

1910.243(a)(3)
Portable Powered Tools

- Pneumatic powered tools and hose
  - Hose and hose connections designed for pressure and service which they are subjected.

Wire used to secure hose
Portable Powered Tools

- Vertical portable grinders
  - Must have safety guard on tool with a maximum exposure angle of 180 degrees.
Portable Powered Tools

● Corrective Action
  − Install proper type of guard
    » Guard must be located so as to be between the operator and the wheel during use.
Summary

Students should now have a basic understanding of the following:

- Basic concepts of machine guarding
- Identification of machine guarding hazards
- Machine guarding abatement methods
- Familiarity with machine guarding standards
Thank You For Attending!

Final Questions?
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