



SAFE USE OF MACHINERY

GENERAL PRINCIPLES OF MACHINE GUARDING

Most businesses use equipment and machinery in their day to day workplace activities. If the hazards associated with machinery are not safely managed, then serious injury and death can occur.

■ Identify Dangerous Parts of Machinery

Machinery designers, manufacturers, suppliers and employers have obligations under the Health and Safety in Employment Act 1992 to ensure machinery is safe to use and won't cause harm to operators. Employers also must ensure employees and machine operators are not exposed to hazards. The best way to identify the dangerous parts of machinery is to visualise how someone could be injured. For example, look for any of the following:

- **Trapping Hazards** – where parts of the body can be squashed or dragged into machinery, e.g. into in-running nips of rollers, revolving parts, between the belt and pulley on transmission machinery, or being trapped in between the closing tool and die on a power press.
- **Impact Hazards** – where machine parts, by their speed of movement, could cause injury if a person is hit.
- **Entanglement Hazards** – where hair, rings, gloves, or clothing could become entangled or wrapped in moving machinery.

- **Contact Friction/Cutting Hazards** – machine parts that may be sharp or abrasive, and could injure someone if touched.
- **Projectile or Ejection Hazards** – the workpiece could be thrown out of the machine and injure or impale someone, breakages of high-speed cutting tools or abrasive wheels disintegrating.
- **Other Hazards** – such as noise, electrically live equipment, extreme heat or cold, hot metal parts, ionising radiation, such as x-rays, and radiation such as microwaves, ultraviolet light, laser beams and radio waves.

Under the Health and Safety in Employment Act Regulations 1995 provision must be made for the safe cleaning, maintenance and repair of machinery. This includes guarding, lockout mechanisms, and a training programme for safe work procedures.

■ Practical examples of elimination of hazards by change of design, using automated material handling



Industrial robot handling and feeding workpiece to a press brake is used to eliminate trapping hazard and manual handling hazard causing back injury to personnel after an accident involving limb injury caused by trapping of the press brake tool and die.



A 4-sider planer machine is guarded by an interlock guard and fixed guards that meet the requirements of the standard to isolate the hazards of the machinery.



■ Hazard Controls

Guards and barriers should be designed so that people cannot reach over, around or through them and come into contact with the dangerous parts of machinery. Ideally machinery should be designed so hazards are eliminated. If this isn't possible, controls should isolate or minimise the hazard. The objective is to take all practicable steps to protect employees from harm through machinery, and equipment used at work is so arranged, designed, made, and maintained that it is safe for use.

Current best practice for machine guarding is based on the Australian Standard AS 4024.1-2006 (*Series*) *Safety of Machinery*.

■ Elimination

Machinery hazards can be eliminated through design features or by substituting a dangerous machine with a less hazardous one. An example is using automated material handling or robots.

■ Isolation

Static Fixed Guards and Interlocked Guards

A static fixed guard is the best method and should be fastened securely to the machine either by welding or with fasteners that cannot be removed without the use of tools. Guards should be constructed and arranged so it is impossible for anyone to reach the dangerous parts from any angle, including from beneath the machine.

Guards lower than 1600mm should not be used without additional safety measures because they can still be climbed over and are not high enough to protect

operators from projectile hazards. The gap between the bottom of guard and floor should not be larger than 180 mm to stop anyone reaching through into dangerous parts of the machine.

Interlocked guards operate by cutting the power to the machine if the guard is opened, ensuring the user can't come in contact with moving parts. The guards must be in place and cover dangerous parts while the machine winds down.

Safe by Position

This method relies on the dangerous machinery parts being out of the reach of people. A down side to this method is the hazard can be accessed with a ladder or other means.

Photoelectric Safety Devices

If a light beam is broken the machine stops its hazardous operation. Likewise, if the beam is broken by the presence of a person, the machine cannot re-start. Photoelectric safety devices often don't show external signs of failure, so they need to be used with a control system that monitors their operation and will shut down the machine in the event of a failure.

Pressure-sensitive mats

To gain access to the dangerous part of a machine, a person has to step on to a mat or platform, which then disconnects the machine from its power source. Pressure-sensitive mats do not usually show any external sign of failure, so they should be used with a control system that monitors their operation which in the event of a failure shuts down the machine.

■ Practical examples of elimination of hazards by change of design, using automated material handling



A fixed guard on a roll former.



An interlock guard on a roll former.

■ Minimisation

Trip Guards

A trip guard is activated to stop machinery from moving if a user reaches into a dangerous part of the machine. If this system fails, there is nothing to protect the user from being injured.

Automatic Push Away Guards

The guarding barrier moves towards the machine operator when the hazardous part of the machine operation occurs, requiring the operator to step back out of reach of the hazard. A downside to this method is if the guard is not carefully designed and maintained, it can become a hazard in itself and cause injury.

■ Options for when there are no other alternatives

Adjustable Guards

A fixed guard with adjustable elements should be positioned to suit each operation. These can also be self-adjusting guards which are forced open by the entry of work, and distance guards which are simply barriers sited at an appropriate distance from the danger zone. Comprehensive training must be given to the operators for the use of adjustable guarding so work is not positioned so it puts the operator at risk from the hazardous parts of the machinery.

Two-Handed controls

This method of guarding is only acceptable if it is not practicable to use other guarding methods. Two-handed

controls should be designed so that both controls have to be applied simultaneously to avoid one-handed control being possible. Two-handed controls do not protect other people except the machine operator, so the rear and sides of the machine should be guarded by fixed guards.

Locked Guards and Gates

Locked guards and gates rely on the operator not opening the gate until the machine has stopped. Isolation and lockout devices can also be used to ensure that the machine is not accidentally restarted during maintenance and cleaning. This should only be used where other effective interlock guarding is not practicable.

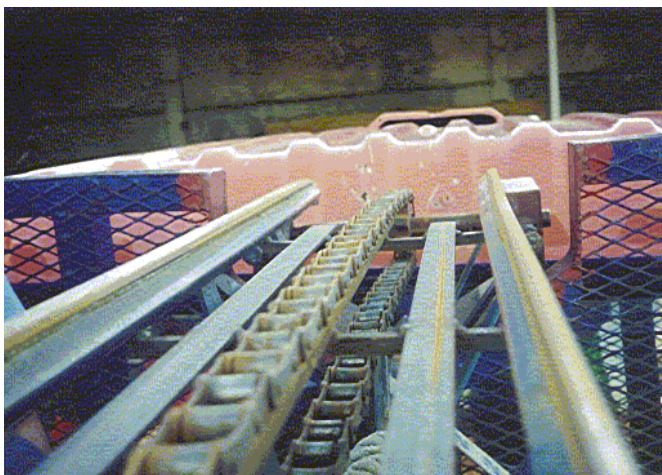
■ Common Problems

A number of trends occur in machinery accidents where employers have been prosecuted for injuries and fatalities to staff and contractors.

The key mistakes made with machinery guarding leading to serious injuries and fatalities are:

- No guarding at all, and operators can reach into dangerous parts of the machine;
- Guards are not securely fastened and can be easily removed while the machine is in operation;
- Openings in the guard where the operator can easily reach through to dangerous parts;
- Operators being able to remove guards for maintenance and not replacing them afterward;
- Interlocked guards that can be opened while moving parts are still in motion or running down;

■ Practical examples of elimination of hazards by change of design, using automated material handling



Trapping hazards of a chain and sprocket on a roof tile conveyor are eliminated by replacing the chain conveyor with rubber belt for the conveyor after an accident.

- Mechanisms from interlock switches can be removed to override the guards;
- Single light beam safeguard devices were able to be switched off;
- Interlock switches being overridden due to not using closed limit switches; and using the interlock guard as a short cut to activate the machine cycle.
- Ineffective lockout and isolation of power systems;
- Failure of supporting systems such as pneumatic ram free-fall.

■ Safe Use of Machinery

Cleaning and Maintenance and Isolation

Regulation 17 of the Health and Safety in Employment (HSE) Act 1995 Regulations, stipulates there must be adequate lock out procedures for the cleaning, maintenance, or repair of machinery. Where machinery is still in motion during cleaning or maintenance, adequate guarding and safeguards shall be put in place to protect the employee. A procedure must be developed.

Isolation, hold cards and lockout devices should always be used before cleaning and maintenance is carried out on machinery. The machine should either be stopped or a hold-to-run inching control should be used so that on the release of hand pressure the machine's dangerous motion will stop immediately. Hold cards should be attached to the power controls to reduce the likelihood that the machinery is started.

Training and Supervision

Health and Safety in Employment Act 1995 Regulation 17 also stipulates that machine operators must be adequately trained on how to carry out procedures for cleaning, maintenance and repair.

All operators should be trained about hazards associated with the machine, including appropriate guard use, and supervised until competent. The training must be given to the operators in a manner that they are likely to understand especially for operators with English as a second language.

Power Controls

Power controls should stop all power sources, be shrouded to prevent accidentally starting the machine, be clearly identified, easy to reach and lockable in the "off" position.

Restrictions Relating to Young People

(HSE) Act 1995 Regulations clearly state that no person under the age of 15 years is to work at or assist with machinery.

Long Hair, Loose Clothing

Tie back long hair to reduce risk of entanglement in moving parts of machinery. Loose clothing should not be worn around machinery for the same reason.

Machine Operators

Machine operators should report any defects immediately and use all safety devices, guards, appliances, protective devices, equipment and clothing to make the machinery safe to use.

Construction

Machine construction should be robust and free from dangerous vibrations.

Correct Installation

Machinery must be installed correctly and in accordance with the manufacturer's guidelines.

Instruction Manuals/Handbook

These should be kept at hand and frequently referred to for guidance.

Good Physical Environment

Reduce noise levels to 85dB(A), which is below damaging exposure limits. The work area should be tidy, free from dust and contamination, as well as being well-lit and adequately ventilated.

■ Current Standards

AS 4024.1 – 2006 Safety of Machinery General Principles – Technical Principles.

■ For further information contact the Department of Labour

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Note: This material has been prepared using the best information available to the Department of Labour at the time of publication.

Information may change over time and it may be necessary for you to obtain an update.

This material is also only intended to provide general advice and does not constitute legal advice. You should make your own judgement about action you may need to take to ensure you have complied with your workplace health and safety obligations under the law.