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► Safety in metal forming: Occupational safety and health (OSH) measures

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Contents

General safety measures	3
Emergency measures	6
OSH measures to be taken in the use of machine tools	7
OSH measures to be taken in the use of drilling machines and guillotine shears	9
OSH measures to be taken in the use of mechanical, hydraulic, hydraulic press brakes, and pneumatic presses	12
OSH measures when performing welding and cutting operations	15
Other matters to be taken into consideration	19

To ensure a safe working environment in the metal sector, the fundamental occupational safety and health measures to be taken in metal forming machines may be exemplified as follows:



► General safety measures

Examples of basic safety rules to be followed in the use of machine tools;

1 Use of machine guards

- Protective covers and guards on all machines must be kept closed.
- Cutting tools and moving parts must not be left exposed.
- No intervention must be made while the machine is in operation.

2 Machine start-up and shutdown procedures

- The machine must be operated only by authorized and trained personnel.



- ▶ Emergency stop buttons must be accessible at all times and kept in active condition.
- ▶ Maintenance and repair operations must not be carried out unless the machine's energy has been isolated.

3 Work area organization and safety

- ▶ The area around the machine must be kept clean and orderly.
- ▶ The work area must be regularly cleaned to prevent the accumulation of chips, dust, oil, and waste.
- ▶ Slippery surfaces must be prevented, and floors must be maintained regularly.
- ▶ The work area must be adequately illuminated.
- ▶ Machine operators and those in the vicinity must comply with safety rules.
- ▶ Persons not related to the work carried out in the work area must not be present.
- ▶ Unauthorized persons must be prevented from interfering with the machine.

4 Use of personal protective equipment (PPE)

- ▶ **Safety goggles or face shield:** It must be used to protect the employee from chips or material projections that may occur during the processing of metal materials.
- ▶ **Hearing protectors:** Hearing protection such as earmuffs or ear-plugs must be used in accordance with the ambient noise level. Employees must be protected from high-noise working environments.
- ▶ **Dust mask:** It must be used during metal processing and similar operations. Inhalation of dust generated during drilling and cutting operations must be prevented.
- ▶ **Work clothing:** Work clothing suitable for the task must be used. Loose and dangling clothing must be avoided. Accessories such as ties, rings, bracelets, and watches must be removed. Long hair must be securely tied back or a head covering must be used.
- ▶ **Use of gloves:** Gloves must not be worn while the machine is in operation in order to prevent the risk of hands being caught in rotating parts of the equipment. Gloves must not be worn while drilling machines, guillotine shears, and presses are operating (due to the risk of entanglement and crushing). However, gloves may be used during chip removal and material handling.





▶ Emergency measures

▶ Emergency stop mechanisms:

- Emergency stop buttons must be in working condition and easily accessible on all machines.

▶ Fire and electrical safety:

- Electrical cables and connections must be regularly inspected. Appropriate fire extinguishers must be readily available in the work area.
- Electrical cables must be kept elevated from the ground within protective enclosures to prevent contact by employees.

▶ First aid measures:

- A first aid kit must be readily available to address cuts and injuries. Employees must receive basic first aid training.
- Depending on the number of employees in the workplace, at least one trained first aider from the emergency response team must be present on each shift.

▶ Training and information:

- Employees must be regularly informed and trained on the safe use of machines, potential risks, and emergency procedures.
- Occupational safety and health training must be provided to newly recruited operators.

▶ OSH measures to be taken in the use of machine tools



▶ Machine-specific safety measures

1 Lathe safety measures

- ▶ Cutting tools must be set at appropriate angles.
- ▶ The workpiece must be securely clamped and must not be checked while rotating.
- ▶ Speed and feed settings must be adjusted according to the workpiece.

- ▶ Chips must be removed using a brush or a chip removal tool.
- ▶ All guards of the machine (such as chuck guards, shields, and screens) must be in place.

2 Milling machine safety measures

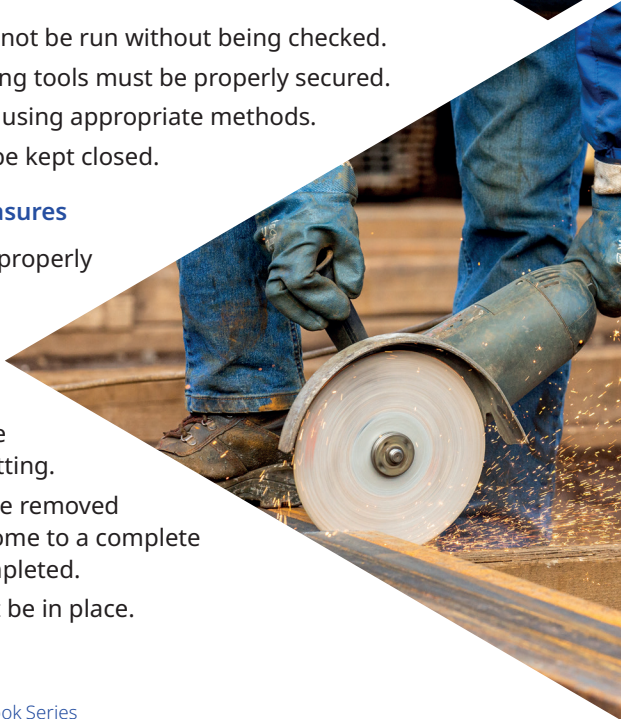
- ▶ Cutting tools must be securely mounted at the correct angle.
- ▶ The workpiece must be secured using a vise or clamping devices.
- ▶ The machine must be switched off when changing the milling cutter.
- ▶ Contact with operation points must be avoided while the machine is in operation.
- ▶ Operation point guards must be in place.

3 CNC machine safety measures

- ▶ The CNC program must not be run without being checked.
- ▶ The workpiece and cutting tools must be properly secured.
- ▶ Chips must be removed using appropriate methods.
- ▶ Protective covers must be kept closed.

4 Cold metal saw safety measures

- ▶ Cutting blades must be properly tensioned.
- ▶ The workpiece must be properly secured and must not be left loose.
- ▶ An appropriate feed rate must be used during cutting.
- ▶ The material must not be removed until the machine has come to a complete stop after cutting is completed.
- ▶ Equipment guards must be in place.



5 Safety measures for stationary grinding machines

- ▶ The grinding wheel must be securely mounted and free from cracks.
- ▶ The workpiece must be processed on the lower part of the wheel, not on the upper part.
- ▶ A face shield or safety goggles must be used during grinding.
- ▶ The machine must not be touched by hand while it is in operation.
- ▶ Equipment guards must be in place.

6 Band saw safety measures

- ▶ The saw blade must be properly tensioned and must not be loose.
- ▶ Safe cutting must be ensured by using blade guards.
- ▶ Appropriate speed settings must be used during cutting.
- ▶ Chips and residual pieces must be cleaned only after the machine has come to a complete stop.

▶ OSH measures to be taken in the use of drilling machines and guillotine shears

Powerful cutting work equipment such as drilling machines and guillotine shears are high-risk equipment that may lead to serious occupational accidents.



Examples of basic safety rules to be followed in the use of drilling machines and guillotine shears;

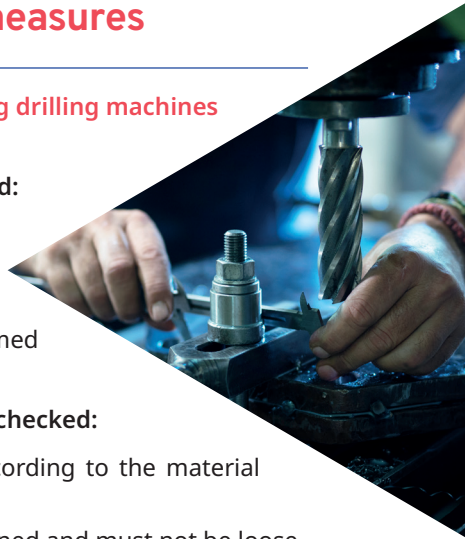
- Guards for cutting and rotating parts must always be in place.
- **Clamping vises and securing devices** must be used on drilling machines.
- **Protective barriers and photoelectric safety systems** must be active on guillotine shears.

In addition to general safety measures and emergency measures, machine-specific safety measures must be implemented.

► Machine-specific safety measures

1 Safety measures to be taken when using drilling machines (radial drill and column drill)

- **The workpiece must be securely fixed:**
 - The workpiece must be secured in a vise or with an appropriate clamping device.
 - The operation must not be performed while holding it by hand.
- **Drill bit and speed settings must be checked:**
 - The drill bit must be selected according to the material type.
 - The drill bit must be securely fastened and must not be loose.
 - Excessive speed settings must be avoided.
- **Points to be observed during drilling:**
 - Hands must not touch the drill bit while the drill is in operation.
 - The operation point guard of the drill must be in place.
 - Chips must be removed using a brush or an appropriate tool (not by hand or with a compressed air gun).
 - The workpiece must not be removed until the machine has come to a complete stop after the drilling operation is completed.



► **Machine maintenance:**

- Drill bits must be regularly inspected, and worn or dull bits must be replaced.
- Electrical connections must be regularly checked, and periodic inspections of the equipment must not be neglected.

2 Safety measures to be taken when using guillotine shears

► **Protective equipment must be active:**

- Safety guards and photoelectric systems (light barriers) at the cutting points of guillotine shears must be in working condition.
- Safe cutting must be ensured by using a two-hand control system operated simultaneously.

► **The material to be cut must be properly positioned:**

- The sheet or metal to be cut must be properly aligned and secured.
- For small parts, devices must be used to prevent hands from approaching the blade.

► **Position of the hands and body:**

- During cutting, hands and other body parts must be kept away from the blade line.
- The workpiece must not be removed until the blade has fully retracted after the cutting operation is completed.

► **Actions to be taken before operating the machine:**

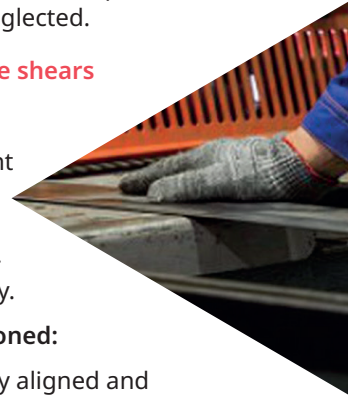
- The blade and clamping mechanism must be checked.
- Appropriate measures must be taken to prevent material kick-back during cutting.

► **Safe handling of cut parts:**

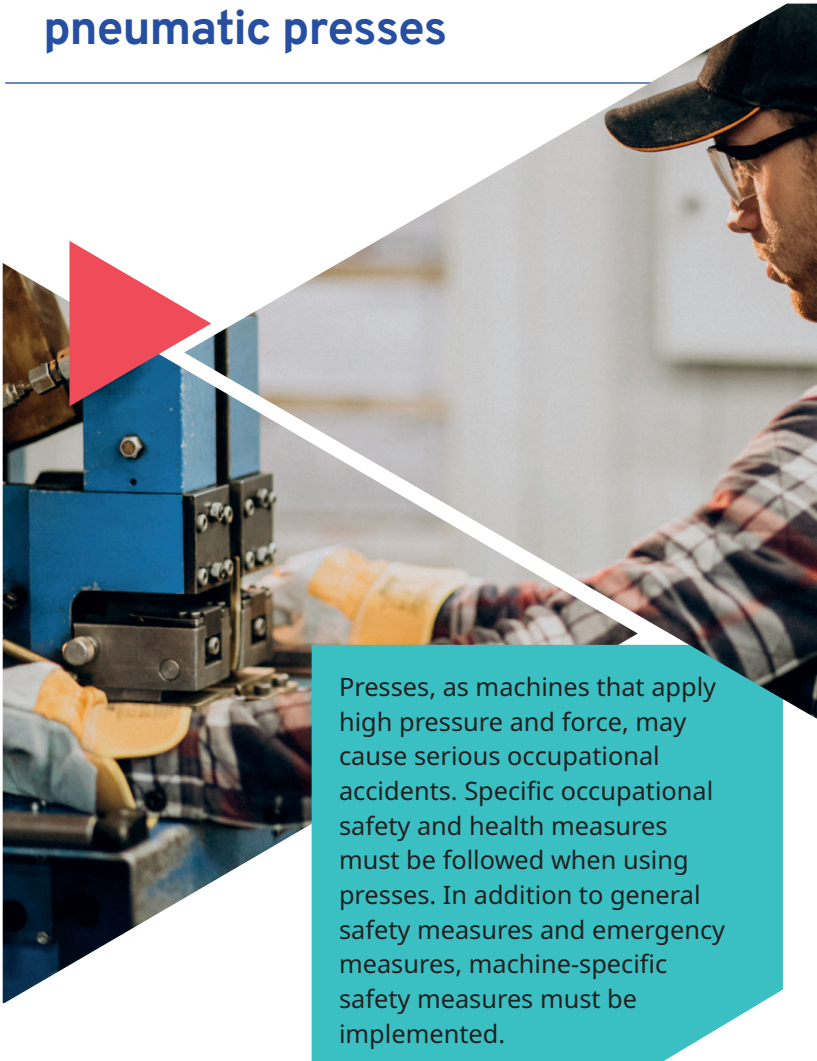
- After cutting, metal parts must be handled using appropriate gloves.
- Sharp edges must be carefully finished or ground.

► **Machine maintenance:**

- Blades must be sharpened regularly and replaced when worn.
- Hydraulic and pneumatic systems must be inspected.



► OSH measures to be taken in the use of mechanical, hydraulic, hydraulic press brakes, and pneumatic presses



Presses, as machines that apply high pressure and force, may cause serious occupational accidents. Specific occupational safety and health measures must be followed when using presses. In addition to general safety measures and emergency measures, machine-specific safety measures must be implemented.

► Machine-specific safety measures

1 Safety measures to be taken when using mechanical presses

- Care must be taken against sudden movements in mechanical presses.
- The workpiece and die must be securely fastened.
- The brake and flywheel system of the mechanical press must be regularly inspected.
- Hands must not be placed in the working area until the pressing operation is completed.
- Depending on whether the operation is based on an open or closed die principle, protective systems such as a simultaneous two-hand control button for open dies or a pedal guard for closed dies must be used.

2 Safety measures to be taken when using hydraulic presses

- The hydraulic system must be checked for oil leaks.
- Safety valves must be inspected to prevent overloading of the cylinders.
- The operator's hands or body must not enter the working area while the press is in operation.



- ▶ Excessive pressure must not be applied, and loading must be carried out in accordance with the manufacturer's instructions.
- ▶ Protective systems such as photoelectric safety systems (light barriers) must be active.

3 Safety measures to be taken when using hydraulic press brakes

- ▶ Hands must not be placed under or between the press.
- ▶ Materials must be positioned at the appropriate angle and secured firmly.
- ▶ Pressure settings of the hydraulic system must be regularly checked.
- ▶ Sudden stops and movements must be prevented while the press is in operation.
- ▶ Protective systems such as photoelectric safety systems (light barriers) must be active.



4 Safety measures to be taken when using pneumatic presses

- ▶ Air pressure levels must be regularly checked.
- ▶ Pneumatic systems must be inspected for air leaks.
- ▶ Hands or body must not approach hazardous areas while the machine is in operation.
- ▶ Safe pressing must be ensured by using a two-hand control system.

▶ OSH measures when performing welding and cutting operations

Welding and cutting operations are hazardous activities that may cause serious occupational accidents due to high temperatures, molten metal splashes, gases, and intense light radiation. The occupational safety and health measures to be taken against factors such as fire, electric shock, gas inhalation, eye injuries, and explosion risks during these operations are as follows:

▶ Measures to be taken before welding and cutting operations

1 Work area safety

- ▶ No flammable or explosive materials must be present in the work area.
- ▶ Appropriate curtains or shields must be used to prevent the projection of welding sparks.
- ▶ Local exhaust ventilation systems must be installed to capture welding fumes before they reach the worker's breathing zone.



- ▶ If welding is to be carried out in enclosed spaces, adequate general ventilation must be provided.
- ▶ Fire extinguishers must be readily available in the workplace.

2 Electrical welding machine safety

- ▶ Electrical connections and the grounding system must be safely installed and maintained in full working condition.
- ▶ Electrical cables and connections must not be worn or damaged.
- ▶ Welding machines must not be used by persons who do not hold a professional qualification certificate.

3 Electrical welding machine safety

- ▶ Gas cylinders must be secured in an upright position and fastened with chains.
- ▶ Oxygen and flammable gases (acetylene, propane) must be stored separately.
- ▶ Gas cylinders must be checked for leaks using soapy water.
- ▶ Gas hoses must be intact and free from holes.

▶ Measures to be taken during welding and cutting operations

- ▶ High-temperature metal must not be touched with bare hands.
- ▶ Appropriate direction must be ensured to prevent sparks from reaching employees.
- ▶ The material being welded must be properly secured.
- ▶ Welding cables and hoses must be arranged in a manner that prevents tripping and entanglement.
- ▶ Sudden opening or closing must be avoided when welding or cutting with flammable gases.
- ▶ After the welding operation is completed, employees must be warned that the metal remains hot.

► Measures to be taken after welding and cutting operations

- After the work is completed, the welding machine must be switched off and unplugged.
- If gas welding has been used, the cylinders must be closed and the gas pressure must be released.
- Hot metals must not be left near flammable materials.
- Waste metal parts must be properly collected and disposed of.

► Fire and explosion prevention measures

- Fire extinguishers must be readily available in the work area.
- Flammable and explosive materials must be removed from the welding area.
- Ventilation must be provided in enclosed spaces to prevent the accumulation of gases.
- Flashback arrestors must be used during flame cutting operations.

► Emergency and first aid measures

- A first aid kit must be readily available for burn injuries.
- In the event of eye injuries, the eyes must be rinsed with plenty of water and medical attention must be sought.
- If respiratory problems occur, fresh air must be obtained immediately and medical assistance must be called.
- Employees must be trained on emergency procedures in welding and cutting operations.

▶ Use of personal protective equipment (PPE)

The following protective equipment must be used in welding and cutting operations:

- ▶ Welding mask or goggles
 - An auto-darkening welding helmet must be used during welding to protect against UV radiation and sparks.
 - Appropriate filtered welding goggles must be worn for oxy-fuel welding and plasma cutting operations.
 - Ordinary sunglasses or clear safety glasses must not be used under any circumstances.
- ▶ Welding gloves
 - Special welding gloves resistant to high temperatures must be used.
- ▶ Flame-retardant work clothing
 - Leather-based flame-retardant clothing must be preferred.
 - Synthetic and nylon clothing must not be used, as they may melt and cause severe burns.
- ▶ Protective footwear
 - Steel-toe and heat-resistant safety footwear must be worn.
- ▶ Respiratory protection mask
 - An appropriate gas mask must be used to prevent the inhalation of gases, especially when welding in enclosed spaces or on rusted metal surfaces.

► Other matters to be taken into

- Operating instructions for work equipment used in the workplace must be clear and understandable and must be kept in a visible location within the operator's working environment.
- During maintenance, repair, and similar operations, a Lockout-Tagout-Try-out (LOTO) set shall be available for the maintenance team to safely isolate energy; a procedure shall be established, and the personnel who will be involved in the use of the LOTO set shall receive the necessary training.
- Hazardous voltage cables and control cables of the work equipment must not be attached to the machine body without protective enclosures.
- To prevent the whip effect that may occur in the event of rupture of hydraulic hoses of the work equipment, retaining systems must be installed at the hose connection points.
- Unauthorized access to electrical panels must be prevented.
- Flammable materials such as paper, sponge pieces, cloth, etc., which may ignite due to heat and cause electrical panel fires, must not be kept inside electrical panels.
- During maintenance and fault intervention in guillotine shears and mechanical presses, a safety block with appropriate capacity and the required safety factor must be used to prevent the blade or ram from falling under the effect of gravity and injuring maintenance personnel.
- In presses, access to hazardous areas through the large openings in the guards of belt-pulley assemblies and the flywheel section must be prevented.
- For personnel working in the front area of presses, risks of entanglement, crushing, and trapping due to exposure to the hazardous movements of the crankshaft-connecting rod assembly must be prevented.
- Unauthorized access to the pneumatic control equipment located on the side of presses must be prevented.

- ▶ In cases such as die changes on machines, manual tightening or loosening of die connections and frame connections using physical force must not be carried out; since conditions such as part breakage or loosening cannot be reliably measured, a torque wrench capable of tightening and loosening in accordance with the values specified by the manufacturer must be used.
- ▶ Door safety switches must be selected so that they are not easily tampered with and meet the required safety performance level.
- ▶ Control panels must be positioned in accordance with safe design principles in a location where the operator can see the machine and that does not create additional risk for the operator.
- ▶ Emergency stop buttons must be kept in working condition, robust, and not tampered with.
- ▶ Electrical panels of machines and all conductive parts of the equipment must be individually grounded.



The information provided in this booklet sets out the fundamental principles; it is essential to take into account variations arising from the specific conditions of the workplace, differences specific to machinery and equipment, frequency of use, and similar factors.

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