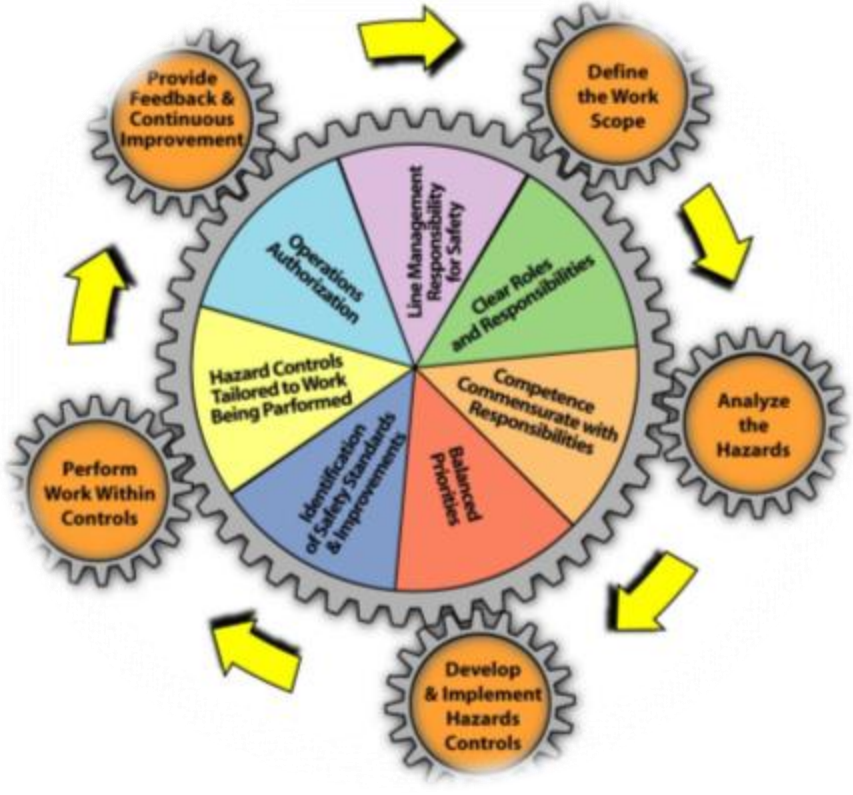


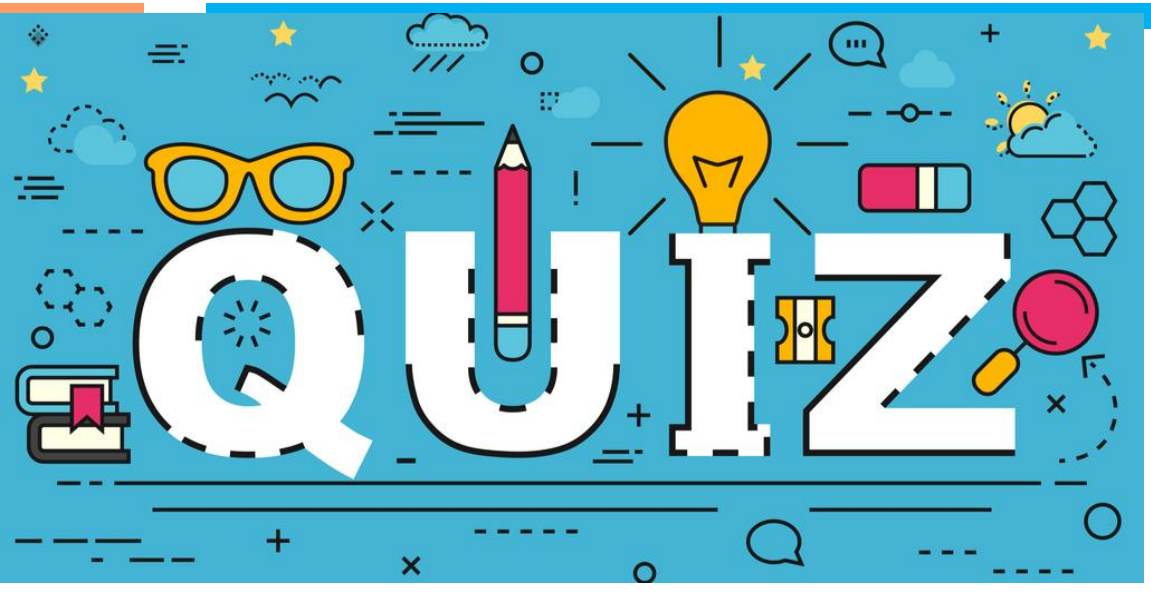
Machines Safety

Dr. Muhamad Usman Farooq

Occupational Health and Safety (CH161)

Ghulam Ishaq Khan Institute of Engineering Sciences & Technology

QUIZ-I Occupational Health and Safety (CH-161)



Date and Time:

October 16th 2024 (Wednesday) 6:30pm

Venue:

Brabers Buidling

Syllabus:

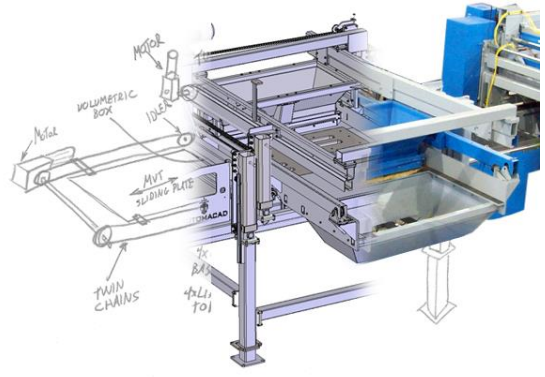
Lecture 1 – Lecture 5

Method of Evaluation:

Short Questions and/or MCQ's

Objectives

- To safeguard workers from machinery-related hazards and prevent accidents, incidents, and health issues in the workplace.
- Providing clear guidelines to ensure machinery at work is safe.
- Ensure all machinery is designed and manufactured to minimize or eliminate associated hazards.
- Provide employers with a reliable mechanism to access essential safety information from suppliers.
- Enable employers to implement protective measures effectively for the safety of workers.



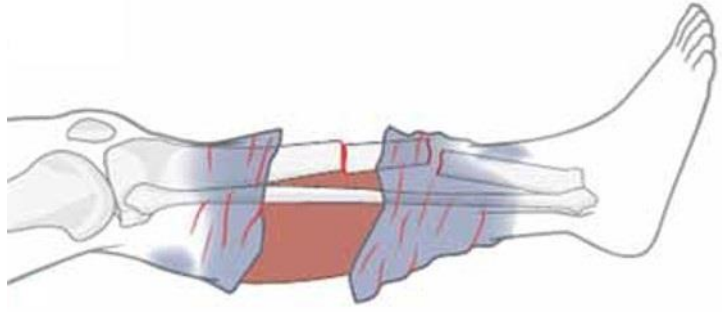
1. Introduction

SAFE MACHINE OPERATIONS:

- Identify workplace machinery and equipment hazards.
- Eliminate or reduce the risk of harm from these hazards.
- Manage risks associated with machinery and equipment in use.
- Prevent through safe use and safe design.

Examples of Machinery Hazards

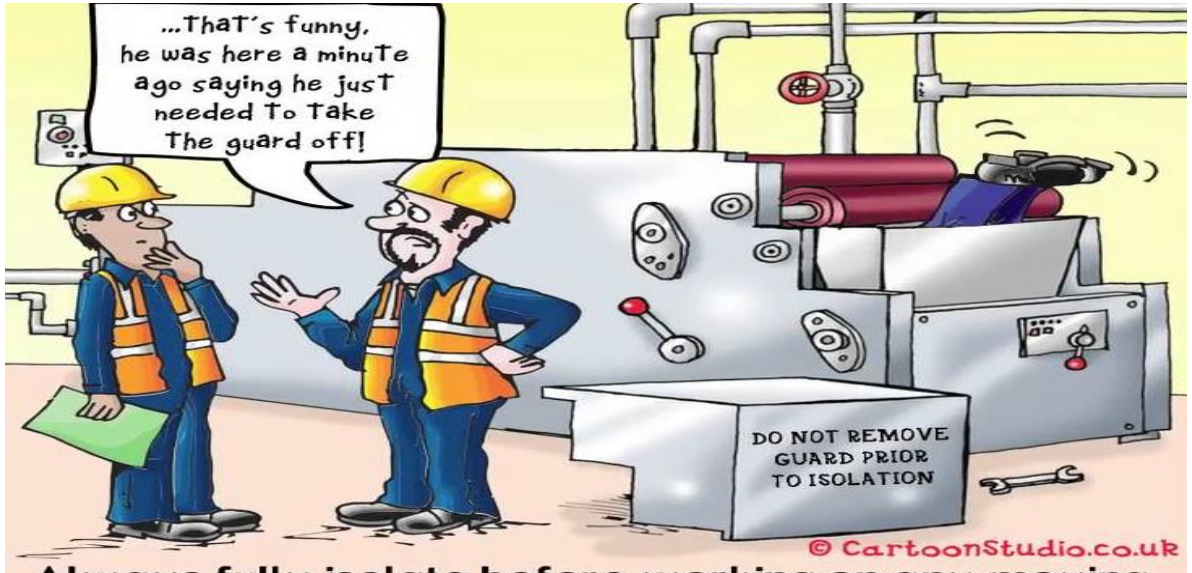
These incidents can cause



- ✓ *Damage to the body, e.g., cuts, crushing of limb, etc.*
- ✓ *Injuries by energies released from the machine, e.g., electrical shock, burn, etc.*
- ✓ *Fatalities*

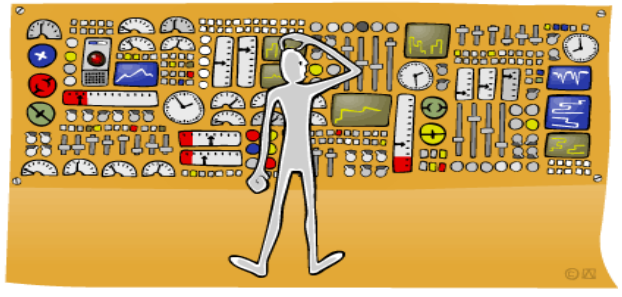
2. Incident History

Incidents occurred due to



Always fully isolate before working on any moving machinery. Never defeat or interfere with any safety device including guarding and electrical panels!

1- Lack of protection (e.g., equipment safeguards)



2. Lack of training

3. Not following procedures

4. Lack of maintenance

5. Horseplay

3. Machine Hazards

When identifying the hazards related with machines, we shall consider:

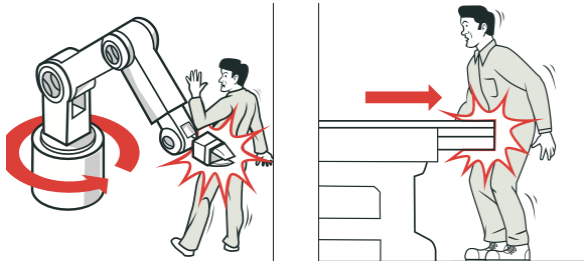
- ✓ Type of machines (lever, pulley, screw, axle)
- ✓ Layout of machines (static or moveable)
- ✓ Driven method (Electricity, air, etc.)
- ✓ Operating parameters (Speed, pressure, temperature, size of cut, mobility, etc.)
- ✓ Materials to be processed or handled and Feeding Method (hard or soft material)
- ✓ Operator position and controls
- ✓ Access for setting Adjustments and Maintenance.
- ✓ Environmental Factors (e.g., Dust, fumes, noise, temperature, humidity etc.)
- ✓ Operating requirements including what the operator needs to do.

3. Machine Hazards

Typical hazards related with operation of machines include:

Mechanical

- Machines possess moving parts, and the motion of these parts can exert significant force, potentially resulting in injuries to individuals.
- For instance, this force can lead to crushing, shearing, cutting, stabbing, or puncture injuries.



Non mechanical

e.g.,

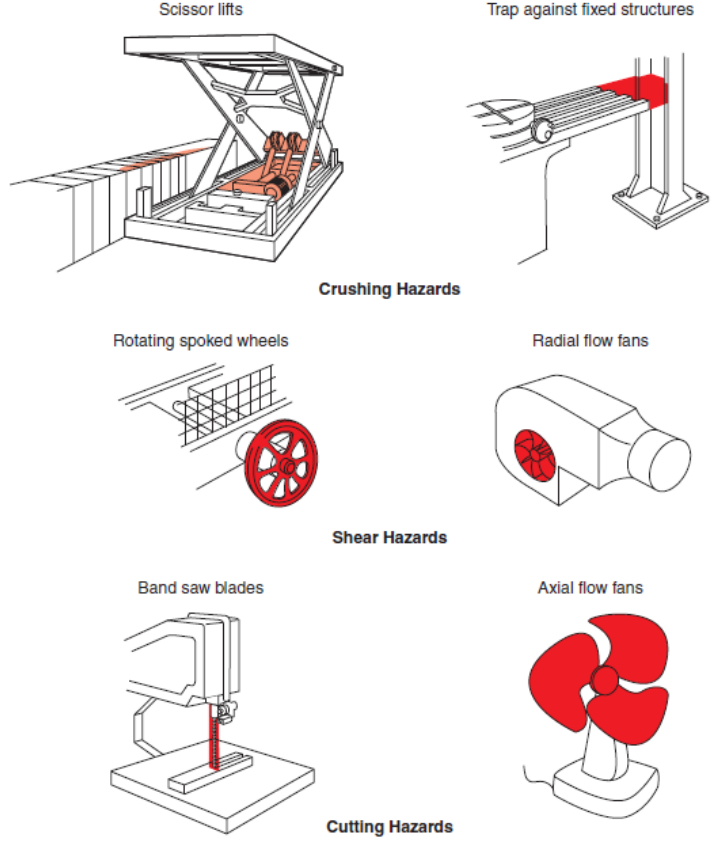
- High pressure fluid ejection
- Electrical shock
- Noise and vibration
- Contact with extremes of temperature
- Ergonomics

3. Machine Hazards

MECHANICAL HAZARDS

Common mechanical hazards and associated risks for machinery and equipment are shown below.

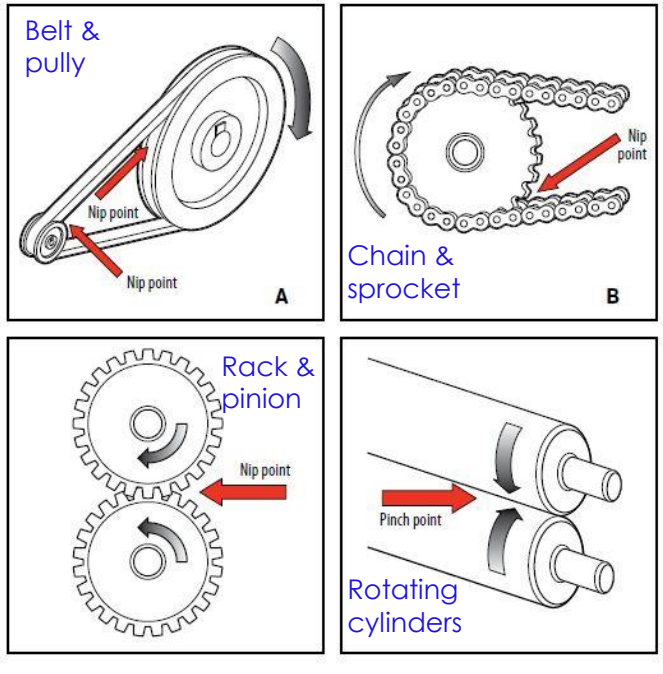
HAZARD	RISK
Rotating shafts, pulleys, sprockets and gear	**Entanglement** 
Hard surfaces moving together	**Crushing** 
Scissor or shear action	**Severing** 
Sharp Edge-moving or stationary	**Cutting or puncturing** 
Cable or hose connection	**Slips, trips and falls** **Oil leaks** 

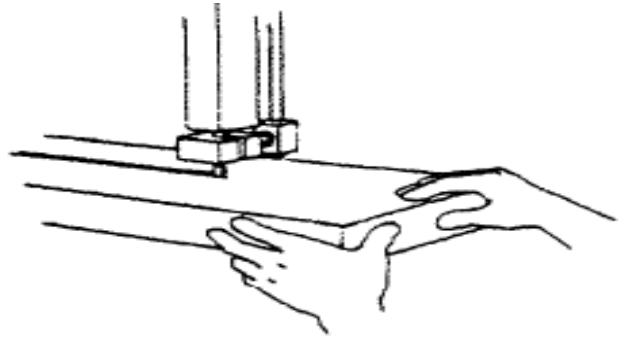


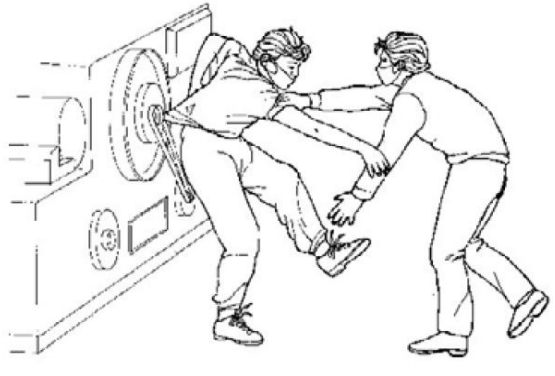
3. Machine Hazards

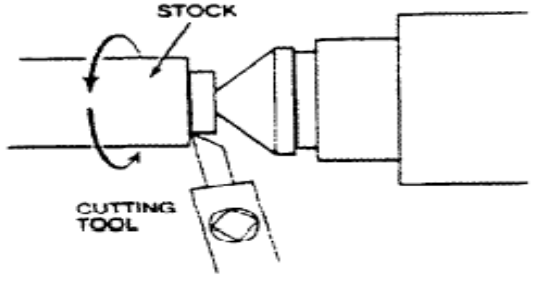
MECHANICAL HAZARDS

Unguarded Rotating Parts of Machine









3. Machine Hazards

NON-MECHANICAL HAZARDS

- *Associated with machinery and equipment can include* ***harmful emissions, chemicals and chemical by-products, electricity and noise.***
- ***Cause serious injury if not adequately controlled.***
- *In some cases, people exposed to these hazards may not show signs of injury or illness for years.*

When reviewing machinery and equipment for possible non-mechanical hazards, consider how machines and equipment can affect the area (environment) around them.

Non-Mechanical Hazard	
Dust	Mist (vapours/fumes)
Explosive or flammable atmosphere	Noise
Heat (radiated or conducted)	Ignition source
High intensity light	Chemicals
Heavy metals	Pressurized fluids/gases

4. Machine Safety

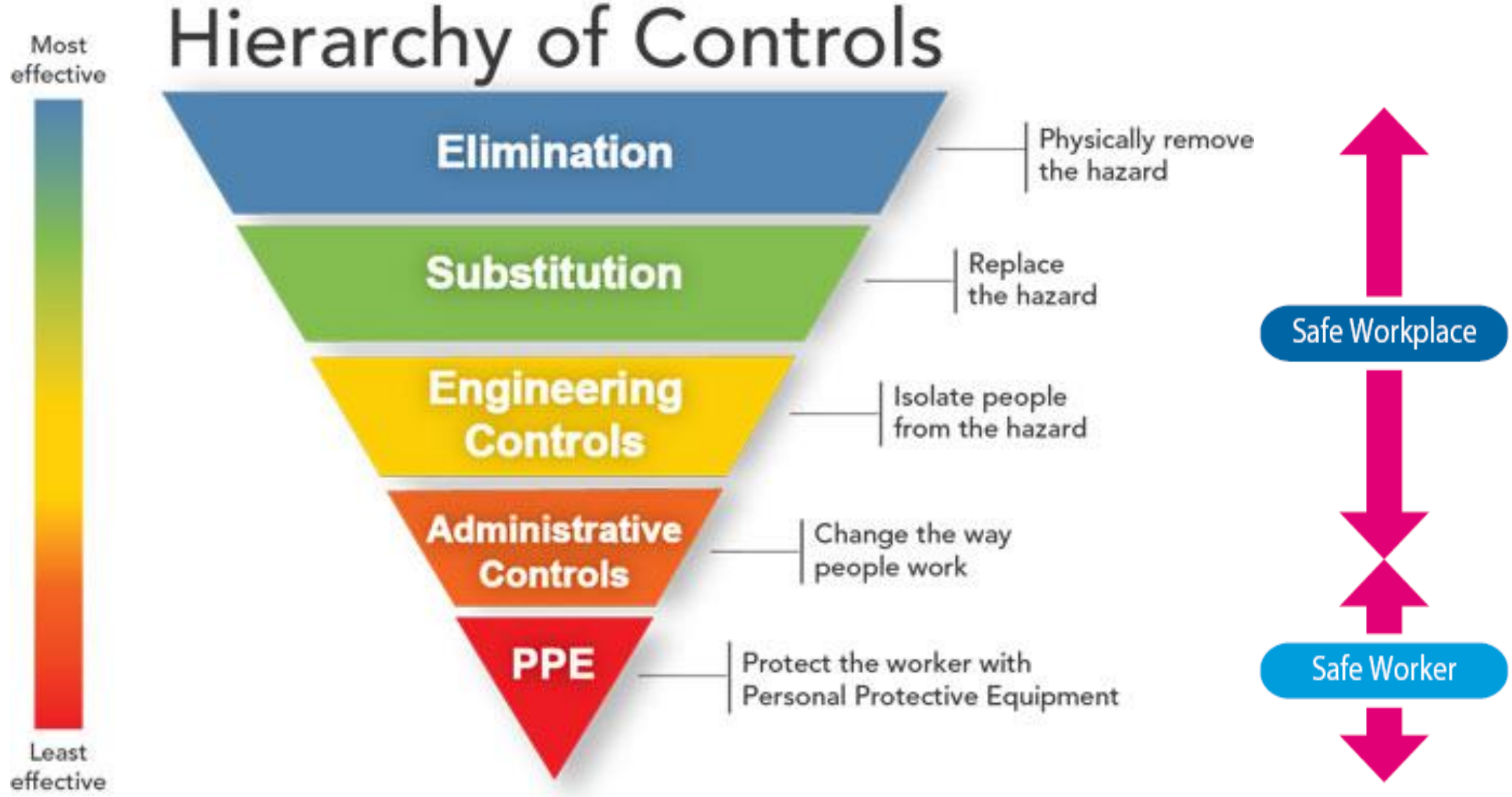
Identify the existing controls

- *Any safeguards in place?*
- *Any written procedures to control or mitigate the risk?*
- *What are the PPE used?*

Identify the need for additional control

- *What is the **risk level** with the consideration of existing controls?*
- *High risk must be reduced to at least medium risk before startup of work*
- *Whether the risk level can be further reduced to As Low As Reasonably Practical ?*

4. Machine Safety



PUWER
Key Requirements:

Be safe and suitable for its intended use

Be maintained in a safe condition

Be used only by those who have received adequate training

Have suitable health and safety measures

Be used in accordance with specific guidelines

Machine Safety: Control Measures

- The Provision and Use of Work Equipment Regulations, (PUWER) 1998 is a set of regulations for safe use of work equipment in the United Kingdom.
- PUWER requires that access to dangerous parts of machinery should be prevented in a **preferred order** or **Hierarchy of Control Methods.**
- Control methods include:
  - ❑ **Physical Barrier:** Fixed enclosing guards.
  - ❑ **Interlocked Guard**: Allows access only when safe; stops machine if opened.
  - ❑ **Detection Device**: Stops machine when an individual enters a risk area (e.g., photoelectric guards, pressure-sensitive mats).

4. Machine Safety

Control Measures

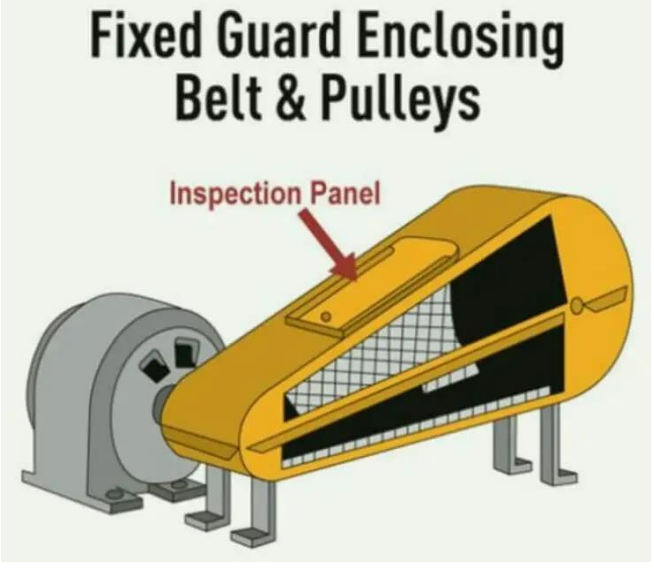
Types of hazards control measures

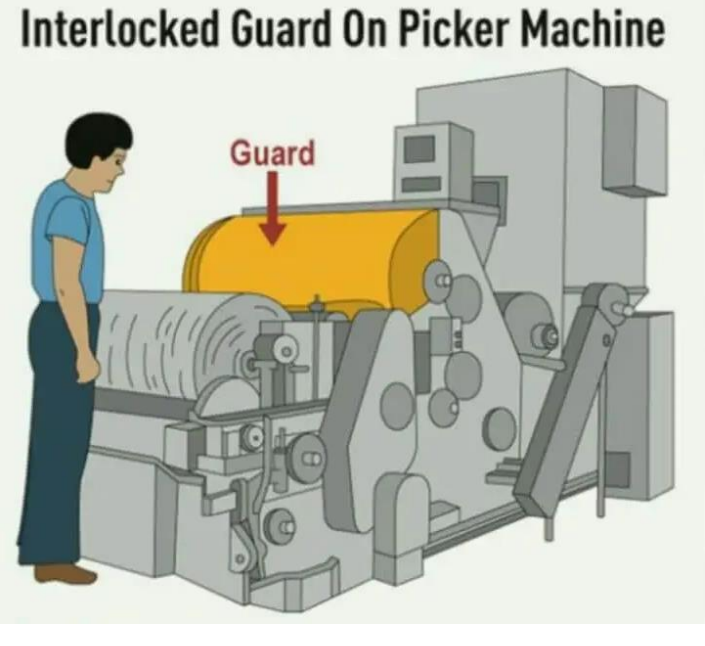
- Machine guarding
- Using devices, e.g., sensor, gates, etc.
- Distance
- Use of automatic or semi-automatic fed and ejection/robots
- Use of feeding tools
- Training, Procedures, etc.
- PPE

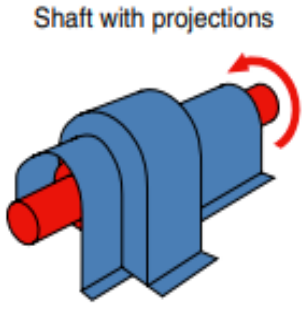
4. Machine Safety

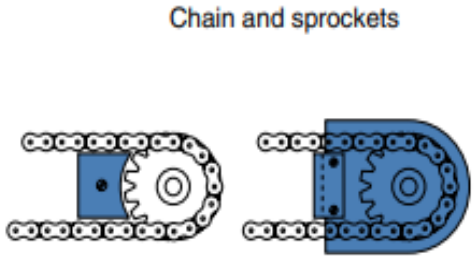
Types of Machine Guarding

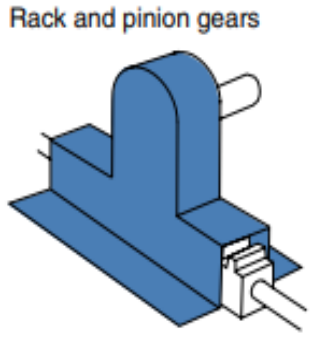
1. Fixed Guard
2. Adjustable Guard
   - ➢ User Adjusted Guard
   - ➢ Self Adjusting Guard
3. Interlocked Guard

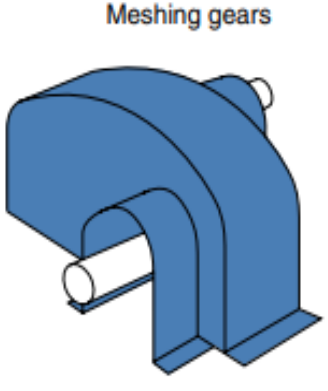


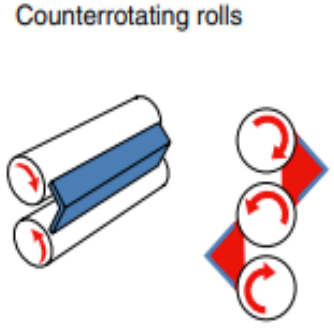


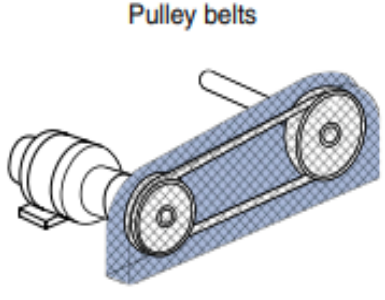


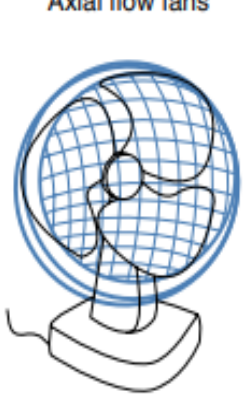


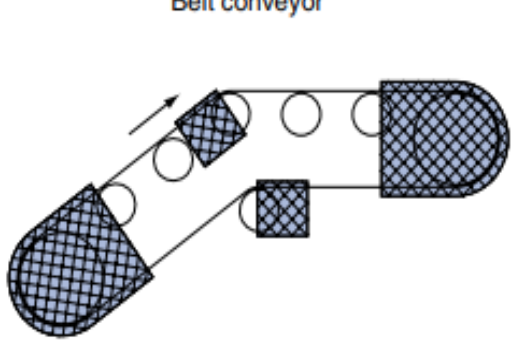












1. Fixed Guards

Fixed guards have no moving parts and are designed to block access to machinery's dangerous components.

Characteristics:

- Robust construction, capable of withstanding process stresses and environmental conditions.

Advantages:

- Simplicity and permanence.
- Difficult to remove.
- Minimal maintenance.

Disadvantages:

- May not always completely prevent access.
- Vulnerable to being left off by maintenance staff.
- Can pose operational challenges for the machine.

2. Adjustable Guard (User Adjusted Guard)

Adjustable guards, whether fixed or movable, can be adapted for specific operations while remaining in place.

Used when:

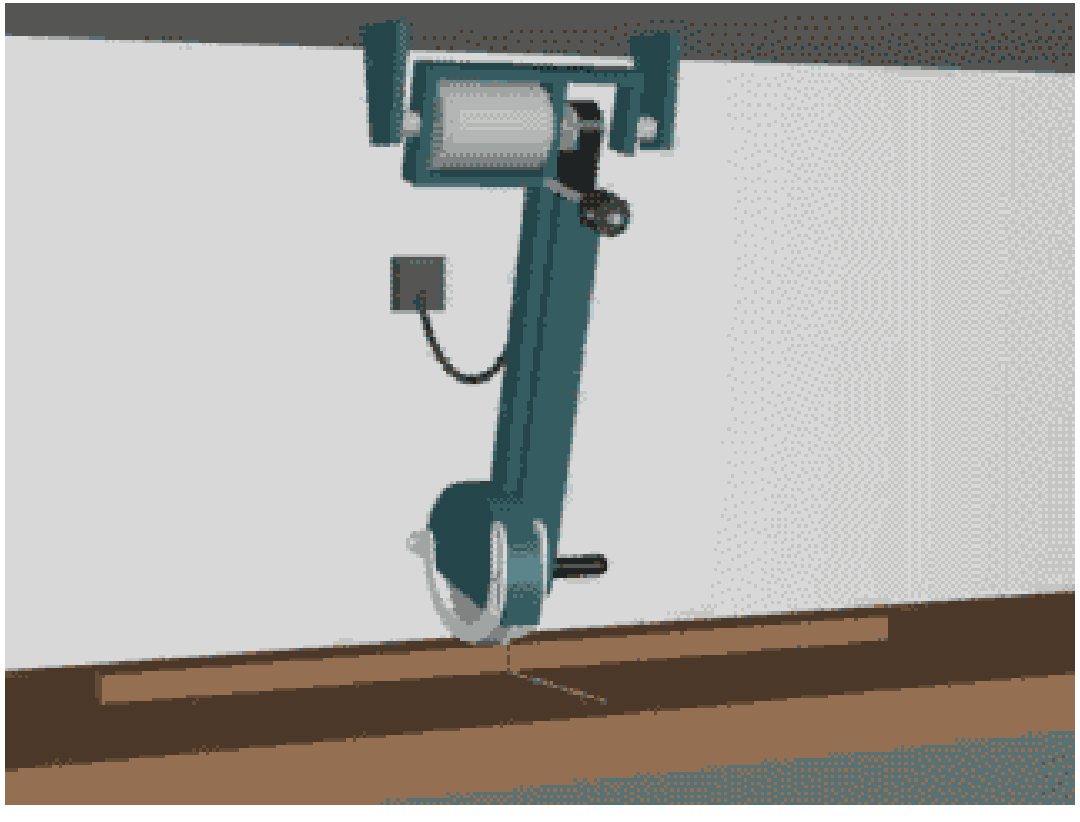
- Partial access to dangerous parts is necessary (e.g., Drills, circular saws, milling machines)
- Clearance varies (e.g., changing cutter size on a milling machine, cutting different-sized timber on a circular saw bench).

Necessity for Cutting Tools: Vital for cutting tools that are otherwise difficult to guard.

Disadvantage: Requires frequent re-adjustment to maintain safety during varying operations.

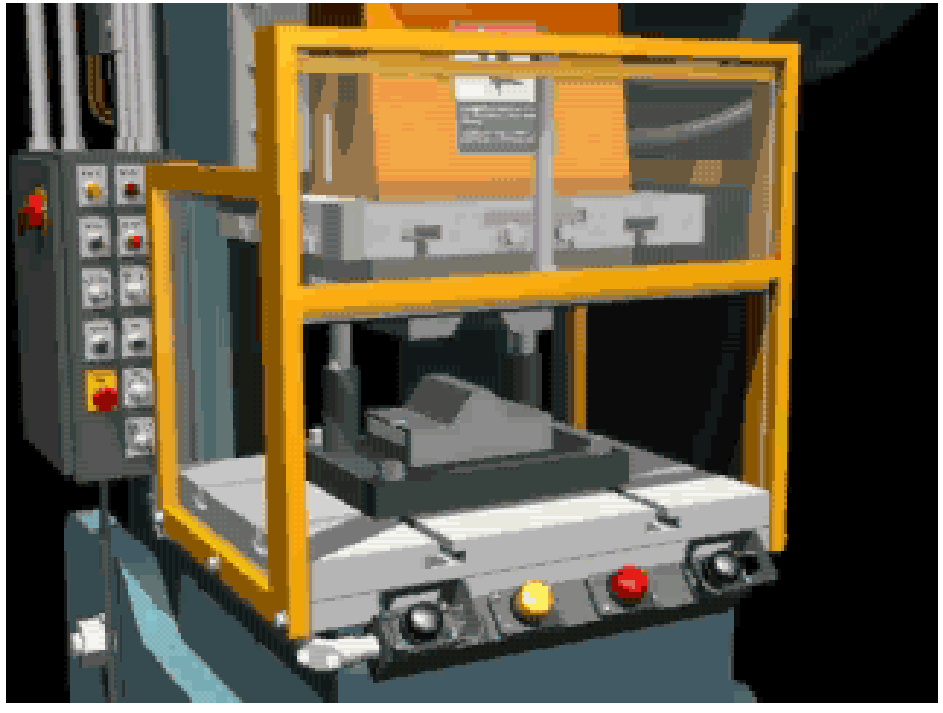
2. Adjustable Guard (Self Adjusting Guard)

- A Self-adjusting Guard is one which adjusts itself to accommodate, for example, the passage of material.
- Example: Spring-loaded guard fitted to many portable circular saws.



3. Interlocked Guard

An interlocking guard is a movable guard or one with a movable part connected to the machine's power or control system.



An interlocking guard must be connected to the machine controls such that:

- Until the guard is closed the interlock prevents the machinery from operating by interrupting the power medium
- Either the guard remains locked until the risk of injury from the hazard has passed or opening the guard causes the hazard to be eliminated before access is possible.

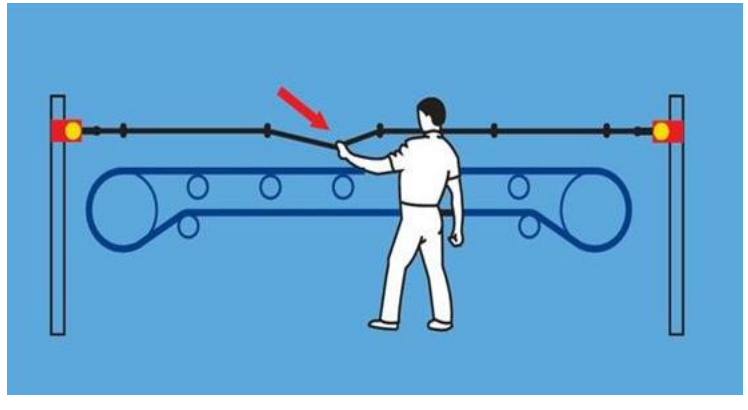
Maintenance and Inspection procedures must be very strict !

Devices

1-Pullback Device

2- Restraint Device

3- Safety Tripwire Cable

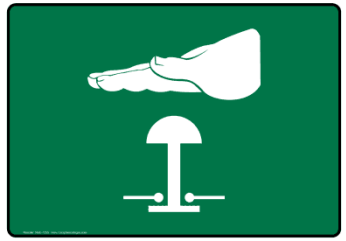


Devices

4- Two-handed Control Devices

These are devices which require the operator to have both hands in a safe place (the location of the controls) before the machine can be operated.

Two-hand Control on a Press



Emergency Switch:

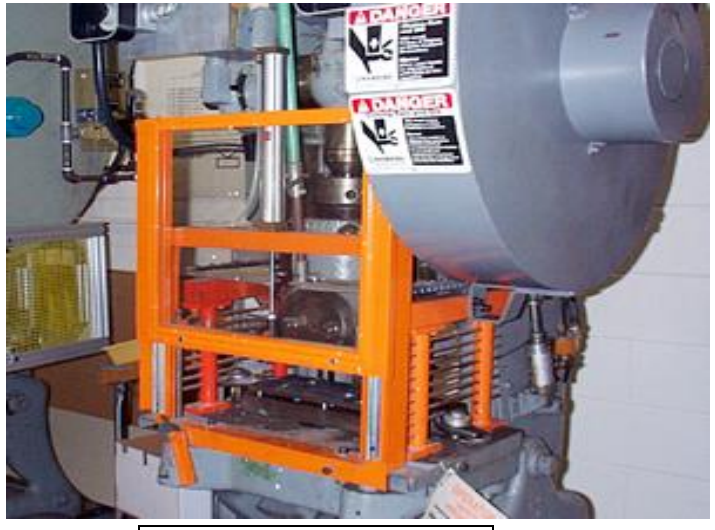
Emergency switch is provided when emergency stopping of machine is necessary,

The switch shall:

- ✓ Be easily accessible to the operator.
- ✓ Be designed for unexpected activation.

Devices

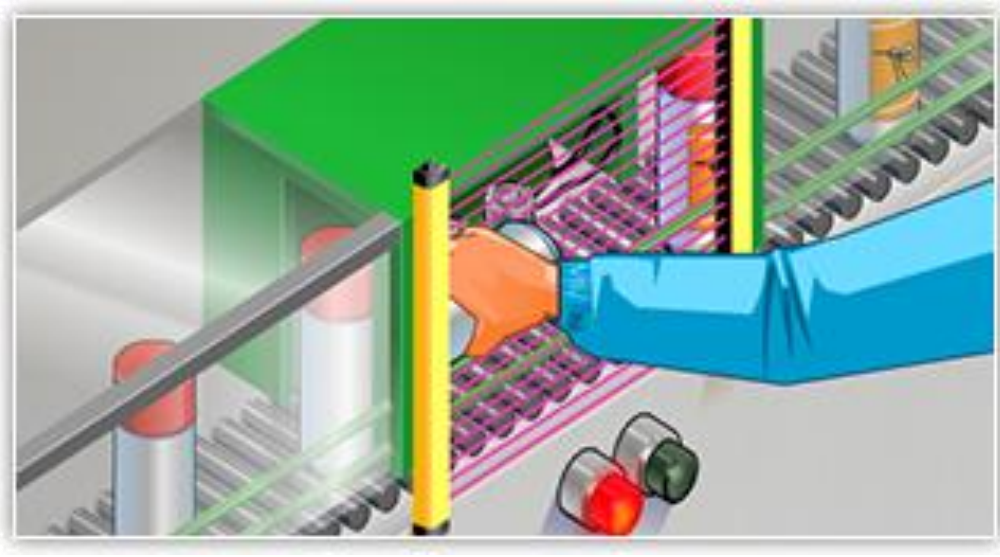
5- Gates



Gate Open

Gate Closed

6- Sensor



7- Safeguard by Distance

8- Automatic Feed and Robot

4. Machine Safety

Non-powered Hand Tools:

A hand tool is any tool that is powered by hand rather than a motor.

- These tools need to be correct for the task, well maintained and properly used by trained people.

Five Basic Safety Rules:

1. Keep all tools in good condition with regular maintenance.
2. Choose the right tool for the job.
3. Inspect tools for damage before use; do not use damaged tools.
4. Follow manufacturer's instructions for tool usage.
5. Wear and use the right Personal Protective Equipment (PPE).

Categories of hand tools include:

Hacksaws

Hammers

Screwdrivers

Chisels

Spanner

Spark Resistant Tools:

- Around flammable substances, sparks produced by iron and steel hand tools can be a dangerous ignition source.
- Where this hazard exists, use spark-resistant materials like brass, plastic, aluminum, or wood for safety.

Hand-held Power Tools:

- Different types, based on power source:
  - Electric
  - Pneumatic
  - Liquid fuel
  - Hydraulic

General Hazards related to power tools:

1. Tripping hazard: Cables, hoses, or power supplies.
2. Contact hazards: Cutting blades or drill bits.
3. Projectile hazard: Flying waste material from cutting areas.

4. Machine Safety

Lockout/Tagout (LOTO) - LOTO is used to control the unexpected release of energy from electricity, steam or gas.

- ✓ Lockout/Tagout gets its name from the equipment used.
- ✓ Lockout/Tagout must be used whenever you are performing service or maintenance on any machine where you or someone else could be injured by the unexpected startup or release of stored energy.
- ✓ LOTO DOES NOT APPLY to single source plug and cord equipment when the equipment is unplugged and under the exclusive control of the person performing the work.

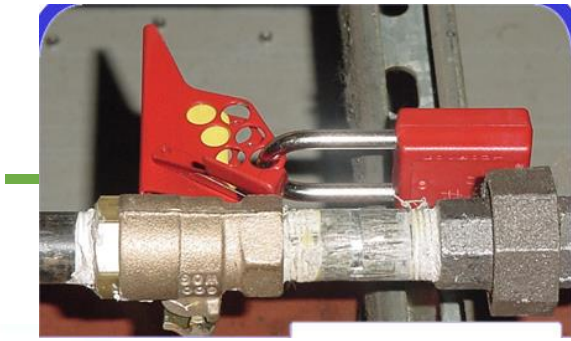
- **Risk to individuals working on powered equipment or machinery can be minimized by adhering to the six-step process of LOTO.**

4. Machine Safety

Types of LOTOs

LOTO Device

- ✓Caution Tag
- ✓Energy Isolating Device
- ✓Individual LOTO Lock
- ✓Supervisor Lock
- ✓Supervisor Tag



Ball valve locks

Hasp

Gate valve locks

4. Machine Safety

Types of Hazardous Energy

✓Mechanical

- Relating to springs, rotating parts, etc.

✓Magnetic

- Can be found in capacitors and superconducting magnetic energy storage

✓Gravity

- Can be found in machinery or equipment parts that might descend, slide or fall if left unblocked

✓Electrical

- Relating to or operated by electricity – AC or DC

✓Hydraulic

- Involving, moved or operated by a fluid under pressure, either internal or external

✓ Pneumatic

- May be in cylinders, lines and pipes

✓ Thermal

- Can be hot or cold

✓ Chemical

- Produced as a result of a chemical reaction

✓ Steam

- Water vapor kept under pressure so as to supply energy for heating or mechanical work

4. Machine Safety

What must workers do before maintenance activities?

1. Prepare for shutdown
2. Shut down the machine
3. Disconnect or isolate the machine from the energy source(s)
4. Apply the lockout or tagout device(s) to the energy-isolating device(s);
5. Release, restrain, or render safe all potentially hazardous stored or residual energy. Regularly inspect to avoid re-accumulation of energy if necessary.
6. Verify the isolation and de-energization of the machine.

4. Machine Safety

Lockout/Tagout (LOTO) Procedure

What are the limitations for tagout devices?

- ✓ A tagout device is a prominent warning of the hazards.
- ✓ Tags do not provide the physical restraint of a lock.
- ✓ Tags may evoke a false sense of security.
- ✓ Therefore, lockout devices are considered more secure and more effective than tagout devices in protecting employees from hazardous energy.

4. Machine Safety

Training

Before using any machine, you should:

- ✓ Be trained by qualified person/agent
- ✓ Clarify any doubt on machine usage
- ✓ Have the correct certificate, if required by law
- ✓ Inspect the machine for good condition (or inspected by qualified persons)
- ✓ Do not operate machine unless authorized

PPE

Before using any machine, you should ensure that:

- ✓ Proper PPE is used to conduct the work
- ✓ The PPE is in good condition
- ✓ Proper training has been given on how to use PPE

4. Machine Safety

Safe Practices

The following practices shall be observed at all times:

- Always use the safety devices correctively;
- Do not wear loose clothing/ties when operating machines with rotating parts;
- Tie up or cover up long hair;
- Use devices to remove trapped materials from the machine;
- Switch off the machine before retrieving dropped material(s) from inside the machine.

THANK YOU!