### Elements of Machine Guarding 29 CFR 1910.212 - 219

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### Facts about machines and equipment guarding from an OSHA enforcement perspective





#### 2016 Top 10 OSHA Volations by Frequency







### **Top 5 Machine Guarding Sections Cited**

#### TOP 5 SECTIONS CITED:

- 1. 1910.212(a)(1) One or more methods of machine guarding shall be provided to protect the operator and other employees in the machine area from hazards – 1,489
- 2. 1910.212(a)(3)(ii) Point of operation 616
- 3. 1910.212(b) Anchoring fixed machinery 156
- 4. 1910.212(a)(2) General requirements 69
- 1910.212(a)(5) Exposure of blades. 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. – 49





### Enforcement

- During FY 2016, 36% of OSHA's Top 10 citations for manufacturing dealt with machine guarding violations.
- Equated to \$7.6 million in penalties. Most were judged as serious violations, which can carry a penalty of up to \$ 12,934 per instance.
- Repeated or willful violations can result in penalties of \$70,000 to \$124,709 per instance.





### Enforcement

- Despite improvements during recent years, nearly 8,440 occupational injuries associated with machine guarding were recorded in the United States during 2016.
- Majority reaching to clear something.
- Many were the result of improperly guarded machines or equipment or lockout violations.





# **2017 Top MG Citations**

### Case 1

 Location: Chicago, OSHA Region 5
Business type: Manufacturer of rigid metal, plastic and hybrid containers
Inspection trigger: Worker injuries

**Event:** OSHA investigated <u>four separate reports</u> of employee injuries prompted by inadequate machine safety procedures, including <u>failure to train in lockout/tagout</u> procedures and providing <u>insufficient machine guarding on a mechanical power</u> press, belts and pulleys, and chains and sprockets. Three workers suffered amputations stemming from unguarded chain and sprocket assembly. Another worker suffered <u>two broken bones</u> when machinery crushed his hand. According to OSHA, <u>15 workers at the plant have suffered amputations in the past five years.</u>





### Case 1

**Major citations**: Cited for <u>five repeated and five serious safety violations</u> of machine safety procedures. The company was placed in OSHA's Severe Violator Enforcement Program.

"Lack of machine safety guards and procedures contribute to multiple employee injuries nationwide each year. Companies must continuously monitor their facilities, and review procedures and training to ensure employees are protected from machine hazards." – Kathy Webb, OSHA area director, Chicago







### Case 2

Location: Oregon, OH OSHA Region 5
Business type: Auto insulation manufacturer
Inspection trigger: Worker amputation

**Event:** A worker's arm became caught while feeding waste materials into a shredding machine, resulting in the <u>amputation of the worker's right hand and wrist</u>, <u>as well as part of the forearm</u>. OSHA cited the company for inadequate machine safety procedures, including failure to lock out equipment to prevent unintentional energization and <u>exposing employees to struck-by hazards from machine components</u>.

**Major citations:** Cited for three willful and two repeated violations







### Where to Start?

- A good rule to remember is: Any machine part, function, or process which may cause injury must be safeguarded.
- A guard should not allow someone to reach over, under, around or through.

### <u>OVER – UNDER – AROUND - THROUGH</u>





### Where Mechanical Hazards Occur

Actions	Motions
Cutting	Rotating
Punching	In-running nip points
Shearing	Reciprocating
Bending	Transverse





### Cutting Action

- Device used to separate material from itself
- Examples: Band saws, circular saws, drills, lathes and mills.
- Injuries: Lacerations and amputations
- Hazards: Flying chips and materials







- Punching Action
  - Powered ram used to blank, draw, or stamp material
  - Example: Power press
  - Injuries: Crushing injury, amputation, or death









### • Shearing Action

- Powered knife or slide is utilized to cut sheet metal or other materials. Can be mechanical, hydraulic or pneumatic.
- Examples: Shear and guillotine
- Injuries: Amputation, cut





#### Bending Action

- Powered slide that is used to draw or stamp material such as sheet metal
- Examples: Power presses, tube benders, press brakes.
- Injuries: Crushing, amputation, or death



MECHANICAL PRESS BRAKE





#### Reciprocating Motions

- Back and forth or up and down motion of machine components. May have nothing to do with point of operation and can be slow or fast
- Examples: Moving tables or slides.
- Injuries: Crushing, amputations, lacerations







#### Transverse Motions

- Movement in straight or continuous line.
- Example: Power belt
- Injuries: Amputation, crushing, laceration
- Hazards: Pulling of fingers, clothing, or hair into pinch point or shear point







#### Rotating Motions

- When parts move or turn around an axis or center point
- Examples: Collars, couplings, flywheels, shaft ends, spindles, horizontal or vertical shafts
- Injuries: Amputations, crushing, laceration, scalping, death









### In Running Nip Points

- Parts with parallel axis rotating in opposite directions; rotating component and a tangentially moving part; or rotating shaft and stationary object
- Examples: Screw conveyors, abrasive wheels, spoked flywheels
- Injuries: Amputation, laceration, crushed hand









### **Protection Against Hazards**

- The type of machine, facility, layout, material handled, and production methods are all major considerations when determining the appropriate guarding for each application.
- Minimum general requirements





### **Prevent Contact**







#### **Proper Guarding**

No guarding on the back side of the gear.











Guard not properly in place.

Guard missing from side of machine.





## **Protect from Falling Objects**



**Protected from overhead objects** 

**Open on Top** 







### **Create No New Hazards**



Jagged edge





### **Create No Interference**



#### Light curtain on Ball Sizer

Self adjusting guard and auto return on radial arm saw







### **Allow Safe Lubrication**









## **Methods of Guarding**

- o Guards
- Devices
- Location/distance
- Feed mechanisms
- Miscellaneous aids







# **Types of Guards**

- Guards prevent access to a hazardous area
  - Fixed (Barrier)
  - Interlocked
  - Adjustable
  - Self-adjusting











## Guarding

- Fixed Guards
  - Most common
  - Permanent type
  - Can be constructed of metal, plastic, screen, or bars.







## **Fixed Guarding**

### Advantages

- Can be constructed to suit many applications.
- Permanently encloses the point of operation or hazard area.
- Provides protection against machine repeat.
- Allow simple, in-plant construction, with minimal maintenance.

### o Disadvantages

- Sometimes not practical for changing production runs involving different size stock or feeding methods
- Machine adjustment and repair often require guard removal.
- Other means of protecting maintenance personnel often required (LOTO)





### **Fixed Guards**

# Full enclosure or adjustable guarding must be provided around all rotating or moving parts.



Proper guarding on rotating component.



No guarding on chain drive.





### **Fixed Guards**

# Guarding must extend around the back side of rotating or moving parts.



**Proper Guarding** 



No guarding on the back side of the pulley.





## Guarding



### Interlocked Guards

- Designed to be opened to allow the worker access to the hazard zone.
- Once the guard is opened, the machine shuts down.
- Machine cannot be restarted until guard is closed.





## **Interlock Guarding**

#### Advantages

 Allows access for some minor servicing work without timeconsuming removal of fixed guards.



#### • Disadvantages

- May require periodic maintenance or adjustment.
- Movable sections cannot be used for manual feeding.
- Some designs may be easy to defeat.
- Interlock control circuitry may not be used for all maintenance and servicing work





## Guarding

### Adjustable Guards

- Allow machine to handle a wide variety of material sizes while keeping the unused portion of the point of operation covered.
- Rely on the operator to adjust the guard







## **Adjustable Guarding**

#### Advantages

- Can be constructed to suit many applications.
- Can be adjusted to admit varying stock size.

### Disadvantages

- May require frequent maintenance or adjustment.
- Operator may make guard ineffective.





## **Adjustable Guarding**



Properly adjusted band saw guard



Open side to band saw blade.





## Guarding

### Self-Adjusting Guards

- Guard moves away from the point of operation when the material is fed into the machine.
- Guard returns to original position completely covering the point of operation.
- Circular saw or table saw







# Self-Adjusting Guarding

### Advantages

 Off-the-shelf guards are often commercially available.

### • Disadvantages

- Does not provide maximum protection.
- May require frequent maintenance and adjustment.



