MAJOR WORKPLACE HAZARDS

# Machine Guarding



Government of South Australia
SafeWork SA

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## INTRODUCTION

Poor machine guarding practices are a major hazard confronted by people in the workplace everyday. Approximately 8 out of 10 workplace fatalities and 1 in 4 workplace injuries involve mechanical equipment. Many workplace injuries, caused through machinery are preventable.

Exposure to dangerous machine parts during operation, examination, lubrication, adjustment and/or maintenance, pose many risks. If the risk cannot be eliminated it must be minimised.

In order to reduce the risk, all machinery must be securely guarded to prevent access to dangerous parts. All guards should be correctly and securely fitted **before** operating machinery.

**MAKE SURE YOUR MACHINE GUARDS ARE IN PLACE**

Machine guarding is vital to every workplace using machinery. It is an essential protection that employers must provide for their workers. Machine guards do not have to be complicated nor interfere with productivity.

## THE HAZARD/RISK MANAGEMENT APPROACH

### WHAT DOES IT MEAN: HAZARD V RISK?

- A **Hazard** is something which has the potential to cause injury, illness or death. The term *hazard* can be applied to substances, methods or machines.
- A **Risk** is the possibility of injury, illness or death to a person due to hazard exposure. The *risk* will depend on factors such as the nature of the hazard, the degree of exposure and the individual characteristics of the person and/or hazard.

*For example, a piece of plant or machinery may be a potential hazard; however, it may not necessarily pose a risk unless it is incorrectly guarded or the operator is inadequately trained.*

Managing health and safety is an ongoing process that requires commitment by both management and employees in order to:

- identify the hazard
- assess the risk
- control the risk
- evaluate control measures

Effective management of health and safety hazards also involves training, consultation, procedure documentation and regular reviews of safety systems.

*Division 3.3 of the Occupational Health, Safety and Welfare Regulations (1995) identify the general minimum requirements for hazard identification, risk assessment and control of risk.*

## GETTING STARTED

The first step in guarding machinery is to identify the hazards and the associated levels of risk. Encourage your staff to read this booklet for ideas and concepts for machine guarding. You may want to ask your staff to walk through the work areas and identify machinery in which moving components or exposed items could cause injury.

It is usually not possible to address everything at once, so draw up a plan to rectify items listed in order of priority. In prioritising items for attention consider not only the likelihood of injury but also the severity of the injury.

It is also a good idea to arrange inspections by someone who is not necessarily familiar with your plant but is familiar with your industry. In some cases you may want to look for long term as well as immediate solutions. Guarding a machine may be the best solution now, but when replacing the machine in the future an improved machine with built in safety features may be the best option.

Look at the safety characteristics of machines when purchasing new equipment and try to get suppliers and manufacturers to fit guards to your specifications. Where you see a widespread problem, alert your industry association to advise suppliers.

## IDENTIFYING THE HAZARDS

Hazard identification is the process of identifying all situations or events that could give rise to a potential for injury. It generally involves consideration of the possible type of injury or illness such as lacerations or crushed fingers caused through inadequate machine guarding. Situations and events which may impact on health and safety and result in injury include:

- machine use
- environmental conditions
- ergonomic needs
- machine failure

*Occupational Health Safety and Welfare Regulation 3.3.1 requires the identification of all reasonably foreseeable hazards to health and safety arising from plant, or systems of work associated with plant.*

Machine guarding hazard identification is achieved through:

- Discussions with employees.
- Safety assessments conducted by engineers and designers in the early stages of a new product and/or process design.
- Prepurchase reviews of specifications for equipment and materials, conducted to ensure only the safest equipment comes into the workplace. Once equipment and materials arrive, check for hazards and introduce controls before use.
- Incident, accident and injury data analysis, to identify any patterns of injury or near misses which have occurred in the workplace, or in other similar workplaces.
- Work process reviews. Informal hazard assessments can easily be conducted by experienced tradespeople. This requires workers to carefully think through the task and try to anticipate where hazards might arise. Workers should consider:
  - activities they perform
  - where their face, hands and feet are placed
  - the body position they assume while they are performing a specific task
  - hazard exposure inherent in the equipment or generated by it
- Regular workplace inspections (using a checklist) to help uncover obvious workplace hazards.

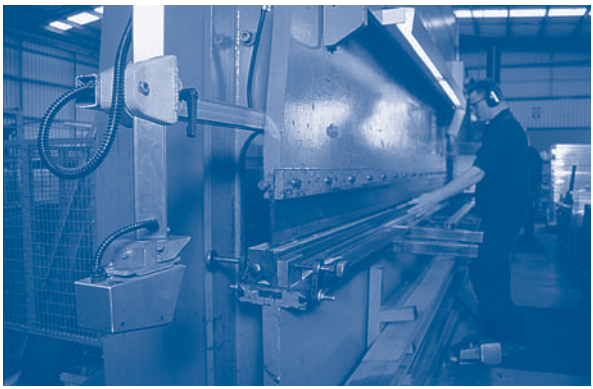
The following areas on machinery may be dangerous and are considered a risk. Consider them in your checklist when conducting a workplace inspection.

**PARTS WHICH MOVE OR TRANSMIT POWER**

- belts and pulleys
- flywheels and gear wheels
- shafts and spindles
- slides and cams
- chain and sprocket gears

**PARTS THAT DO THE WORK**

- tools and dies
- guillotine blades
- milling cutters
- circular saws
- drills and chucks



**To help identify dangerous machine parts, look for:**

- 'drawing in' points
- shear points
- impact and crushing areas
- cutting areas
- entanglement areas
- stabbing points
- abrasion areas
- flying particles
- any protrusions which could cause injury

**Machine hazards which may be controlled by guarding include:**

- contact or entanglement with machinery
- being trapped between machine and material or fixed structure
- contact with material in motion
- being struck by ejected parts of machinery
- being struck by material ejected from machine
- release of potential energy

Once you have **identified** the hazards (or danger areas), you should **assess** the risk (how likely it is to cause injury, and how severe the injury could be) and **control** these risks by guarding or by some other risk control method.

## RISK ASSESSMENT

Risk assessment is the process of prioritising identified hazards so that effort can be directed to eliminate, or control, those risks that have a high potential to cause harm. This is particularly important when an injury has occurred, or a new work practice or procedure is to be introduced. Risk assessments need to be undertaken on a regular basis and need to consider:

- **frequency** and level of exposure
- **pattern** of exposure (continuous or intermittent)
- **adequacy** of any existing risk control measures

*Occupational Health Safety and Welfare Regulation 3.3.2 states the method used for risk assessment must adequately address the identified hazards.*

Employers should conduct a separate risk assessment **for each machine** and any associated system of work used with that machine.

Identified hazards should be assessed to determine their potential to cause injury. The **likelihood** of the hazard causing an injury **(probability)** and the **severity** of the possible injury **(consequence)** need to be considered.

## THE RISK ASSESSMENT CALCULATOR

The Risk Assessment Calculator is a tool which helps you identify the level of risk.

**Using the Risk Assessment Calculator:**

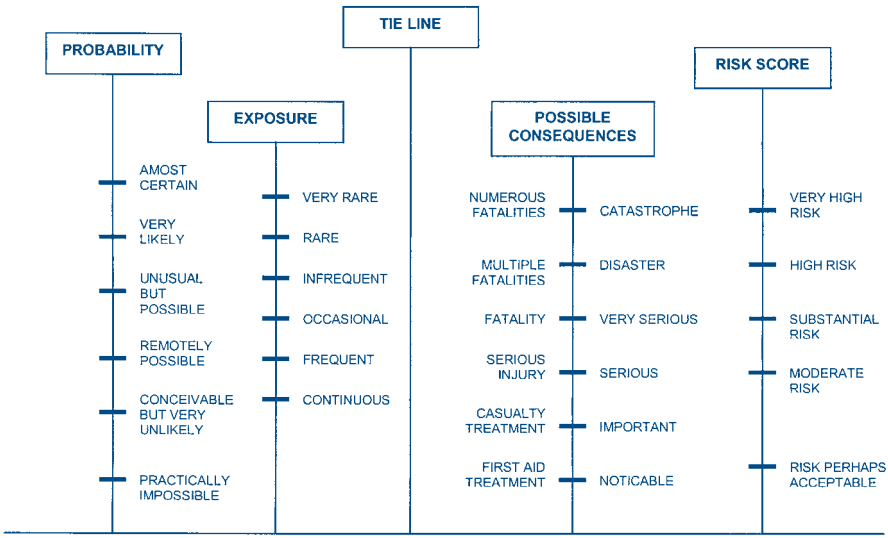
- select the appropriate point on the 'Probability' scale
- select the appropriate point on the 'Exposure' scale
- draw a line between the points chosen on the 'Probability' and 'Exposure' scale
- extend the line so that it intersects with the 'Tie Line'
- select the appropriate point on the 'Possible Consequence' scale
- draw a line from the point on the 'Tie Line' to the point on the 'Possible Consequences' line
- extend the line to the risk score scale

The risk score obtained may be used to make a judgement about whether the level of risk (for this particular task) is acceptable or not. However, **the risk score should only be used as a risk assessment guide**. It should be interpreted with caution, as it has certain limitations and requires allowances for unpredictable human behaviour.

If the risk **score** falls between 'very high risk' and 'risk perhaps acceptable', the risk must be minimised to the lowest possible level, eg, 'risk perhaps acceptable'.

*Australian Standard 4360 - risk management provides a generic guide for the establishment and implementation of the risk management process involving establishing the context and the identification, analysis, evaluation, treatment, communication and ongoing monitoring of risks.*

**RISK ASSESSMENT CALCULATOR**




SafeWork SA produce a '**Risk Assessment Form**' to help you identify risks associated with machinery. *(See contact details for SafeWork SA at the back of this booklet)* When using the 'Risk Assessment Form' use one page per machine. If the machine has several identified hazards use one page per machine part.

Once you have **assessed** the risk (ie, how likely it is to cause injury, and how severe the injury could be), you will need to **control** these dangers by applying machine guarding or implementing appropriate risk control measures.

## CONTROLLING THE RISK

The *Occupational Health Safety and Welfare (OHS&W) Regulations* require an employer to control the risk identified in any machine guarding task as far as 'reasonably practicable'. This means consider the following:

- severity of the hazard or risk in question
- knowledge of the hazard/risk and suitable ways of removing or reducing it
- availability and suitability of control measures
- cost of removing or reducing it

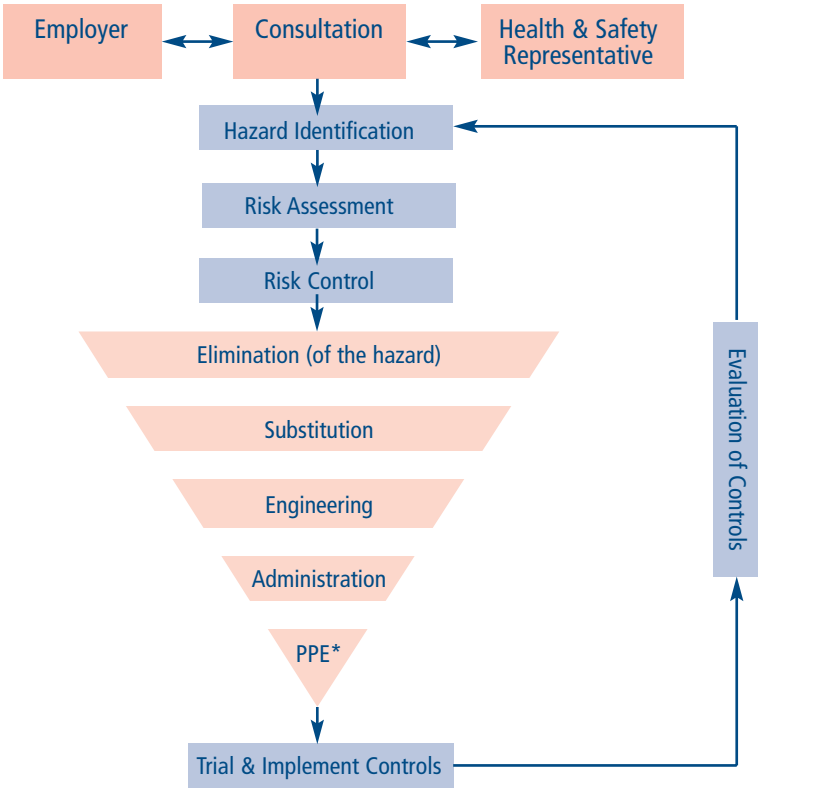
Appropriate control measures must be put in place to eliminate the risk, or where it is not reasonably practicable to do so, the risk must be minimised.

The ***hierarchy of control*** (listed in order of priority) is:

1 Elimination
2 Substitution
3 Engineering
4 Administration
5 Personal Protective Equipment (PPE)

Control measures must be chosen in order of priority, starting at level 1 and working to level 5 in the hierarchy of control. If control measures cannot be implemented, then the hazard management approach (as shown in the following page) should be applied. This approach shows the step-by-step process for identifying the hazard, assessing the risk and implementing appropriate risk control measures.

Consultation between employers and employees (or their health and safety representative) to evaluate the effectiveness of implementing control measures (eg, machine guarding) is essential.




** PPE – Personal Protective Equipment*

**THE HAZARD MANAGEMENT APPROACH**

## THE HIERARCHY OF CONTROL

### 1. Elimination

'Elimination' means to completely remove the hazard, or the risk of hazard exposure. Removal of the hazard is the ideal control solution. For example:

- removal of a noisy machine.

### 2. Substitution

'Substitution' involves replacing a hazardous piece of machinery or a work process with a non-hazardous one. For example:

- the operator using a tool to load a press with parts instead of placing them in by hand
- automating a process to prevent the operator from entering a danger area

### 3. Engineering

If a hazard cannot be eliminated or replaced with a less hazardous option, the next preferred measure is to use an engineering control. 'Engineering' controls may include:

- guarding machinery
- using enclosures (eg, enclosing a noisy piece of machinery)
- automating a process

### 4. Administration

Where 'Engineering' cannot fully control a health and safety risk, administration controls should be used. 'Administration' controls introduce work practices that reduce risk and limit employee exposure. They include:

- training employees in correct and safe operation
- developing Safe Operating Procedures (SOPs)
- reducing the number of employees exposed to the hazard
- reducing the period of employee exposure
- developing and implementing lock-out procedures
- displaying appropriate warning signs

### 5. Personal Protective Equipment

Personal Protective Equipment (PPE) should only be used when other higher order control measures are not possible, and only as a short term solution. Efforts to remove health and safety risks using 'Elimination', 'Engineering' and 'Administration' controls should be fully explored before PPE is implemented. Examples of PPE include:

- safety glasses
- gloves
- hearing protection

Control measures adopted should be monitored on a regular basis to assess their effectiveness. A documented record of your chosen method of controlling the risk should be kept. If control measures cannot be put into place immediately, implement interim controls, document them and any future measures to be implemented.

## SELECTING A GUARD

### GUARD TYPES

There are numerous guard types used to control risks. All are suited to a particular purpose or machine. Consider the type of guard best suited to your needs.

Different guard types include:

- **Fixed Guards**

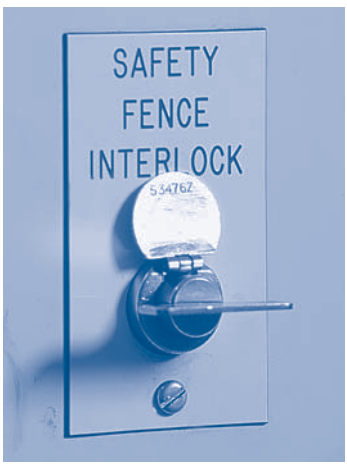
  A fixed guard is a permanent barrier without moving parts, which prevents contact between moving machinery and the operator. A fixed guard will only offer protection when correctly fixed into position. However, the fixed guard must not create a new hazard. To deter easy removal, a fixed guard must require the aid of an appropriate **tool** to open, remove, replace, perform maintenance or repair work.

  Fixed guard slides can also be adjusted (with the aid of an appropriate tool) to allow work to be fed through the guard and into the work area.

- **Interlocked Guards**

  An interlocked guard has moveable parts and is interconnected with the power (or control) system of a machine. Interconnections can be electrical, mechanical, hydraulic or pneumatic. An interlocked guard prevents a machine from operating while the guard is open or removed.

  Interlocked guards are essential when guards have to be removed or opened to allow for adjustments or maintenance. Opening the guard will disengage or lock the machine and stop all dangerous movement.

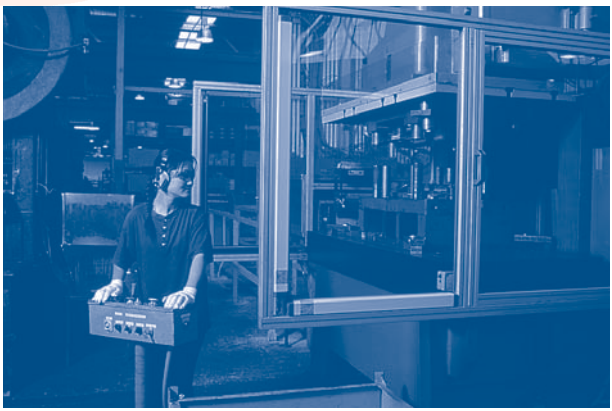


- **Presence Sensing Devices**

  Presence Sensing Devices (PSD) detect entry into the 'dangerous work space' of a machine and stop all moving parts. Restart of the machine is possible only after a person, body part or obstacle has been removed. Examples of PSD include photoelectric light curtains, laser scanners and pressure mats.

  The installation of these devices should comply with Australian Standard 4024 – Safeguarding of machinery – general principles.

*The correct application of various types of guards can be found in AS 4024.1 Safeguarding of machinery – general principles and AS 4024.2 Safeguarding of machinery – presence sensing systems.*



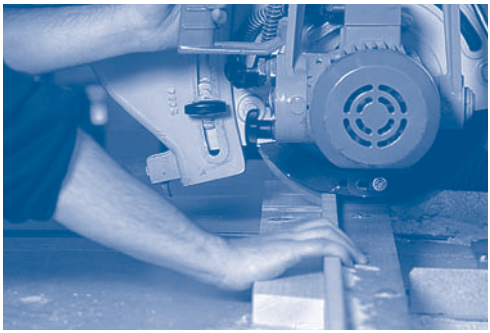
- **Automatic Guards**

  Automatic Guards automatically move into position as the machine or cycle is started. They are also known as push away guards and are only suitable on slow moving machines.

- **Adjustable Guards**

  Adjustable Guards can be adjusted to accommodate different sizes, shapes and materials. They also provide a barrier, that can be adjusted, to assist with a variety of production operations.

- **Self Adjusting Guards**

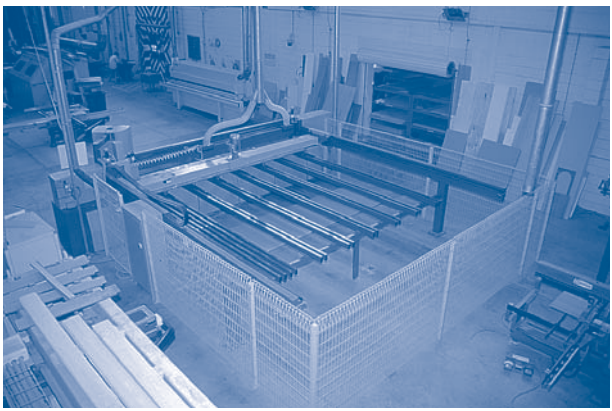


Self Adjusting Guards are movable guards that allow an opening large enough for materials to enter the point of operation. They are suitable for docking saws, rip saws and cross cut saws.

Note: A self-adjusting guard fitted over the circular saw blade will automatically rise over the material being cut. If the guard is not affixed, the cutting blade is exposed whenever the machine is running.

- **Distance Guards**

Distance Guards prevent operator access to dangerous areas of the machine by the use of a barrier or fence. Access points through the guard such as gates and doors must be secured with a lock or interlock system.



- **Partial Guarding**

Partial Guarding is used in cases where it may not be possible to completely guard a machine (eg, a circular saw or planer). Other methods of risk control such as administration controls and personal protective equipment should also be applied when using partial guarding.

## GUARDING COMMON MACHINE TYPES

### Exposed Rotating Cutting

Exposed Rotating Cutting machinery includes cut-off saws, planers, milling machines, friction cutters and boring equipment. Fixed, adjustable and self adjusting guards should be fitted where appropriate.

Note: An adjustable guard fitted to a planer allows material to be fed over the rotating cutters while protecting the operator.

### Pulleys and Drives

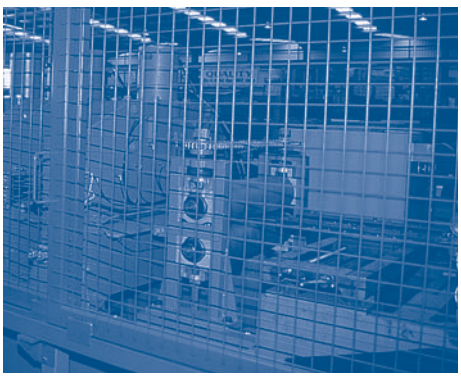
Fixed guards are preferred for Pulleys and Drives. All nip-points are to be guarded so as to be out of the operators reach.

### Rotating Shafts and Rollers

Fixed guards are preferred for Rotating Shafts and Rollers. It is important that guarding provides adequate protection against loose clothing and long hair becoming entwined within rotating shafts and rollers.

Examples of rotating shafts include:

- couplings
- spindles
- fan-shafts
- ironing rollers



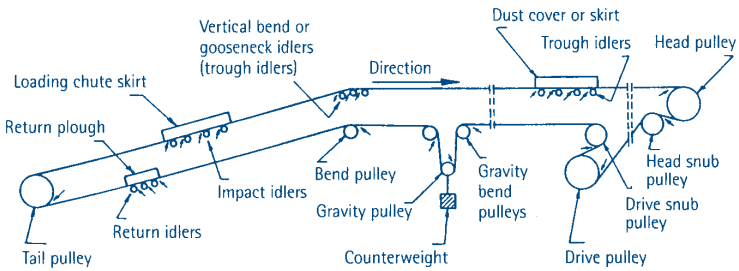
*(**Case study**) A man had his hand severely crushed and the skin stripped away from the wrist to the fingertips when it was drawn in between the inking rollers of a printing press. The man was attempting to remove a flake of paint off one roller while the press was running at high speed. A fixed guard was later installed.*

## Conveyors

The 3 primary types of conveyors used for bulk handling are belt, screw and bucket conveyors. Conveyors present multiple hazards along their length. Guards must be fitted to ensure it is physically impossible for operators to access dangerous parts while the conveyor is in operation. Hand rails on conveyors are not guards.

*Australian Standard 1755 Conveyors – design, construction, installation and operation is an approved code of practice that specifies the minimum legal requirements for guarding conveyors.*

Dangerous parts of conveyor can include (but are not limited) to the following items:




Physical guarding is not the only method of controlling risks on conveyor systems. The range of other safeguards required include:

- power isolation procedures (eg, lock-out/tag-out systems for maintenance, set-up, etc)
- easily accessible emergency stop controls (eg, lanyards or emergency stop controls that are less than 30 m apart)
- access provisions (eg, for safe lubrication)
- adequate local lighting

### Power Presses

The two main categories of power presses are:

- power stamping presses
- brake presses

Suitable methods to control hazards associated with power presses may involve a **combination** of guard types. For example, fixed and interlocked guards may be appropriate for a power press during a production run, whereas, presence-sensing devices (ie, light curtains or light beams) may be used to guard a brake press.

Supplementary information on guarding power presses is provided in the SafeWork SA brochure titled '*Machine Guarding – Metal Fabrication Industry*'.

*Guarding of power presses must (as a minimum) comply with AS 1219 Power presses – safety requirements and should be in accordance with AS 4024.1 Safeguarding of machinery – general principles and AS 4024.2 Safeguarding of machinery – presence sensing systems.*

The machine guarding method you choose for a power press depends upon the type of job and how it is to be carried out. Associated hazards must be identified, the level of risk assessed and adequate controls put in place to minimise or eliminate the risk.

Regular maintenance of machinery is extremely important. For maintenance to be effective, inspection records must be kept. Other safeguards (eg, two-handed controls, emergency stops, etc) must be considered when designing a machine guarding system.

## GUARD DESIGN

The primary function of a guard is to provide a physical barrier which prevents access to dangerous parts of a machine.

Poorly designed or inappropriate guarding often contributes to machine related injuries.

Guards should be designed to make tasks such as machine cleaning, adjustment or belt changes easier, particularly if these tasks need to be undertaken regularly. You should **be able to remove a guard only with the aid of a tool.**

Hinged guards may be used but should be restricted to instances where guard weight or restricted access for removal is an issue. An interlock device must be used in conjunction with any hinged guarding and the guard should fail to safety mode.

If you use a guard from another machine, ensure it is not defective and is appropriate for the new machine.

If making your own guards, ensure the materials used are made of good quality, solid material.

Guarding can play a useful role in both dust and noise reduction. In many cases, issues of wear, heat and ventilation affect operating efficiency, health and safety. Careful attention to design and layout at the outset can avoid problems later on.

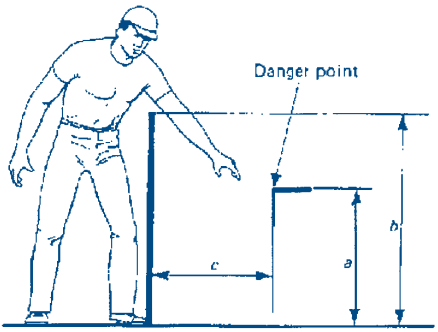
Technical assistance on guard design can be found in the **Australian Standards**. The Standards with particular relevance to machine guarding are listed on pages 29 - 30, together with a brief description of their contents.

(Case study) *A caravan repairer was fined $3000 after an electrician lost three fingers while using an unguarded bench saw. The electrician was a contractor who was not supposed to be using the saw as part of their job. The machine guard had been removed by the employer to prevent damage occurring to materials being cut.*

## ERGONOMIC CONSIDERATIONS

The following illustrations and tables may help you assess what sort of guarding is required and where it should be located (in order to keep a danger point on a machine safely out of reach).

Where doubt exists in relation to the distances shown, measurements should be taken of the actual work place to ensure danger points are beyond reach.




LEGEND

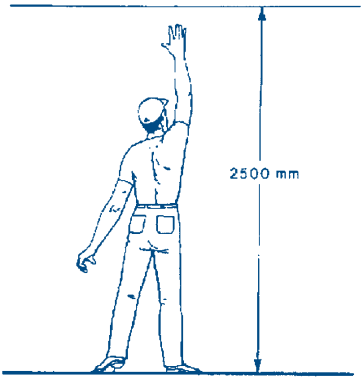
a = distance of danger point from floor

b = height of edge of barrier

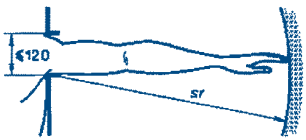
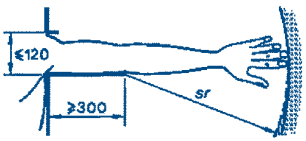
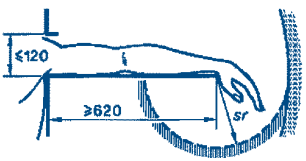
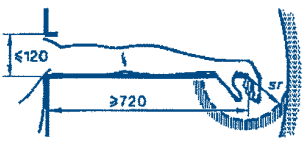
c = horizontal distance from edge of barrier to danger point

millimetres

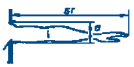
| Height of danger zone *a* | Horizontal distance to danger zone *c* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Height of protective structure *b** | | | | | | | | |
| | 1 000† | 1 200† | 1 400† | 1 600† | 1 800 | 2 000 | 2 200 | 2 400 | 2 500 |
| 2 500 | — | — | — | — | — | — | — | — | — |
| 2 400 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | — |
| 2 200 | 600 | 600 | 500 | 500 | 400 | 350 | 250 | — | — |
| 2 000 | 1 100 | 900 | 700 | 600 | 500 | 350 | — | — | — |
| 1 800 | 1 100 | 1 000 | 900 | 900 | 600 | — | — | — | — |
| 1 600 | 1 300 | 1 000 | 900 | 900 | 500 | — | — | — | — |
| 1 400 | 1 300 | 1 000 | 900 | 800 | 100 | — | — | — | — |
| 1 200 | 1 400 | 1 000 | 900 | 500 | — | — | — | — | — |
| 1 000 | 1 400 | 1 000 | 900 | 300 | — | — | — | — | — |
| 800 | 1 300 | 900 | 600 | — | — | — | — | — | — |
| 600 | 1 200 | 500 | — | — | — | — | — | — | — |
| 400 | 1 200 | 300 | — | — | — | — | — | — | — |
| 200 | 1 100 | 200 | — | — | — | — | — | — | — |
| 0 | 1 100 | 200 | — | — | — | — | — | — | — |




SAFETY DISTANCE FOR REACHING UP

| Limitation of movement | Safety distance *sr* | Illustration |
|---|---|---|
| Limitation of movement only at shoulder and armpit | ≥850 |   |
| Arm supported up to elbow | ≥550 |   |
| Arm supported up to wrist | ≥230 |   |
| Arm and hand supported up to knuckle joint | ≥130 |   |

DIMENSIONS IN MILLIMETRES

| Part of body | Illustration | Opening | Safety distance *sr* | | |
|---|---|---|---|---|---|
| | | | Slot | Square | Round |
| Fingertip |  | $e \leq 4$ | ≥2 | ≥2 | ≥2 |
| | | $4 < e \leq 6$ | ≥10 | ≥5 | ≥5 |
| Finger up to knuckle joint |  | $6 < e \leq 8$ | ≥20 | ≥15 | ≥5 |
| | | $8 < e \leq 10$ | ≥80 | ≥25 | ≥20 |
| | | $10 < e \leq 12$ | ≥100 | ≥80 | ≥80 |
| or |  | $12 < e \leq 20$ | ≥120 | ≥120 | ≥120 |
| Hand | | $20 < e \leq 30$ | ≥850 | ≥120 | ≥120 |
| Arm up to junction with shoulder |  | $30 < e \leq 40$ | ≥850 | ≥200 | ≥120 |
| | | $40 < e \leq 120$ | ≥850 | ≥850 | ≥850 |

DIMENSIONS IN MILLIMETRES

## OTHER CONSIDERATIONS

### Work Organisation and Work Processes

Your work practices should incorporate the use of guards on machinery.

Sometimes guards are removed, or not used to make a task easier or quicker. Avoid work practices that may encourage workers to remove or bypass guards, eg, bonus or incentive payment systems may encourage guard removal and therefore should be used with caution.

When developing a machine guarding solution:

- talk to the employees who use the machinery
- take into account safety, job procedures and production rates
- you may need to modify existing work procedures to ensure guarding does not create new problems
- consider the movement of materials on site

In the long term, a carefully considered guarding solution will prove to be less costly and more efficient for your business and employees.

## Layout

Machine guarding can only be effective if used in conjunction with proper attention to layout. Machines which are poorly located or simply too close together may not be safe even if guarded.

Consider the following points in relation to layout:

- avoid congestion or worker movement near machinery, which may cause problems
- make sure layout does not encourage hazardous movements in relation to operation, cleaning or maintenance (eg, blocking access)
- keep areas in the vicinity of machinery clear from rubbish, materials, clutter etc
- minimise unnecessary movements by trucks, people and materials
- simple and well understood flow lines will help reduce the likelihood of persons coming near dangerous machinery or being 'in the wrong place at the wrong time'

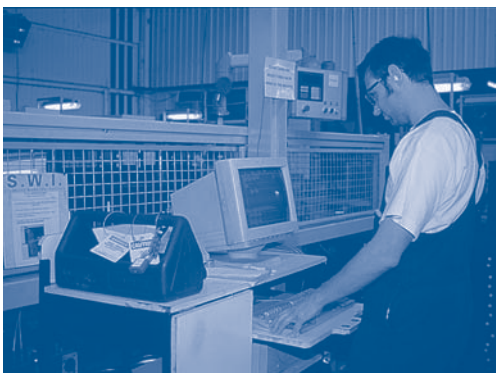
## Habit

Employees may continue to operate machinery in an unsafe manner out of habit, despite signs of danger. Some ways of dealing with this include:

- clear labelling of controls
- clear and simple warning notices

People also become accustomed to a particular arrangement of controls. Use standardised controls as much as possible, and ensure that the location of controls is appropriate.

The action used to operate a control should also be compatible with the effect on the machinery, eg, switching a control towards the left, moves material into the machine in the same direction.



### Fatigue

The safe use of machinery requires more than attending to guarding. Long hours of work or long periods without adequate breaks can lead to loss of concentration and slow reflexes which enhance the risk for human error. Excessive heat, poor ventilation and poor operator comfort, ie, inappropriate seating position, location of controls can also contribute to a loss of concentration and error. Employers should take this into account when considering machine guarding.

### Lighting

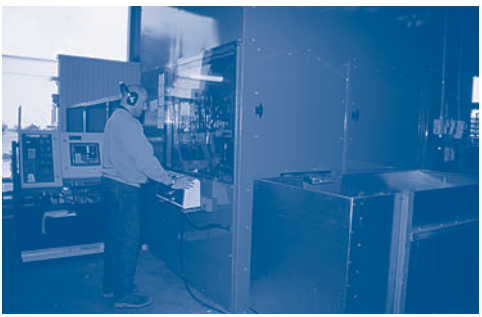
Consider the following safety issues relating to the provision of adequate and appropriate lighting around machinery:

- direction and intensity of lighting
- contrast between background and local lighting
- colour of the light source
- reflection, glare and shadows
- stroboscopic effect of fluorescent lighting on moving machinery. It can make moving parts of machinery look as if they are stopped

### Noise

Noise, particularly excessive noise, interferes with concentration and can cause an operator stress which may lead to errors in judgement and prevent effective verbal communication.

Given this, it is essential to minimise noise in the workplace. Where noise levels remain high ensure operators wear appropriate and properly fitted hearing protection.



In many instances, carefully designed guarding of moving parts can aid noise reduction and help remove the stress associated with prolonged exposure to excessive noise.

### Ventilation

Some processes and machinery generate heat. Design guarding to allow air flow through areas of mesh so that equipment does not overheat.

(Case study) *A factory was fined $75000 after a 16 year-old worker had two fingers severed by a power press in December 1999. The employer pleaded guilty for failing to maintain a safe work area.*

*Penalties in South Australia for non-compliance with the OHS&W legislation were significantly increased in January 2001.*

## Training

All persons who supervise, manage or operate machinery must receive appropriate training and instruction for health and safety. Training should include safe operating procedures and any necessary precautions for controlling hazards whilst operating machinery.

Never assume people know or can informally learn about machine safety. Include training on any required personal protective equipment. As part of this training, employees must be made aware that guards must be kept in place at all times when the machine is operating.

## Isolation

With the exception of those circuits required for safety systems, all machinery should be fitted with a means of isolation from all energy sources. Such isolators should be clearly identified and be capable of being locked if reconnection could place persons at risk.

Appropriate isolation methods include:

- a lock-out (or tag-out) system, (where one or more padlocks are fitted to the isolation switch)
- danger tags with the exposed persons' names on them

## Controls

Operational controls and emergency stop devices must be suitably identifed and readily accessible to each person using the machine. Emergency stop devices must have handles, bars or push buttons which are coloured red and are immediately accessible in the event of an emergency.

A large machine may require a number of control switches. Multiple controls must be of the 'stop and lock-out' type.

Additional emergency stop controls are required in situations where machines have multiple operator work stations or operate in series such as on production lines and conveyors.


*Poorly located switches may encourage dangerous practices such as reaching across moving parts, failure to shut down machinery when a problem occurs or situations where a machine can be started by one worker while another is in a dangerous location (eg, cleaning a bin or during maintenance and setup).*

*Relevant Australian Standards and the Occupational Health, Safety and Welfare Regulations (1995) outline minimum requirements for controls on various types of machinery or processes in the workplace.*

Safe operating procedures are required to ensure machinery cannot be restarted when undergoing maintenance or other temporary operations. A lock-out (or tag-out) system may also be required. Conduct a hazard identification and risk assessment to determine the most suitable location of controls.

### Weight

Large or heavy sections of guards may need to be removed for maintenance access. Some sections may remain fixed; however, when possible ensure that the sections to be removed can be easily handled by one person. Put handles on moveable sections where appropriate.

### Colour Coding

It is good policy for all safety guards within a workplace to be painted the same colour, eg, 'sunflower' yellow, for high visibility (if different to the general machinery colour) to assist in easily identifying when a safety guard is not in its proper place.

### Interactions

Guards that move out of the way for each operation (automatic guards) need special consideration. Assess the potential for problems in the following interactions:

- between **guard and machine**
- between **guard and person**
- between **guard and workpiece**

### Dust

A dusty workplace can be dangerous. Dust and other airborne contaminants can have direct and severe long term affects on the health of workers. Respiratory problems, skin disorders and even cancer may be caused through dust. The discomfort caused by dust on the skin, clothing and protective equipment can also compromise safety.

Dust can also be a potential safety risk by clogging machinery parts, inducing sudden breakdowns, obscuring moving parts and other hazards.

Airborne dust also can create an explosive hazard in some industries.

A dust collection system can save on clean up time and make your workplace much easier to work in. Furthermore, a little thought can lead to solutions which solve the health and machinery hazards associated with dust. A simple lid, cover or shield on saws, augers and other machinery can reduce the level of dust.

Guarding may also reduce the level of noise and improve worker comfort and productivity.

### Inspection, Cleaning & Maintenance

To safeguard employees you must have regular inspections, cleaning and maintenance procedures which are well understood throughout the workplace. Special 'Precaution Isolation Procedures' need to be implemented where workers are performing inspection, cleaning and maintenance tasks and are either not visible to others or where there are multiple operating controls.

Isolation procedures need to be applied whenever maintenance or repair requires people to enter the danger area around machinery. For ease of maintenance and adjustment, hinged guards may be used; however, this type of guard must be interlocked if dangerous parts are exposed.

## YOUR OBLIGATIONS

As an employer you have a legal requirement to adequately guard dangerous machinery. Non-compliance of these obligations can lead to significant fines, imposed restrictions and loss of staff productivity.

**Employers** are responsible for providing all necessary machine guarding and safety equipment throughout their factory, workshop or other workplace.

**Workers** are responsible for using the guards and other safety measures required by the employer.

### Why you should treat machine guarding seriously

- Employers have a 'common law' duty of care to the people who come into contact with their business.
- The South Australian OHS&W Act (1986) and the OHS&W Regulations (1995) outline legal responsibilities which include the provision of guarding for machinery in the workplace. Non compliance can lead to significant fines.

**OHS&W Act 1986**
**Section 19**

An employer shall, in respect of each employee employed or engaged by the employer, ensure so far as is reasonably practicable that the employee is, while at work, safe from injury and risks to health and, in particular -

(a) shall provide and maintain so far as is reasonably practicable -
  (i) a safe working environment;
  (ii) safe systems of work;
  (iii) plant and substances in a safe condition; and

(b) shall provide adequate facilities of a prescribed kind for the welfare of employees at any workplace that is under the control and management of the employer; and

(c) shall provide such information, instruction, training and supervision as are reasonably necessary to ensure that each employee is safe from injury and risks to health.

- Temporary or permanent loss of an experienced staff member through injury can be very costly, especially in terms of loss of expertise to the business.
- Injuries can retard your business. The legal, medical and other costs often go uncalculated. Even one incident involving litigation may bankrupt a small employer.
- Employers may face increased premiums.
- Adverse publicity resulting from death, severe injury, prosecution, or common law claims may impact on your workers as well as your customer group.

Have you factored these costs into your business?

## FURTHER ASSISTANCE

### Consulting Engineers

There are a number of consultants that can offer advice on machine guarding. If you decide to use a consultant, shop around and make sure that the consultant is fully conversant with South Australian legislative requirements. Ensure their approach is consistent with the principles identified in this guide. Ask for evidence of previous work in the area and check out their standard of work for yourself by talking with other clients.

You may consider reducing your costs and time by sharing the Consulting Engineers costs with other employers in your area.

### Your Workers

Workplace safety committees or health and safety representatives should also be involved in developing safety solutions. If you don't have these in your workplace you should still involve workers. In the end, your employees have a direct interest in safeguarding their own health.

Your workers can assist in developing solutions. They work with the machinery every day and can often help identify a problem and assist in devising the most effective and cost-efficient solutions.

A guard may look fine from an engineering viewpoint but should also consider worker comfort and ease of operation. Workers are usually in the best position to judge this.

**Section 21**
An employee must take reasonable care to protect the employee's own health and safety at work.

**OHS&W Regulations 1995**
**Division 1.2.1 Employers**
1.2.1 (1) Subject to any express provision in a particular regulation to the contrary, an employer must, in respect of the health, safety or welfare of his or her employees, and the health or safety of any other person who could be adversely affected by the performance of work, ensure compliance with any regulation that, pursuant to regulation 1.2.14 and schedule 1, applies to employers.

## AUSTRALIAN STANDARDS

Standards Australia is responsible for the development, publication and distribution of Australian Standards, the recommended Standards for machine guarding and other safety issues in Australia. Listed below are some of the most useful Standards available from Standards Australia relating to machine guarding.

### AS 4024 - Safeguarding of machinery

Sets out the general underlying principles for machine guarding and provides the means for identifying hazards and risks arising from the use of machinery during all phases of machine life. Methods for eliminating or reducing these hazards and risks, for safeguarding machines, and for implementing safe working practices are described. Guidelines for assessing the safety measures needed in particular circumstances are provided. It does not provide guidance for safeguarding any particular machine. The Standard is in two parts covering 'general principles' and 'presence sensing systems'.

### AS 1121 - Guards for agricultural tractor 'power take off' (PTO) drives

Specifies requirements for guards for PTO drives of agricultural tractors and associated implements.

### AS 1219 - Power presses - safety requirements

Specifies safety requirements for the design, construction, operation and maintenance of power stamping presses and brake presses. Incorporates details for safeguarding power presses, die design and die setting. Provides recommendations for operation, maintenance and inspection of presses, and the training and supervision of operators.

### AS 1418 - Cranes (known as the SAA Crane code) - (including hoists and winches)

Specifies general requirements for cranes (including hoists and winches), as defined in AS 2549 and appliances intended to carry out similar functions.

**Division 1.2.2 Employees**

1.2.2 (1) Subject to any express provision in a particular regulation to the contrary, an employee must, insofar as is within the employee's control (but without derogating from any common law right) -

(a) do all such things as are required of him or her by the employer to ensure compliance with these regulations; and

(b) use any plant, equipment, clothing, or other items or materials provided under or in accordance with these regulations; and

(c) ensure that he or she is not, by the consumption of alcohol or a drug, in such a state as to endanger his or her own safety at work or the safety of any other person; and

(d) without derogating from the operation of paragraphs (a), (b) and (c), comply with any regulation that, pursuant to regulation 1.2.14 and schedule 1, applies to employees.

**AS 1473 – Wood-processing machinery - safety**
Specifies minimum requirements for the guarding and safe use of powered machines which cut or abrade wood, wood products and like materials, to be observed by employers, trainers, employees, designers, makers and suppliers of woodworking machinery and other persons having an interest in woodworking machine operations.

Chainsaws, and machinery used in the milling of raw sawlogs, together with debarkers and log peelers are not covered.

**AS 1755 - Conveyors - safety requirements**
Specifies minimum safety requirements for the design, construction, installation and guarding of conveyors and conveyor systems, with specific requirements for unit and bulk handling conveyors. Provides recommendations for inspection, maintenance, marking and identification, and the training of operators.

**AS 1788 - Abrasive wheels**
Specifies requirements for the design and construction of abrasive wheels and the manufacture, installation, aplication and operation of abrasive wheels and ancillary equipment. Particular requirements are given for the construction of guards for all equipment fitted with abrasive wheels and for the construction of flanges for use with abrasive wheels.

**AS 1893 - Guarding & safe use of metal & paper cutting guillotines**
Outlines the general specifications of guarding requirements, with particular information on guarding different types of machines. Fixed, interlocked, automatic and electronic guards are included.

**AS 2294 - Protective structures for earthmoving machines**
Specifies the requirements for roll-over protective structures and falling-object protective structures.

**Australian Standards** are available from:

Standards Australia
63 Greenhill Rd, Wayville
Tel: 1300 654 646
www.standards.com.au

# SAFEWORK SA

## HELP AND EARLY INTERVENTION CENTRE

100 Waymouth Street, Adelaide

**HELP CENTRE**

Telephone: **1300 365 255** or **(08) 8303 0400** for mobile and interstate callers

Email: help@safework.sa.gov.au

To report all serious workplace accidents and incidents telephone **1800 777 209** (24 hour service)

**LIBRARY**

Telephone: (08) 8204 8877
Facsimile: (08) 8204 8883
Email: library@safework.sa.gov.au

**BOOKSHOP**

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Email: bookshop@safework.sa.gov.au

Opening hours from 8.30am - 5.30pm, Monday to Friday (the Help Centre closes at 4.15pm on Wednesdays)

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**MOUNT GAMBIER**

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PO Box 871, Mount Gambier SA 5290
Telephone: **(08) 8735 1199**

**PORT LINCOLN**

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PO Box 2862, Port Lincoln SA 5606
Telephone: **(08) 8688 3057**

**PORT PIRIE**

Level 1, 104 Florence Street, Port Pirie
PO Box 462, Port Pirie SA 5540
Telephone: **(08) 8638 4777**

**WHYALLA**

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PO Box 696, Whyalla SA 5600
Telephone: **(08) 8648 8733**

To speak to SafeWork SA in a language other than English, contact the Interpreting and Translating Centre on (08) 8226 1990 and ask them to contact SafeWork SA. This interpreting service is available at no cost to you.

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