# Construction Hazard and Risk Control

## Lecture Title: Work Equipment and risk control

Lecturer: Josette Cutajar

Date: 10th December 2025

Undergraduate Diploma in
Occupational Health and Safety

# This lecture covers the following learning objectives:

This lecture covers the following learning objectives:

- Outline general requirements for work equipment.
- Outline the hazards and control measures for hand- held tools, both powered and non-powered.
- Describe the main mechanical and non- mechanical hazards of construction machinery

# Supply of work equipment

Most new work equipment should have ‘CE’ marking when purchased. The ‘CE’ mark requires manufacturers to:

- identify the health and safety hazards likely to be present when the machine is used,
- assess the associated risks,
- remove the significant hazards at the design stage or, if that is not possible,
- provide safeguards (such as guarding or noise enclosures) or, if that is not possible,
- use warning signs on the machine to warn of hazards.

# Supply of work equipment

Additional requirements of equipment manufacturers:

- retain related information in a technical file;
- fix a CE mark to the equipment – indicates compliance with all relevant supply laws;
- issue a ‘Declaration of Conformity’ for the equipment.of work equipment

# CE markings:

## EC-Declaration of Conformity

**MACHINERY DIRECTIVE**

CE

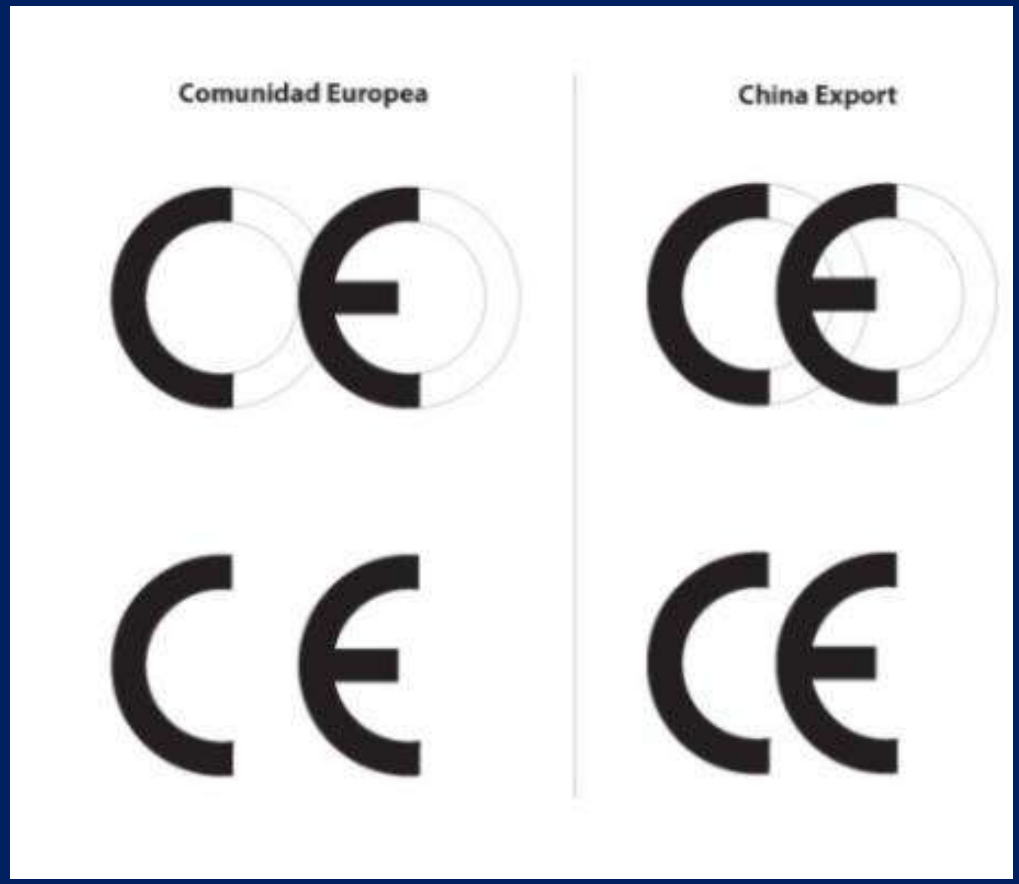
**DC720, DC721, DC722, DC725, DC727, DC730, DC731, DC732, DC735, DC737, DC742, DC743, DC745**

DEWALT declares that these products described under "technical data" are in compliance with: 98/37/EC (until Dec. 28, 2009), 2006/42/EC (from Dec. 29, 2009), EN 60745-1, EN 60745-2-1, EN 60745-2-2.

These products also comply with Directive 2004/108/EC. For more information, please contact DEWALT at the following address or refer to the back of the manual.

H. Grossmann

Horst Grossmann
Vice President Engineering and Product Development
DEWALT, Richard-Klinger-Strase 11,
D-65510, Idstein, Germany
30.07.2009



# Declaration of Conformity

The Declaration of Conformity states that the equipment complies with all relevant health and safety requirements. The declaration must:

- state the name and address of the manufacturer or importer into the EU;
- contain a description of the equipment, its make, type and serial number;
- indicate all relevant European Directives with which the machinery complies;
- state details of any notified body that has been involved;
- specify which standards have been used in the manufacture (if any);
- be signed by a person with authority to do so; and
- provide the purchaser with instructions on the safe installation, use and maintenance of the equipment

# Division of responsibility for the safety of machinery

# Use of work equipment

Definition of work equipment

Any equipment used by an employee at work, such as:

- hand tools – hammers, knives, spanners
- machines – photocopiers, drilling machines, vehicles
- apparatus – laboratory equipment
- lifting equipment – fork-lift trucks, hoists
- other equipment – ladders, vacuum cleaners
- installations – scaffolds, sound enclosures

# Use of work equipment:

Uses of work equipment include:

- starting and stopping
- repair and maintenance
- modification and servicing
- cleaning
- transporting

# Management duties:

Work equipment must:

- be suitable for its purpose of use and only used for specified operations, and
- suitable in terms of initial integrity and place of use;
- be selected with the health and safety of the user in mind;
- be maintained in an efficient working order and in good repair;
- be inspected at regular intervals;
- be restricted in use to designated persons when it has specific hazards;
- be used together with appropriate information, instruction and training; and
- conform to EU requirements

# Management duties:

Other duties include:

- the guarding of dangerous parts of work equipment;
- the provision of stop and emergency stop controls;
- ensuring that the equipment is stable;
- the lighting around the equipment is suitable and sufficient; and
- suitable warning markings or devices, such as flashing lights, are fitted.

# Hierarchy of risk control for work equipment

1. eliminate the risks
2. control risks by physical methods (such as guarding)
3. software measures (such as safe systems of work)

# Information, instruction and training

Should include:

- the significant health and safety issues with the equipment
- any limitations or problems with the use of the equipment;
- safe methods to deal with these problems;
- details of any residual risks associated with the equipment;
- details of safe working procedures; and
- the location of the manufacturer's manual or guidance.

# Information, instruction and training

Induction training will be required on recruitment, but refresher training will also be needed when:

- jobs are changed, particularly if the level of risk increases;
- new technology or equipment is introduced;
- the system of work is modified;
- there are legislative changes; or
- periodically as a refresher course

# Types of maintenance



Types of maintenance:

1. Preventative planned maintenance
2. Condition-based maintenance
3. Breakdown-based maintenance
4. Predictive Maintenance

https://www.youtube.com/watch?v=S3rf9aa6Ca0

# Hazards associated with maintenance:

- Lack of competence and/or training;
- Equipment not made safe before maintenance;
- Lack of permit to work; or
- Use of incorrect tools or unsafe equipment

# Equipment controls:

**The equipment should have:**

- operating controls easily reached and operated and with adequate markings and warning signs;
- no obstructions or debris around it;
- emergency controls (red emergency stop buttons); and
- stability during use.

**Other issues:**

- the level and quality of general and local lighting
- clear and durable markings on equipment

# Statutory requirements for examination of boilers and air receivers

- supplied with correct written information and markings;
- properly installed;
- used within its operating limits;
- written scheme for periodic examination certified by a competent person;
- examined by a competent person in accordance with the written scheme; and
- a report of the periodic examination held on file and any required actions undertaken

# Responsibilities of users:

1. Take care for the health and safety of themselves and others who may be affected by their acts or omissions;
2. Cooperate with their employer, as far as is necessary, to ensure compliance with any statutory health and safety duty;
3. Not to interfere with or deliberately misuse anything provided, in accordance with health and safety legislation, to further health and safety at work;
4. Use any equipment or substance in accordance with any training or instruction given by the employer;
5. Keep the area around the machine clear and free of obstructions;
6. Wear suitable clothing, eye protection and footwear;
7. Report to the employer any serious or imminent danger; and
8. Report any shortcomings in the employer's protective health and safety arrangements

# Hand tools

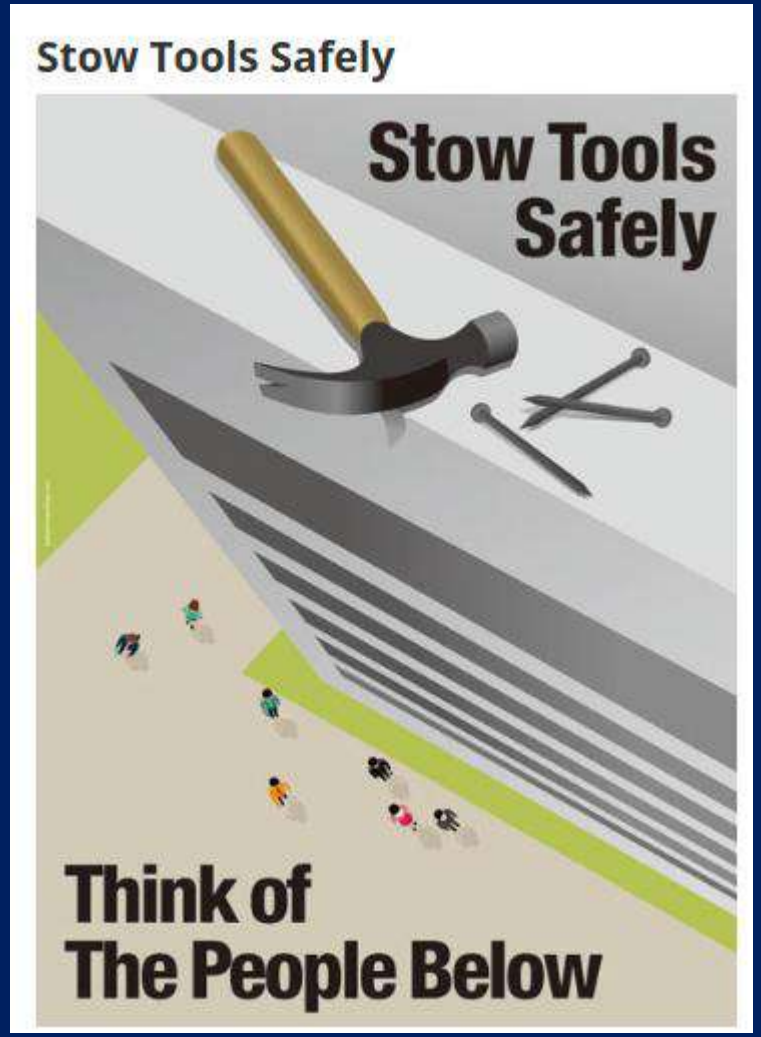
Typical hazards include:

- broken handles
- incorrect use of knives, saws and chisels
- tools that slip
- splayed spanners
- flying particles
- electrocution and/or burns

# Hand tools

Controls:

1. suitable for purpose (e.g. insulated tools for electricians)
2. inspection on a regular basis
3. training for all hand tool users



# Hand- held power tools

Examples of hand-held power tools:

- pneumatic drills/chisels
- electric drills
- disc-cutters/cut-off saws
- Sanders
- cartridges
- pneumatic nail guns
- chainsaws

# Hazards include:

- entanglement
- flying particles (eye injury)
- contact with cutting edges
- striking hidden/buried services (electrical cables, gas mains)
- manual handling injuries
- hand–arm vibration syndrome
- noise levels
- dust levels
- trailing leads
- fire and/or explosion

# Typical controls:

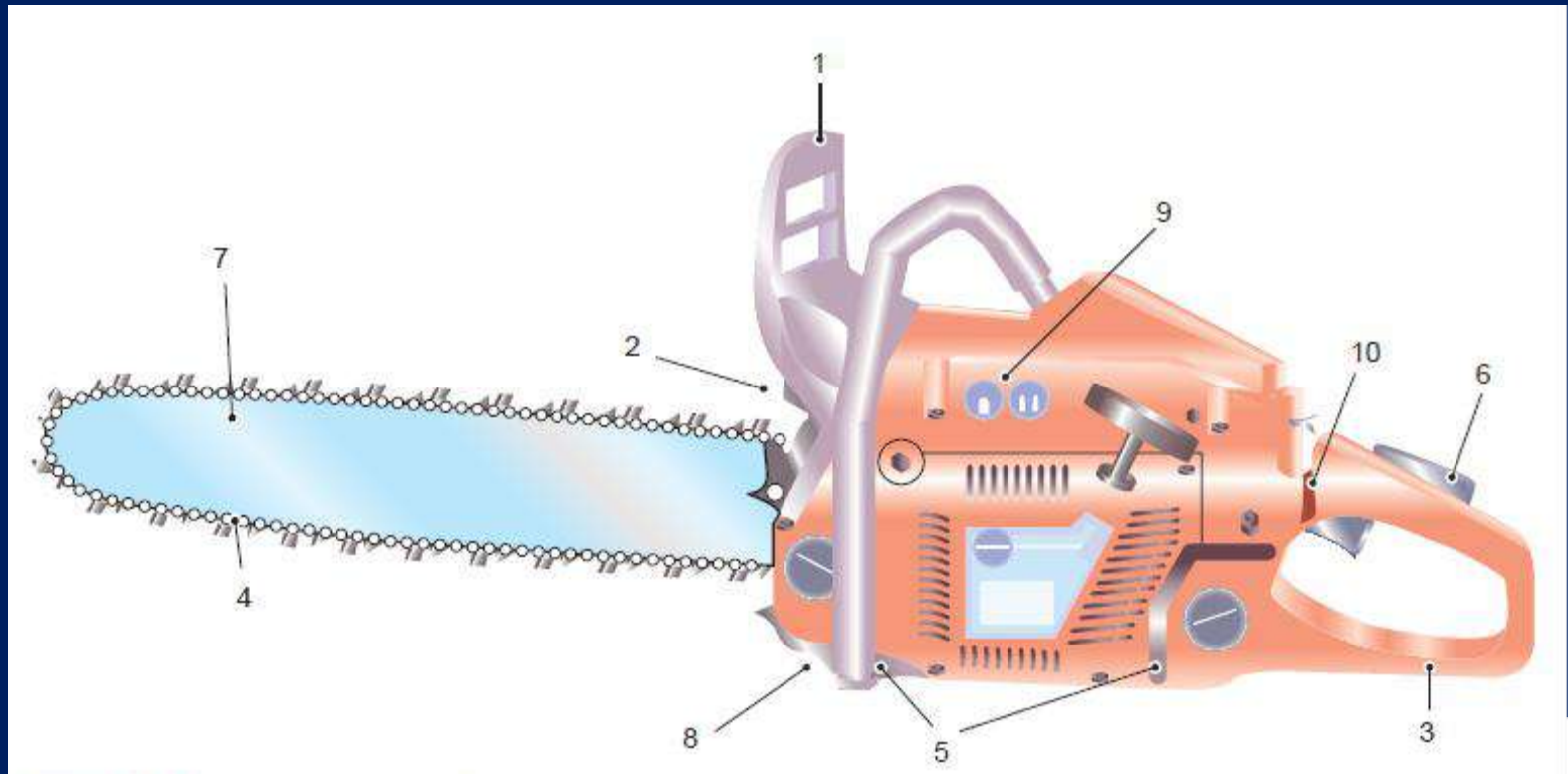
- read operating instructions before initial use;
- maintain a clean, tidy and well-lit working area;
- never use power tools near water, combustible fluids or gases;
- store tools in a dry, safe and secure place;
- never overload tools;
- always use the correct tool and/or attachment for heavy jobs;
- always wear suitable work clothes and appropriate personal protective equipment;

# Typical controls:

- ensure that the work piece is securely held in clamps or a vice;
- dust levels from concrete cutting operations can be controlled by wet cutting and/or by fitting a dust collector to the machine;
- maintain tools with care, keep them clean and sharp and inspect cables regularly;
- always check that the power switch is turned off before connecting the power cable; and
- use only tool accessories and attachments recommended by the tool manufacturer

# Use of chainsaws:

- there is no guard on the cutting chain
- they are heavy
- they are noisy



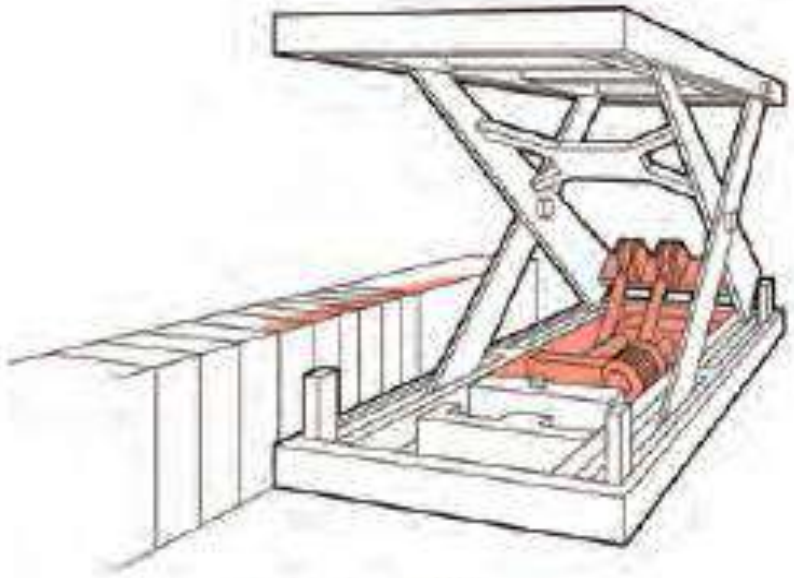

Typical chainsaw with rearguard. 1 – hand guard with integral chain brake; 2 – exhaust outlet directed to the right-hand side away from the operator; 3 – chain breakage guard at bottom of rear handle; 4 – chain designed to have low-kickback tendency; 5 – rubber anti-vibration mountings; 6 – lockout for the throttle trigger; 7 – guide bar (should be protected when transporting chainsaw); 8 – bottom chain catcher; 9 – PPE hand/eye/ear defender signs; 10 – on/off switch.

# Machinery hazards

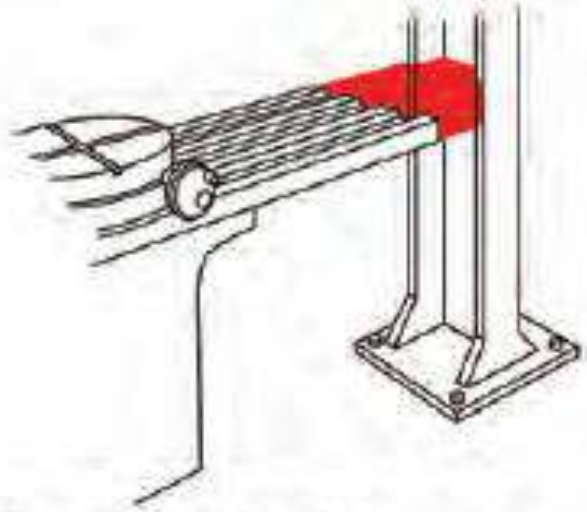
Mechanical machinery hazards:

- crushing
- shearing
- cutting or severing
- entanglement
- drawing-in or trapping (in-running nips)
- impact
- stabbing or puncture
- friction or abrasion
- high-pressure fluid ejection

## Crushing hazards

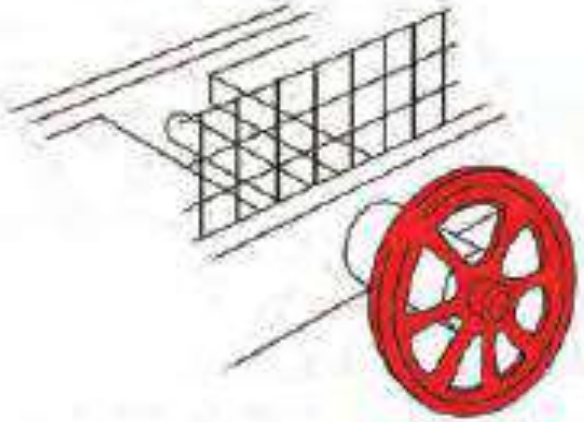


Scissor lifts

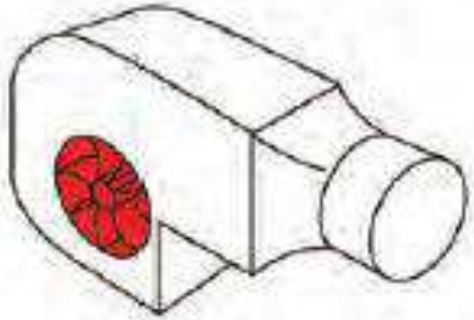


Trap against fixed structures

## Shear hazards

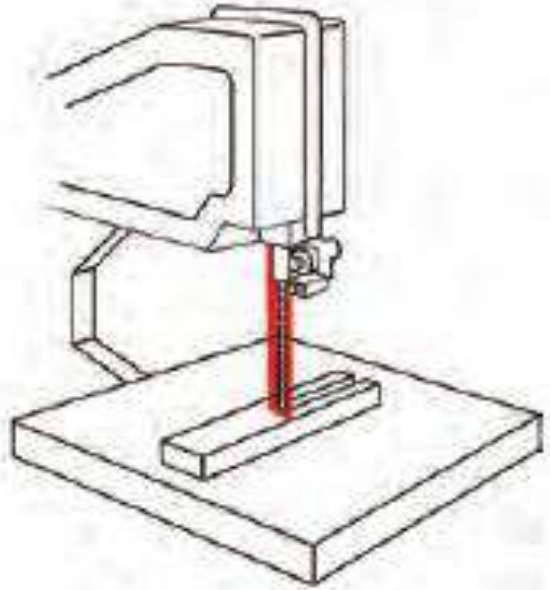


Rotating spoked wheels



Radial flow fans

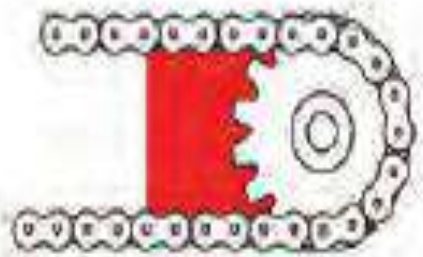
## Cutting hazards



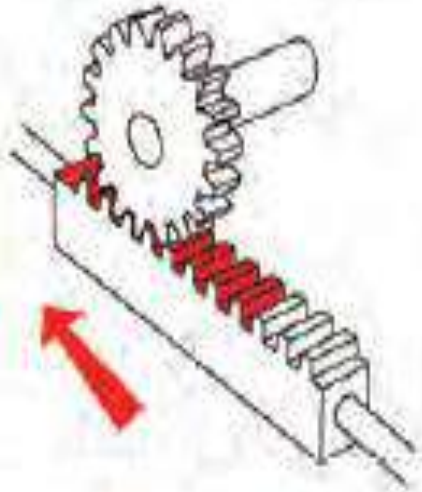
Band saw blades

Axial flow fans

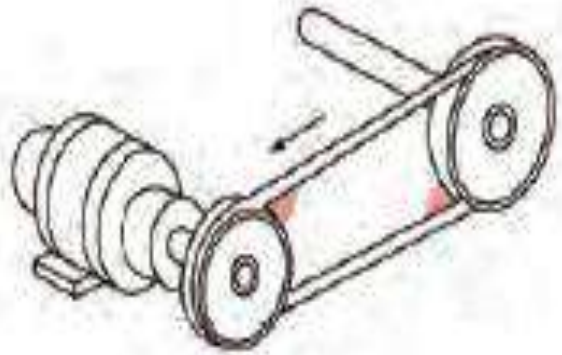
## Drawing-in hazards



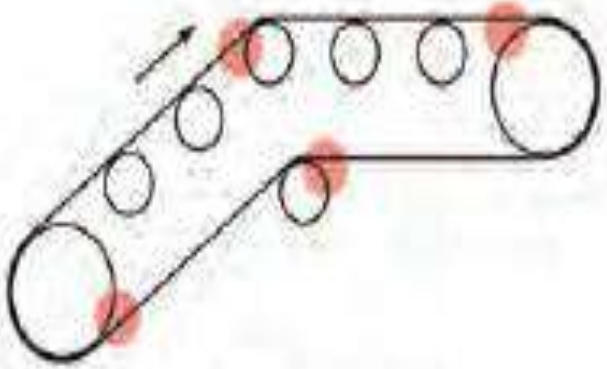
Chains and sprockets



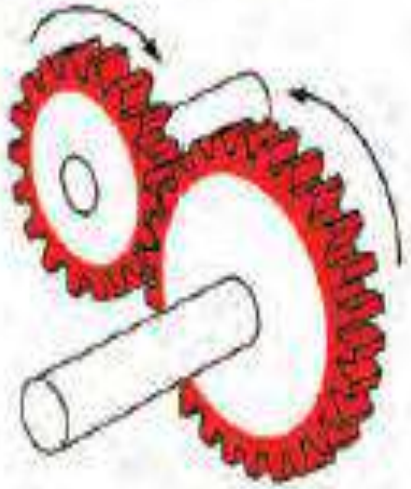
Rack and pinion gears



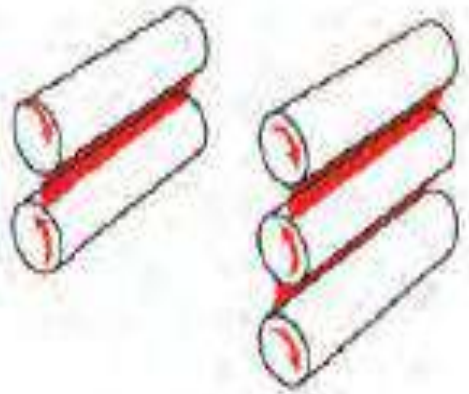
Pulley belts



Belt conveyor



Meshing gears

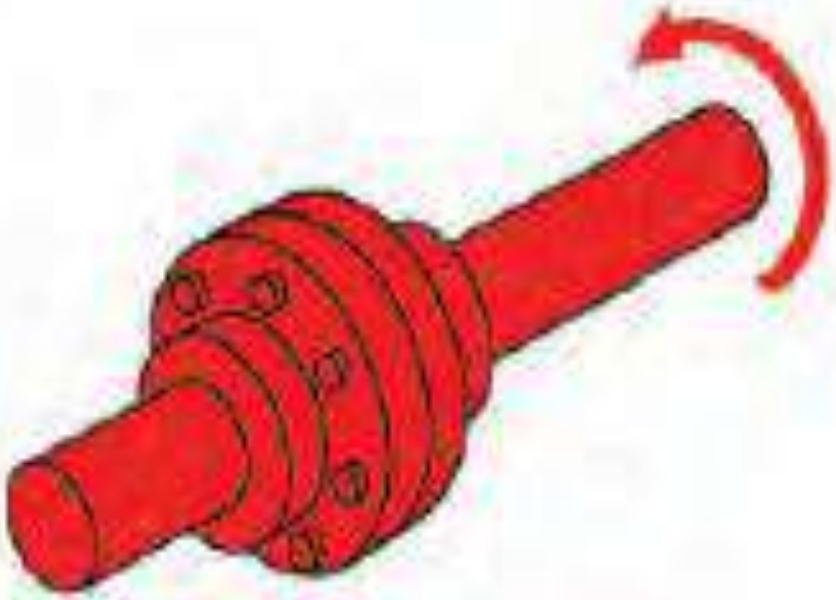


Counterrotating rolls

# Machinery hazards

Abrasion and ejection hazard

Entanglement hazard



# Examples of equipment with machinery hazards:

- Photocopier
- Document shredder
- Bench-top grinding machine
- Pedestal drill
- Bench-mounted circular saw
- Hand-fed power planer
- Spindle moulding machine
- Compressor
- Cement mixer
- Plate compactor
- Ground consolidation equipment
- Circular saw
- Road marking equipment
- Electrical generator

# Mechanical machinery hazards

**1) acceleration, deceleration –** potential for impact, being thrown, run-over, slipping, tripping or falling, for example from a piece of mobile plant or an overhead travelling crane

**2) angular parts –** potential consequences are impact, crushing or shearing when a person hits a stationary part of the machine or a moving part impacts on an operator particularly in mobile plant;

# Mechanical machinery hazards

**3) approach of a moving element to a fixed part** potential consequences are crushing or impact through being trapped between a moving part of a machine and a fixed structure, such as a wall or any material in a machine;

**4) cutting parts** – potential consequences are cutting or severing through contact with a cutting edge, such as a band saw or rotating cutting disc;

**5) elastic elements** – consequences are crushing or impact when an elastic part is deformed and suddenly straightens or returns to its original dimensions or explodes when an airbag used for lifting fails;

# Mechanical machinery hazards

**6) falling objects** – potential consequences are crushing or impact, for example if a load fell from an overhead hoist or rail system;

**7) gravity** – potential consequences are crushing or trapping, for example if a vehicle lift failed while a person was underneath;

**8) height from the ground –** potential consequences are crushing, impact, slipping, tripping or falling, for example getting out of a truck or large piece of mobile plant or gaining access to a tower crane;

# Mechanical machinery hazards

**9) high pressure –** potential consequences are injection, stabbing or puncture, impact, for example from a high-pressure hydraulic system leak;

**10) instability –** potential for being thrown, crushing or impact when a machine breaks its holding down bolts and falls over or a tower crane is not left free to slew to the wide direction and is blown over;

**11) kinetic energy –** potential for impact, puncture or severing, for example when a kinetic recovery rope is used to tow a vehicle or ship and it snaps the whiplash can be very hazardous;

# Mechanical machinery hazards

**12) machinery mobility –** potential consequences are being run over, impact, crushing when, for example, a large machine is being manoeuvred in a small space;

**13) moving elements** – potential consequences are crushing, friction, abrasion, impact, shearing, severing, drawing-in, for example on grinding wheels or sanding machines, or when a moving part directly strikes a person, such as with the accidental movement of a robot's working arm when maintenance is taking place. A further example is when persons are drawn-in between in-running gear wheels or rollers or between belts and pulley drives;

# Mechanical machinery hazards

**14) rotating elements** – potential consequences are severing or entanglement, for example an exposed rotating shaft which grips loose clothing, hair or working material, such as emery (sand) paper. The smaller the diameter of the revolving part the easier it is to get a wrap or entanglement. A further example is a shearing which occurs when part of the body, typically a hand or fingers, is trapped between rotating and fixed parts of the machine;

# Mechanical machinery hazards

**15) rough, slippery surface** - potential consequences are friction, abrasion, slipping, tripping and falling, impact when, for example, the operating area round a machine is very slippery from product spillages and the operator falls over and/or into the machinery hazard zone;

**16) sharp edges** - potential consequences are severing, impact, shearing, stabbing or puncture

# Mechanical machinery hazards

**17) stored energy** – potential consequences are crushing, impact, puncture, suffocation when the stored energy is released suddenly, for example when the valve on a welding gas bottle (other hazards such as explosion or fire may also be present) is broken off or a high pressure air hose breaks;

**18) vacuum** – potential consequences are crushing, drawing-in suffocation for example the sudden failure of a large vacuum vessel.

# Non-mechanical machinery hazards:



These include:

- access to the machinery
- slips, trips and falls
- falling and moving objects from the machinery
- obstructions and projections
- manual handling and lifting
- electricity (shock, burns or fire)
- fire and explosion
- noise and vibration
- high-pressure ejection from hydraulic hose leaks
- high/low temperature
- dust, fume or mist
- radiation – ionising and non-ionising
- lack of adequate lighting

# Non-mechanical machinery hazards



Non-mechanical hazards are also set out in ISO 12100:2010 and include:

**Electrical** hazards from:

- arc;
- electromagnetic phenomena;
- electrostatic phenomena;
- live parts;
- not enough distance to live parts under high voltage;
- overload;
- parts which have become live under fault conditions;
- short-circuit;
- thermal radiation.

# Non-mechanical machinery hazards

**Thermal** hazards from:

- explosion;
- flame;
- objects or materials with a high or low temperature;
- radiation from heat sources.

# Non-mechanical machinery hazards

**Noise** hazards from:

- cavitation phenomena (Cavitation is the formation and subsequent violent collapse of vapor bubbles within a liquid due to rapid changes in pressure).
- exhausting system;
- gas leaking at high speed;
- manufacturing process;
- moving parts;
- scraping surfaces;
- unbalanced rotating parts;
- whistling pneumatics
- worn parts.

# Non-mechanical machinery hazards

**Vibration** hazards from:

- cavitation phenomena;
- misalignment of moving parts;
- mobile equipment;
- scraping surfaces;
- unbalanced rotating parts;
- vibrating equipment;
- worn parts.

# Non-mechanical machinery hazards

**Radiation hazards from:**

- ionising radiation sources;
- low frequency electromagnetic radiation;
- optical radiation (infrared, visible and ultraviolet), including laser;
- radio frequency electromagnetic radiation.

# Non-mechanical machinery hazards

**Material/substance** hazards from:

- aerosol;
- biological and microbiological (viral and bacteria) agent;
- combustible;
- dust;
- explosive;
- fibre;
- flammable;
- fluid;
- fume;
- gas;
- mist;
- oxidiser.

# Non-mechanical machinery hazards

**Ergonomic** hazards from:

- access;
- design or location of indicators and visual display units;
- design, location or identification of control devices;
- effort;
- flicker, dazzling, shadow, stroboscopic effect;
- local lighting;
- mental overload/underload;
- posture;
- repetitive activity;
- visibility.

# Non-mechanical machinery hazards

**Hazards associated with the environment** in which the machine is used from:

- dust and fog;
- lightning;
- moisture;
- pollution;
- snow;
- temperature;
- water;
- wind;
- lack of oxygen.

# Control measures for reducing risks from mechanical hazards

Practical safeguarding

Defined by the legal definition of ‘practical’ – if it is technically possible to guard an item of equipment then it should be guarded irrespective of cost and convenience.

Levels of protection or hierarchy of measures (Regulation 11 of PUWER)

1. Fixed enclosing guarding
2. Other guards or protection devices (interlocked, trip, etc.)
3. Protection appliances (jigs, push sticks, etc.)
4. Provision of information, instruction, training and supervision.

# Types of Guarding

| Guard | Example |
|---|---|
| Fixed | around a fan |
| Adjustable | around a drill bit on a pedestal drill |
| Interlocking | on the gates of a passenger lift, microwave oven |
| Trip device | photoelectric cell in front of a guillotine |
| Two-handed control | crimping machine |
| Hold-to-run | Tube train driver |

# Factors in guard construction



- Strength
- Weight and size
- Compatibility with process
- Hygiene
- Visibility
- Noise attenuation
- Free flow of air (ventilation and/or cooling)
- Free of sharp edges
- Maintenance and cleaning
- Openings

# Example of machinery hazard

The hazards are:

- entanglement around the rotating spindle and chuck;
- contact (cutting, puncturing, severing) with the cutting drill or work-piece;
- being struck (impact) by the work-piece if it rotates;
- being cut or punctured by fragments ejected from
- the rotating spindle and cutting device;
- drawing-in to the rotating drive belt and pulley;
- contact or entanglement with the rotating motor;
- electrical from faulty wiring and/or earthing or during maintenance;
- possible health hazard from cutting fluids or dust given off during the process.

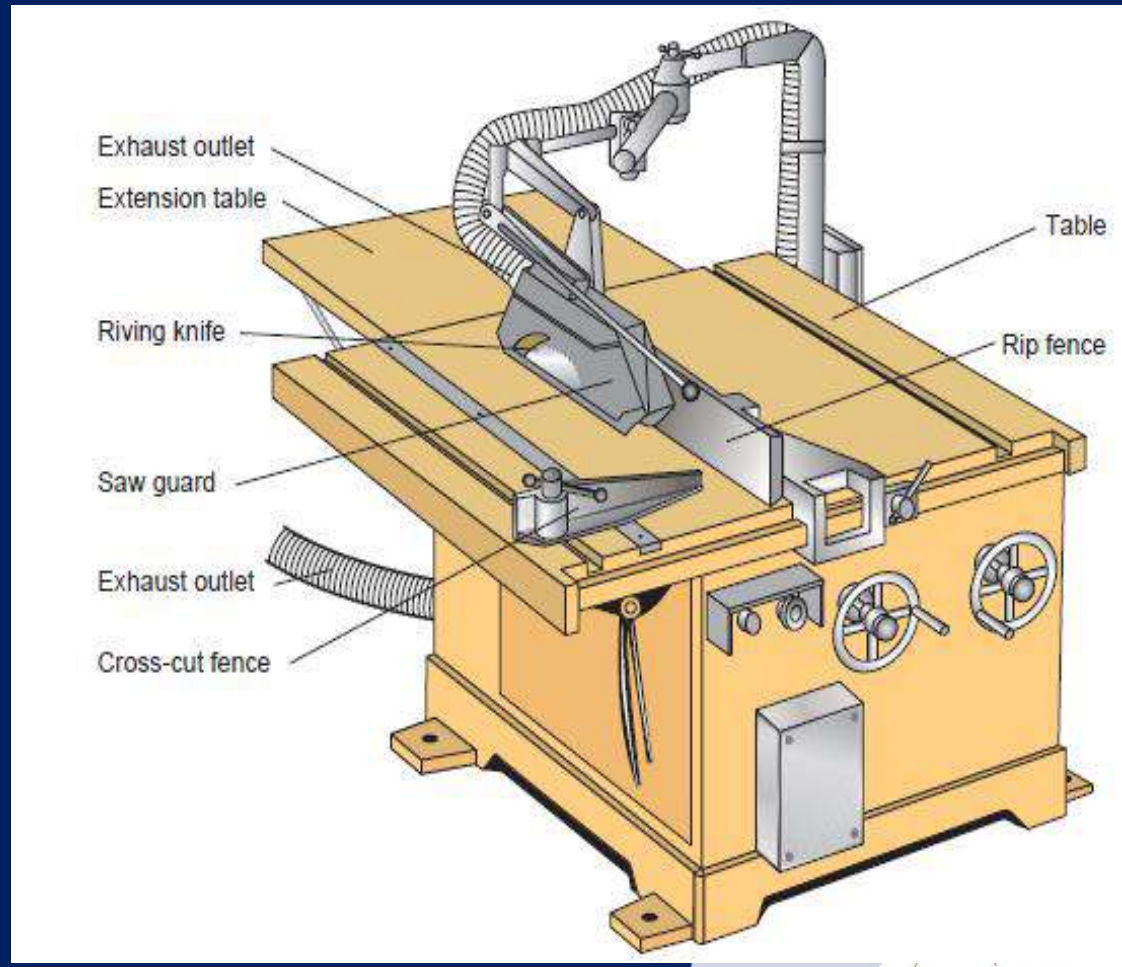
# Example of machinery hazard



**Workshop machinery – bench-mounted circular saw**

The hazards include:

- contact (cutting or severing) with the cutting blade above and below the bench;
- ejection of the work-piece or timber as it closes after passing the cutting blade;
- drawing in between chain and sprocket, V-belt drives or powered feed rollers;
- contact (impact, drawing-in and entanglement) with moving parts of the drive motor;
- likely noise hazards from the cutting action and motor;
- health hazards from wood dust given off during cutting;
- electric shock from faulty wiring and/or earthing or during maintenance.



# Example of machinery hazard



**Site machinery – ground consolidation equipment**

The hazards include:

- noise hazards from the action of the vibrating roller and a petrol- or diesel-driven engine;
- contact (impact, drawing-in, cutting) with moving parts of the engine;
- vibration from the action of the roller;
- operative or person standing by being run over or crushed by a self-propelled roller;
- manual handing injuries, as it is generally handled by a single person;
- dust from dry material being consolidated;
- possible health hazard from lubricants or fuels in the engine;
- possible health hazards from exhaust;
- contact with hot parts of the engine;
- fire if highly flammable liquids are used as fuel.

# Example of machinery hazard



**Site machinery – cement/concrete mixer**

The hazards include:

- contact (impact, drawing-in, entanglement) with moving parts of the drive motor;
- crushing between loading hopper (if fitted) and drum;
- drawing-in between chain and sprocket drives;
- electrical, if electrically powered;
- burns from hot parts of the engine;
- fire if highly flammable liquids used as fuel;
- possible noise hazards from the motor and dry mixing of aggregates;
- eye injury from splashing cement slurry;
- possible health hazard from cement dust and
- cement slurry while handling.

21 ACADEMY

# Undergraduate Diploma in Occupational Health and Safety