

CMPA

Guarding Plant and Equipment in the Construction Materials Industry



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Disclaimer

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The guidelines here may not apply in all circumstances and should not replace a quarry manager's considered assessment of a particular situation before them.

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Introduction to this Guideline

1. Overview

This Guarding Guideline together with the CMPA's Work Safely Reference Manual aims to support members in meeting the requirements of the Victorian Occupational Health and Safety (OHS) Act 2004 and the Victorian OHS Regulations 2017.

In doing so, this document demonstrates a process that can be used to establish and successfully implement plant and equipment guarding specific to your site requirements.

2. Scope

The Guarding Guideline focuses on the guarding requirements of both fixed and mobile crushing and screening plant and equipment inclusive of concrete agitators/mixers used within the construction materials industry.

3. Relevant Regulation and Documentation

When designing, manufacturing and installing guarding, management must take into account as a minimum the following documents;

- Victorian Occupational Health and Safety Act 2004
- Victorian Occupational Health and Safety Regulations 2017, Part 3.5. Plant
- AS/NZS 4024.1 2014 Safety of Machinery Series
- AS/NZS 4024 2015 Part 3610: Conveyors—General Requirements
- AS/NZS 1319-1994 Safety Signs for the Occupational Environment

References and guidance materials;

- Managing Risks of Plant in the Workplace, Safe Work Australia- Code of Practice 2011
- WorkSafe Code of Practice for Plant 2006
- How WorkSafe applies the law in relation to Reasonably Practicable Edition No. 1 November 2007
- Ergonomics of Machine Guarding Guide, Ministry of Business, Innovation and Employment (New Zealand) June 2013

4. Attachments to this Document

- Attachment A - Plant and Equipment Identification Checklist for Guarding (This checklist should be used to identify what plant and equipment may require guarding)
- Attachment B - Plant and Equipment Component Checklist for Guarding (This checklist should be used to identify what components of plant and equipment may require guarding)
- Attachment C - Guarding Integrity Review Checklist (This checklist should be used at scheduled intervals to review the integrity of your guarding program)
- Attachment D - Guarding Example Photo Gallery

Attachments A, B and C are available in electronic format through the CMPA.

5. General Guarding Requirements to assist with Compliance

The following table is an overview of the general guarding requirements that must be taken into account to assist in achieving compliance with regulatory requirements whilst providing a safe workplace.

This guideline provides details on how to apply these requirements.

Guarding must be installed to restrict access to all equipment, or parts of equipment, or material or objects that exit equipment, or parts of equipment which are extremely hot or cold that may present risk to workers.	✓
Guarding must have an appropriate aperture size and be positioned so as body parts cannot contact hazardous areas of the operational plant or equipment that may present risk to workers.	✓
Guarding must be installed where there is potential for workers to fall onto operational plant or equipment.	✓
If access to the area of the plant requiring guarding is not necessary during operation, maintenance or cleaning of the plant, the guarding must be a permanently fixed physical barrier.	✓
If access to the area of the plant requiring guarding is necessary during operation, maintenance or cleaning of the plant, the guarding should be an interlocked physical barrier that allows access to the area being guarded at times when that area does not present a risk and prevents access to that area at any other time.	✓
If it is not reasonably practicable to use guarding referred to in the above two sections guarding used must be a physical barrier that can only be altered or removed by the use of tools.	✓
Guarding that is removed for maintenance can only be removed once the plant or equipment is de energised and locked out and must be replaced and secured prior to the plant or equipment being re energised and the lockout locks removed. The weight of the guarding (for ease of removal) and its temporary location once removed (to avoid trip hazards etc.) must also be taken into consideration.	✓
Fence guards must be installed at a safe height and located at a safe distance from the machine and its moving parts to prevent people from reaching over, reaching through and reaching under and accessing the danger zone.	✓
The use of cable ties to temporarily secure guarding is only allowed in certain circumstances.	✓
Lanyards must be located in such a manner that they are clearly visible and readily accessible for a person potentially trapped in a danger zone.	✓
All workers must be made aware of guarding requirements that have the potential to affect their or other workers safety.	✓
Guarding must be inspected on a routine and scheduled basis to ensure integrity of the guarding and records of these inspections must be maintained.	✓

6. Guarding Definition and Overview

Definition of Guarding

Guarding - Devices such as barriers and other means of physically barring, or restricting access to equipment, or parts of equipment, or material or objects that exit equipment, or parts of equipment which are extremely hot or cold that may present risk to workers.

Overview of Guarding

Guarding is an engineering control as defined in the Hierarchy of Controls. Guarding is a shield or device covering hazardous areas of a machine to prevent contact with body parts, i.e. entanglement or to control hazards like rock chips, scrap steel, dust or noise from exiting the machine. Guarding provides a means to protect workers from injury while working nearby or while operating equipment. In order to understand the concepts of machine guarding there are three fundamental areas of a piece of machinery that should be guarded. These areas are the point of operation, the power transmission device and the operation controls.

- **The Point of Operation** is defined as the point where the work is being performed on the material. This would include crushing, shaping, conveying or screening materials.
- **The Power Transmission device** is defined as all the parts/components of the mechanical system, which transmits energy to the part of the machine performing the work. This includes hydraulic/electric motor, shafts, pulleys, belts, connecting rods, chains, gears, spindles and flywheels.
- **The Operation Controls** are defined as all the other moving parts of the machine, which move while the machine is in operation. This includes reciprocating, rotating, and transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine.

Equipment Requiring Guarding

In general terms guarding is required where a worker has the potential to;

- Come in contact or be entangled with machinery;
- Become trapped between a machine and a fixed structure;
- Come in contact with material in motion;
- Come in contact with extreme hot or cold surfaces;
- Be struck by parts of machinery, falling objects such as rocks, trough and return rollers or projectiles inclusive of rock chips, tramp metal; and
- Fall into equipment or fall to another level.

Specifically guarding is required where the following have been identified:

- Rotating and moving parts such as belts, pulleys and drives;
- Pinch points between vibrating parts such as jaw crushers, feeders and screens;
- Low head room due to confined working space;
- Protection from falling material; and/ or
- Operational requirements e.g. access for cleaning or inspection.

For assistance in identifying your guarding requirements refer to;

- Attachment A - Plant and Equipment Identification Checklist for Guarding
- Attachment B - Plant and Equipment Component Checklist for Guarding

7. OHS Regulation requirements for Guarding

Victorian OHS Regulations (2017) Part 3.5 Plant

The Victorian OHS Regulations (2017) Part 3.5 Plant lists the following Hierarchy of Controls for Guarding of plant and equipment.

The employer or self-employed person must ensure, so far as is reasonably practicable, that guarding will prevent access to the dangerous area of the plant.

In doing so, the employer or self-employed person must ensure that:

- a) If access to the area of the plant requiring guarding is not necessary during operation, maintenance or cleaning of the plant, the guarding is a permanently fixed physical barrier; or
- b) If access to the area of the plant requiring guarding is necessary during operation, maintenance or cleaning of the plant, the guarding is an interlocked physical barrier that allows access to the area being guarded at times when that area does not present a risk and prevents access to that area at any other time; or
- c) If it is not reasonably practicable to use guarding referred to in paragraph (a) or (b), the guarding used is a physical barrier that can only be altered or removed by the use of tools; or
- d) If it is not reasonably practicable to use guarding referred to in paragraph (a), (b) or (c), a presence-sensing safeguarding system is used that eliminates any risk arising from the area of the plant requiring guarding while a person or any part of a person is in the area being guarded.

The employer or self-employed person must ensure that the guarding:

- a) Makes bypassing or disabling the guarding, whether deliberately or by accident, as difficult as is reasonably possible; and
- b) Does not create a risk in itself.

If the plant to be guarded contains moving parts that may break or that may cause workpieces to be ejected from the plant, the employer or self-employed person must ensure that the guarding will, in relation to any risk from those broken or ejected parts or workpieces:

- a) So far as is reasonably practicable, eliminate the risk; or
- b) If it is not reasonably practicable to eliminate the risk, reduce the risk so far as is reasonably practicable.

An employer or self-employed person must ensure, so far as is reasonably practicable, that any pipe or other part of plant associated with heat or cold is adequately guarded or insulated in a manner that ensures that any risk to health or safety is:

- a) So far as is reasonably practicable, eliminate the risk; or
- b) If it is not reasonably practicable to eliminate the risk, reduced so far as is reasonably practicable.

What does Reasonably Practicable mean?

The test for what is reasonably practicable is an objective test: that is, a person is to be judged by the standard of behaviour expected of a reasonable person in the duty-holder's position who is required to comply with the same duty and is:

- Committed to providing the highest level of protection for people against risks to their health and safety;
- Proactive in taking measures to protect the health and safety of people.

To avoid doubt, a duty imposed on a person by the regulations to ensure health and safety so far as is reasonably practicable, requires the person:

- a) To eliminate risks to health and safety so far as is reasonably practicable; and
- b) If it is not reasonably practicable to eliminate risks to health and safety, to reduce those risks so far as is reasonably practicable.

To avoid doubt, regard must be had to the following matters in determining what is (or was at a particular time) reasonably practicable in relation to ensuring health and safety;

- a) The likelihood of the hazard or risk concerned eventuating;
- b) The degree of harm that would result if the hazard or risk eventuated;
- c) What the person concerned knows, or ought reasonably to know, about the hazard or risk and any ways of eliminating or reducing the hazard or risk;
- d) The availability and suitability of ways to eliminate or reduce the hazard or risk; and
- e) The cost of eliminating or reducing the hazard or risk.

Designers, Manufacturers and Suppliers

Australian designers and manufacturers have a duty under the Victorian OHS Regulations (2017) Part 3.5 Plant, to design and manufacture plant taking into account the Hierarchy of Controls for Guarding as listed in the OHS regulations and referenced on the previous page.

Plant that is imported to Australia may not have necessarily been designed or manufactured to meet the same requirements and may potentially be inadequately guarded.

Suppliers that supply imported plant in Australia have a responsibility to ensure that the Guarding on the plant meets the requirements of;

- Victorian OHS Regulations (2017) Part 3.5 Plant
- AS/NZS 4024.1 2014 Safety of Machinery Series
- AS/NZS 4024 2015 Part 3610: Conveyors—General Requirements

A supplier of plant who hires or leases plant must ensure that, between any hiring or leasing of the plant, the plant is inspected and maintained to ensure that any risk arising from the use of the plant is:

- a) So far as is reasonably practicable, eliminated; or
- b) If it is not reasonably practicable to eliminate the risk, reduced so far as is reasonably practicable.

8. Types of Guarding

Interlocked Guards

Interlocked guards such as enclosure guards are interconnected with the power or control system of the machine. The interlock prevents the machinery from operating unless the guard is closed. They cannot be opened until the dangerous parts of the machine have come fully to rest.

Interconnections are usually mechanical, electrical, hydraulic or pneumatic. They provide an effective safeguard where access to the point of operation is required between each cycle of the machine or regular access is needed.

In the event of electrical failure, loss of power or malfunction, the machine's guarding system should 'fail to safe' and render the machine or part inoperable until the power is restored, or the guarding mechanism is repaired.

Interlocked guards and their components must be designed so that any failure does not expose people to danger. The design also needs to consider the possibility of a person being inside the area covered by the guard when an attempt is made to start the machine.

The type of safety device installed with the guard, and the level of integrity of the related control circuitry, can only be determined after conducting a risk assessment. If required, the following Australian Standard will guide the risk assessment. Refer to AS 4024 2006 Safety of machinery, Part 1501: Design of safety related parts of control systems—General principles for design.

Notes:

When using interlocked guards, the exposure to dust, water and vibration and the affect those elements may potentially have on the interlock devices must be taken into account.

Although interlocked guards are the highest order in the guarding Hierarchy of Controls some interlock guards can be and have been tampered with so as entry into the guarded area is accessible whilst the machinery is operational.

A key interlock system can keep workers safe by locking the guards in place. The key to unlock and open these guards is retained in the machine power isolating switch. In this way, the only way to unlock and open the guards is to switch off the power. The locks on the guards retain the key when the guard is open.



Interlocked Guard

Fixed Guards

Fixed guards are stationary guards and prevent contact between moving machinery parts and any part of the body.

Fixed guards should be easy to remove and replace, but only able to be opened or removed with the aid of a tool and when the machine is not in operation and is isolated/locked out. Fixed guards should contain a visual inspection point of low aperture mesh, enabling operators to see the vee belts or other required components without the need to remove the guard.

NOTE: Bright colours can make it difficult to see through guards. Consideration should be given to painting inspection viewing sections matt black to facilitate visual inspection.



Matt Black Guard

Fixed Guards may be in the form of a Fixed Enclosure Guard or a Fixed Distance Guard.

Fixed Enclosure Guards

A Fixed Enclosure Guard is where the machine or moving parts are totally enclosed by the guard and is generally in the form of a steel plate and a mesh inspection point as close as practical to the machine and its moving parts.



Fixed Enclosure Guard with mesh inspection point to view vee belts

A Fixed enclosure guard may also be a solid box surrounding a chute or head drum that has an access door and a visual inspection hatch. The access door should be mechanically locked and

signposted stating it must remain locked unless the machinery is isolated. The inspection hatch will have a fixed mesh guard at an appropriate distance to the hazard covered by a rubber flap to enable visual inspection.

Where access to a drop box or a chute may be required it should be designed so the access to enter, and where applicable access to rescue is not hindered by obstruction and the airflow is enhanced assisting any contaminants to disperse.

The solid box surrounding a chute or head drum could be designed so that it swings over enabling easier access and greater airflow.



Solid box fixed Enclosure Guard with locked and signposted inspection hatch

Fixed Distance Guards

A fixed distance guard is where the guard is fixed at a point to prevent any body parts accessing any moving parts. It is generally in the form of a mesh with an aperture size appropriate to the distance from the machine and its moving parts to prevent body part access, i.e. entanglement.



A Fixed distance guard with conveyor tracking bolts protruding



A fixed distance guard set back from the conveyor belt to allow spillage to fall through without damaging belt whilst maintain a safe distance from the head drum.

Fence Guards / Perimeter Guards

A fence guard or perimeter guard is a stationary fixed guard generally in the form of mesh which completely surrounds a machine or group of machines restricting access.



A fence guard or perimeter guard with conveyor tracking bolts protruding

Fence guards shall be:

- Installed at a safe height and located at a safe distance from the machine and its moving parts to prevent people from accessing the danger zone. Reaching over, reaching through and reaching under must be considered when implementing fence guards;
- Only able to be removed or adjusted with the use of tools.

Where access may be required to the machine, e.g. cleaning under a conveyor, fence guards can be fitted with an interlocked gate or gates with their usage directed by a Safe Work Procedure.

Interlocks may be mechanical, electrical or electronic and shall be opened by catcher keys held by an authorised person.

When considering the use of fence guards the following should be taken into account:

- If an interlock device is used it only allows the machine to operate when the gates are closed and once the gate is opened the machine shuts down automatically, effectively eliminating the hazard;
- If a mechanical lock, e.g. padlock is used, a Safe Work Procedure directing complete isolation of all energy sources must be established and implemented to direct the activity;
- Mechanical locking, e.g. padlocks, encourage an operator to stop and think, and not rely only on the integrity of an interlock;
- Machine shutdowns should be designed so moving parts cannot be reached until the machine has come to a complete halt;
- Any unscheduled stop may create additional hazards e.g. blocking crushers or leaving conveyors unable to start without removing materials;
- Remotely started or operated plant should be fitted with presence sensing devices, and a warning sign with a flashing light and a loud warning sound which operates for a given time prior to starting;
- Mechanical, electrical or electronic arrangements should be connected to gates in such a way that they prevent the machine from starting or stopping the machine, if the gate is not in its proper position.

Types of Guarding - Summary

The type of guarding used must take into consideration the operation of the plant, its inspection and maintenance requirements.

For example, to visually inspect a conveyor using an interlock guard on a gate to the catwalk may not be practical as the conveyor would shut down on entry. Unless all materials have been run out this may mean all materials have to be removed from the conveyor prior to re starting. Secondly you would not be inspecting the conveyor in motion, assessing its tracking and integrity of rollers etc.

Fixed guards must be removed through the use of a tool and practical to handle and store whilst removed. Where fixed guards are removed all energy sources must be locked out.

In summary, the guarding selected is only as effective as the commitment of the workers and management to their safety.

9. Guard Design General Principles

Design Overview

For guarding to be effective and practical a commitment to the design process is vital.

A pragmatic approach is necessary in order to develop a solution to satisfy the OHS regulations and the reduction of risk as well as ensuring the plant is still able to operate effectively.

Complicated solutions can often tempt operators to bypass guarding in order to perform their work.

Guarding design should take the following into account;

- Be of solid construction and securely mounted so as to resist impact or shock;
- Make bypassing or disabling of the guarding, whether deliberately or by accident, as difficult as is reasonably practicable;
- Size, shape, weight and facility for storage when removed so as not to cause a risk e.g. manual handling injuries when removing or re-fitting or trip hazards when removed and placed alongside;
- So far as is reasonably practicable, to control any risk of entanglement or ejected materials, or contact with extreme hot or cold surfaces;
- Not cause build up within the guard resulting in blockages or component damage, i.e. conveyor or vee belt;
- Do not have to be removed to lubricate or grease;
- Not subject to vibration leading to metal fatigue;
- Position of locking and/or fixing mechanisms are easily accessible; and
- Suitable clearance when replacing the guard i.e. an easy fit does not require persuasion with a sledge hammer or another forceful implement.

Typical Shortcomings with Guarding:

- Guarding does not extend far enough from head and tail pulleys, e.g. can still reach nip point;
- Small gaps are left around guards allowing potential entanglement;
- Snubber, return rollers and belt scraper pinch points are not always suitably guarded;
- Trough and return rollers not guarded due to height being above reach limits but can still dislodge and fall from brackets, therefore require guarding as fall protection;
- Distance to hazard at times not sufficient for mesh aperture size;
- Guarding can restrict maintenance and lubrication;
- Guarding not properly secured, e.g. must require tool for removal;
- Guarding that allows build up within it causing blockage and potential belt damage; and
- Guarding positioned, mounted and attached in a manner that potentially exposes the person removing and storing the guard to undue risk, e.g. manual handling risk.

Conveyor Guarding and Access

Industry best practice is to guard and provide walkways and platform access to both sides of conveyors.

Trough idlers rollers, in particular damaged, worn or spilt rollers can and have caused serious injury including de-gloving of hands and arms although they are not necessarily regarded as a pinch point.

Providing walkways and platform access to both sides of the conveyor and the head drum allows maintenance activities to be conducted in a safe manner whilst eliminating the needs for a working at heights regime.

Working on a conveyor belt to access the side without a walkway presents a risk of fall and therefore is a prohibited practice unless a fall restraint system is used by a trained and competent worker under direction of a SWMS that is inclusive of a rescue plan

Providing walkways and platform to access conveyors for maintenance establishes a safe work place, i.e. a higher order of control, rather than a working at heights regime that relies on workers commitment and behaviour.

The initial capital cost should be considered in comparison the ongoing costs and effort of hiring Elevated Work Platforms, establishing SWMSs, approving work permits, conducting observations and supervision of workers, establishing rescue plans and facilities and conducting routine training and competency assessment of workers.

Where there is potential for a worker to fall onto a conveyor from a walkway or platform a hand rail at suitable height or guarding should be installed.

Guarding and Damage from Spillage

Spillage of raw materials into Guarding is a common cause of damage to guards, conveyor belts and rollers and often eventuates in the guard detaching and falling from height or the belt tearing or tracking offside.

Spillage should be controlled at the point of release, so it does not enter the guard and become entrapped.


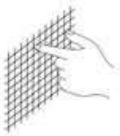


Where safe and practicable, in particular with lesser size aggregates the aperture of the guarding mesh should be greater than the aggregate size so as it can pass through the guard in the event of uncontrolled spillage.

Guard Distances from Danger Points

Machine guarding must be designed so as to ensure a worker, who chooses to reach past the guarding, e.g. upwards, over, into, under or around or along a guard cannot make contact with the danger point.

The following tables illustrate how to determine the required gap or mesh openings (aperture), wire diameter and the distance the guard should be from the hazard.

Aperture and reach

			
No admittance	No admittance, reach restricted to root of finger	No admittance, reach restricted to root of thumb	No admittance, reach restricted to hand thickness

The aperture and the distance the guard is from the hazard shall ensure that physical contact with that hazard is not possible.

Alignment of wire aperture, wire diameter and distance from hazard

Guard type	Aperture	Wire diameter	Distance form hazard
Fixed Enclosure Guard	10 to 20mm	2.5mm	25mm to 150mm
Fixed Distance Guard	40mm	3mm	200mm
Fence Guard	55mm x 155mm	4mm	See table, next page

Wire diameter is selected taking the following into account:

- It must be light enough so as not to enhance the occurrence of a manual handling injury during removal, placement and re-fitting;
- It must be durable enough to withstand forces such as falling or projecting rocks and ongoing vibration.

Galvanised guarding although initially more expensive, is generally regarded as more durable and cost effective over time.

All guarding should be manufactured and fitted as per the requirements of the following Australian Standards;

- AS/NZS 4024.1 2014 Safety of Machinery Series
- AS/NZS 4024 2015 Part 3610: Conveyors—General requirements

The table below provides guidance to the height of a fence guard taking into account the horizontal distance to the hazard and the height of the hazard from the floor.

Distance of Hazard from Floor	Height of Barrier or Guard (mm)							
	2400	2200	2000	1800	1600	1400	1200	1000
	Horizontal Distance to be maintained between Barrier or Guard and Hazard							
2400		100	100	100	100	100	100	100
2200		250	350	400	500	500	600	600
2000			350	500	600	700	900	1100
1800				600	900	900	1000	1100
1600				500	900	900	1000	1300
1400				100	800	900	1000	1300
1200					500	900	1000	1400
1000					300	900	1000	1400
800						600	900	1300
600							500	1200
400							300	1200
200							200	1100

Fence guards are generally 1.8m high using a mesh size appropriate to the distance with a maximum gap of 200mm at the bottom to allow cleaning.

To determine the most effective Height of Barrier or Guard a practical and physical assessment is required.

The objective of the assessment is to ensure that workers on the outside of the guard cannot make:

- Bodily contact with the hazard
- Contact the hazard with tools, in particular crow bars and shovels
- Fall onto the hazard or into the guarded area from a level above

10. Removing, Re-Fitting and Securing of Guards

Where interlock guarding is not being used guards can only be removed and re-fitted by the use of tools. Where practicable one locking/securing point simplifies the removal process. Appropriate mechanisms of securing guards are as follows;

- Nuts and bolts suitably treated e.g. galvanised or stainless steel;
- Bolts with a head requiring a specialised tool;
- A bracket seat with a bolt; or
- Any other bolt, pin or similar arrangement that requires the use of a tool to remove.



If there are guards being used on plant that do not include the use of any of the above mechanisms, then a process should be in place to review and change the current guards to ensure that the guards can be secured by means of any of the above mechanisms.



The above guard is secured by a locating pin at the top and retaining cotter at its base.

Handles can be placed in different positions as required to assist with ease of lift when removing guards.

The panel retaining cotters are designed to hold the panels firmly in position whilst allowing quick and easy panel fitment and removal. However, the cotters by themselves do not comply with the requirements of the standards. A supplementary method to prevent unauthorised release of the cotters is required.

This is achieved by inserting a fastener through the loop end of the cotter to prevent the cotter being able to open to the outward pointing position. The fastener can be a simple M6 bolt and nut (preferably Nyloc), a steel cable loop and cable grip or similar method that will require a tradesman's tool for removal.



Guard Retention Cotter in the secured position.



Guard Retention Cotter in the secured position with an M6 screw and nyloc nut attached.



Guard Retention Cotter cannot be released with screw in place.

11. Use of Cable Ties

During this interim period where guards are being changed, cable ties may be used for guarding of fixed plant but only under the following conditions;

- Cable ties must be a heavy duty, UV resistant cable tie with a minimum width of 7.0mm;
- Cable ties must be designed so as the cable tie cannot be removed by hand, i.e. the securing toggle is to be recessed;
- The tails of the cable ties must be cut flush with the securing toggle;
- Heavy duty UV cable ties may only be used in areas such as perimeter guarding around plant and conveyor guarding;
- Heavy duty UV cable ties may be used in other areas only as a temporary/short term attachment until maintenance or other works are completed;
- When a cable tie is removed, it must be immediately replaced with a new cable tie when the guard is re-fitted; and
- A Safe Work Method Statement (SWMS) is to be developed detailing the use of cable ties, auditing of their condition and ensuring cable ties are in place.

It is not acceptable practice for cable ties to be used in the following circumstances;

- In load bearing situations e.g. to support a guard;
- In high risk areas of the plant where the guards are being used to protect drive mechanisms, e.g. around tail drum and flywheels; or
- In areas of the plant where guards are subject to excessive vibration e.g. around prime crusher or vibrating screens.

Note: The use of cable ties as per the above application has been approved by WorkSafe Victoria.



Cable tie tail cut flush with the securing toggle



Cable ties should not be used in high vibration locations

12. Conveyor Lanyards (Pull Wires)

Location

AS/NZS 4024 2015 Part 3610: Conveyors—General Requirements states that the design risk assessment of the conveyor shall determine the optimum location for pull wire systems.

Where practicable, lanyards should be located in such a manner that they are:

- Clearly visible;
- Readily accessible for a person potentially trapped in a danger area and a person nearby;
- Outside any readily removable guard and external to vertical line of any nip or shear point and no further than 1m from the nip or shear points;
- At least 900mm above the access floor;
- Generally, not more than 1500mm above the access floor; and
- Shall serve as an emergency stop system.

Note: Where it is required to be higher than 1500mm, the lanyard should be located lower than all nip or shear points.

Where the design risk assessment of the conveyor determines the optimum location of the lanyard is enclosed within the guarding and as close to any nip points as possible, the control box for the lanyard where inclusive of an emergency stop button should be fitted to the external side of the guarding so as the emergency stop button is accessible.

Where this is not achievable a separate emergency stop must be fitted to the external side of the guarding, clearly visible and easily accessible.

Where the conveyor is not accessible a lanyard may not be required but an emergency stop accessible at ground level is.



The Control box for the lanyard on the external side of the Guarding where the actual lanyard is enclosed within the Guarding

General Information Lanyards

Lanyards and other forms of emergency stops are not to be used for the purpose of lockout and isolation as they are generally wired to a control circuit and can be overridden at the switchboard.

Lanyards shall not be used as a replacement for guards.

Lanyards are a last line of defence and theoretically should never be activated apart from during their testing regime when the belt is not carrying material. Their purpose is to provide an emergency stop to a worker who is at risk of entanglement.

This risk of entanglement should only arise if a worker blatantly breached safe work procedures and climbed over a guard, or removed a guard without isolating the conveyor first.

Where reasonably practicable lanyards shall be installed where readily removable guards are used without interlocks.

Lanyards should be installed in a manner so as guards can be removed without disconnecting the lanyards.

Lanyards should be coloured red. Where the environment is such that the colour may not be identifiable consideration should be given to the use of reflective labelling placed at no more than 30m intervals and at the head, tail and transfer points of the conveyor.

The design and distance between Lanyard supports shall be such that the lanyard moves freely when pulled and does not become disengaged from the support. The AS/NZS standard directs that a maximum spacing of 6m should apply.

Refer to AS/NZS 4024 2015 Part 3610: Conveyors—General Requirements for further information in regards to design requirements, force required to activate the lanyards and testing frequency and criteria.

Lanyards must be easily accessible to all workers in all situations who have the potential to be entangled in a conveyors or associated equipment such as head and tail drums.



13. Guard Colours

It has always been recommended that guarding should be painted in a different colour from the machine so it easily distinguishable and workers can easily identify if it has been removed.



Typically, Guards are painted in yellow



Galvanised guards facilitate more effective vision for inspection purposes and don't require re-painting.



Australian/New Zealand Standard Safety of Machinery Part 3610 Conveyors – General Requirements, section 2.4.4.2 *Guard design for cleaning and inspection* notes that it is industry practice to paint guards with a bright colour such as safety yellow or orange.

However, the bright and contrasting colours can make it difficult to see through the guards.

Consideration should be given to painting inspection viewing sections a matt black colour to facilitate visual inspection.

14. Guard Signage

Signage is an administrative control only and serves as a reminder and creates risk awareness amongst workers.

Signage should be fixed to Guards as applicable and must comply with AS 1319-1994 Safety Signs for the Occupational Environment.



Display on fence/perimeter guards



Display on guards where access for maintenance or operations is not required



Display on machinery which have positional guards, i.e. drop saws, lathes, bench grinders



Display on guards where access for maintenance or operation is required

15. Mobile Crushing and Screening Equipment



The majority of mobile crushing and screening equipment is currently imported into Australia.

Quite often the guarding does not comply with Australian Standards requirements and suppliers must retrofit or install guarding to meet these requirements.

Although suppliers are working with international Original Equipment Manufacturers (OEMs) it is reported that they are slow to amend their designs to suit the adoption of Australian Standard requirements.

Heads drums and rollers on the underside of conveyors are often not guarded. These pinch/entanglement points may not be accessible when the conveyor is elevated for discharge but once a stockpile is formed below the conveyor, they become accessible and therefore require guarding or the area that allows access is to be physically restricted to workers.

Due to this design issue guards often have to be removed for relocation on site, or transport to another site.

Used Mobile Crushing and Screening Equipment

Suppliers of used plant have specific responsibilities when selling used plant. They must provide the purchaser with any information relating to the safe use of the plant and must at the time of supplying the used plant provide any record kept by the previous owner of the plant that is in the possession of the supplier. *(Contact Work Safe Victoria on 1800 136 089 for further clarification of this requirement)*

During the pre-purchase process or on receipt but prior to use of the new or used mobile crushing and screening equipment it is recommended by the CMPA that an inspection of guards and their compliance with Australian Standards by a competent person is conducted and an action plan is established to ensure the plant is compliant prior to its use.



Separate matt black guard for rollers providing:

- More effective vision for daily inspection purposes; and
- Ease of removal of guard for roller replacement.

16. Agitator Guards

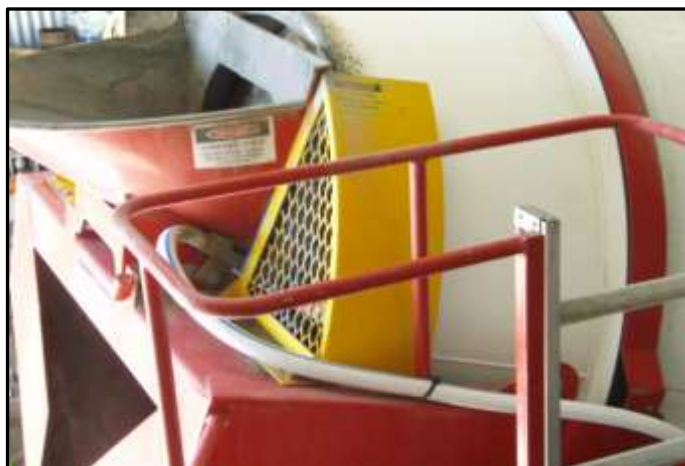
Agitators/mixers, like all other equipment have pinch, entanglement and crush hazards that workers and customers are potentially exposed to if not effectively guarded.

Most recently purchased agitators have appropriate guarding but again should be assessed during the pre-purchase process or on receipt but prior to use.

Older agitators are often inadequately guarded. An assessment of all agitators in service should be undertaken and guards manufactured, and retro fitted to suit.

Agitator - Barrel Ring Guard

Positioned to stop driver making contact with barrel ring or placing hands/hose into barrel.



Agitator - Front Flange Guard



Agitator - Power Take Off Guard



Agitator – Rear Stand Guard

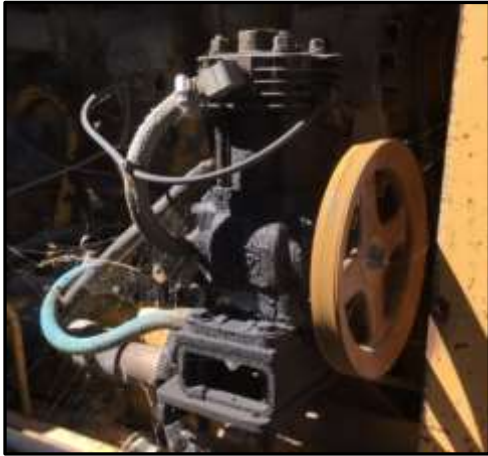


Agitator - Trunnion Roller Guard



17. Other Guarding Requirements

Mobile Equipment, e.g. Loaders, Graders



Recently purchased mobile equipment is generally appropriately guarded, although an inspection should be undertaken when acquiring new or leased mobile equipment.

Older mobile equipment, although generally only used at random for back up or specific purposes often lacks appropriate guarding. This equipment should be included in the guarding program and guarding fitted prior to use.

Powered Hand Tools



Powered hand tools should be inspected prior to use to ensure the integrity of the guarding.

Hot Surfaces

Where there is potential for contact with hot surfaces such as truck/mobile equipment exhaust systems they should be guarded.



18. Establishing a Guarding Program

On site Consultation

The first step when establishing a guarding program is to ensure all relevant on-site workers are consulted and contribute to the effectiveness of the program. When either designing, manufacturing or installing guarding, it is not only operationally smart but a legal requirement that management consult with all relevant workers, inclusive of but not limited to;

- Plant and equipment operators;
- Maintenance workers, i.e. boiler maker/manufacture of guarding;
- Quarry Manager;
- Quarry material technicians who access plant and sample materials; and
- Any worker whose health and safety may be affected by the standard of guarding.

Management must ensure documented records of the consultation are established and maintained.

Off-site Consultation

Where applicable the guarding manufacturer should be able to provide advice on guarding requirements.

It is the responsibility of the OEM to provide suitable guarding on all new plant and equipment and to provide the purchaser with a copy of the risk assessment or other documented processes conducted to establish those guarding requirements.

It is the responsibility of the purchaser/employer to ensure that the guarding is appropriate for the plant/equipment's intended application in its specific location.

Identification of Guarding Requirements

Attachment A – Plant and Equipment Identification Checklist for Guarding should be used to identify what plant and equipment may require Guarding. This checklist is available in electronic format through the CMPA.

Attachment B - Plant and Equipment Component Checklist for Guarding should be used to identify what components of plant and equipment may require Guarding. This checklist is available in electronic format through the CMPA.

Identification of appropriate and effective guarding

This Guarding Guideline should be referenced so as to understand:

- The OHS Regulations for guarding;
- Guard design general principles;
- Types of guarding available to meet your needs.

Utilising this Guideline and its attachments should assist you in establishing a guarding program that is both effective and compliant.

Guarding Rules

The following Guarding Rules can be expanded in consultation with your workers to suit your local requirements and should be included in your site safety rules, communicated at safety inductions and displayed on your WHS noticeboards.

Do Not:

- Climb over guards, fences and handrails;
- Tamper with guards;
- Shovel through or over guards;
- Remove guard when machine is operating;
- Place other implements such as crow bars through guards.

Do:

- Immediately report, damaged, ineffective or missing guards;
- Lockout all energy sources prior to removing guards.

19. Ongoing Guarding Review

It is imperative that ongoing scheduled reviews of guarding are conducted by management in consultation with the workers who use the guards and those who manufacture and maintain the guards.

The objective of the reviews is to ensure that the guarding is:

- Providing the protection that it is intended to;
- Practical to use, i.e. remove, store and replace; and
- Not causing any operational issue, e.g. material hangs ups, blockages and damage to other components.

For assistance in effectively conducting a guarding review refer to Attachment C - Guarding Integrity Review Checklist.

Routine workplace inspection checklists should also include the checking of the integrity of guarding.

CMIPA

Attachment A – Plant and Equipment Identification Checklist for Guarding

This checklist should be used to identify what plant and equipment may require Guarding and is available in electronic format through the CMPA.

Site		Date	
Access Platforms		Crusher - Gyratory	
Agitator Opening Guard		Electro Magnet	
Bin - Feed Bin		Feeder - Apron	
Bin - Side Feed		Feeder - Belt	
Bin - Surge		Feeder – Grizzly	
Cement Silos		Feeder - Reciprocating Plate	
Chutes		Feeder - Vibrating	
Conveyor - Gravity Take Up Units		Fixed Ladders	
Conveyor - Head Chute Access Doors		Laboratory Testing Equipment	
Conveyor - Radial Stackers		Motors – Drive Shafts	
Conveyor - Return Idlers		Motors – Pulleys	
Conveyor - Tripper		Motors- Gear Box	
Conveyor - Underside 2.5m		Primary Hopper	
Conveyors – Head Drum		Pug Mill Mixer	
Conveyors - Tail Drum		Pumps – Water	
Conveyors – Head Snubber		Pumps- Hydraulic	
Conveyors - Tail Snubber		Screen - Inclined	
Crusher - HIS		Screen - Trommel	
Crusher – Impactor		Screens - General	
Crusher – Jaw		Silo Hatch	
Crusher - Rolls		Tunnel Entrances,	
Crusher - VSI		Washing Plants	

Attachment B - Plant and Equipment Component Checklist for Guarding

This checklist should be used to identify what components of plant and equipment may require Guarding and is available in electronic format through the CMPA.

Site		Date
Equipment and or Component	Compliant Yes or No	Action Required
Conveyors		
Pulleys		
Gearbox shaft		
Drive shaft		
Drive belts		
Head drum		
Rock boxes		
Snubber drum		
Belt scraper		
GTU assembly		
Guide rollers		
Trough rollers		
Conveyor belt		
Lanyard		
Return rollers		
Tail drum		
Crusher		
Drive belts		
Fly wheel		
Drive shaft		
Drive pulley		
Infeed hopper		
Engulfment		
Swing stock		
Protection on from fly rock		
Toggle Seat / Toggle		
Toggle Springs		
Feeder		
Drive belts		
Drive chain		
Drive shaft		
Guide rollers		
Head drum		
Snubber drum		
Feeder plate skirting		
Trough rollers		
Return Rollers		
Reciprocating roller		

Reciprocating hydraulics		
Apron Tracks		
Workshop		
Gas bottles		
Grinding tools		
Cutting tools		
Bending/ pressing equipment		
Drilling tools		
Lathes		
Bins/Hoppers		
Bin access equipment		
Bin access people		
Bin discharge gates		
Vibrating nip points		
Wheel stops		
Silos		
Hatch		
Access Platforms		
Ladders		
Discharge point		
Screens		
Drive belts		
Drive shaft		
Pulleys		
Weights & mechanisms		
Vibrating points		
Infeed area		
Rock box discharge area		
Springs		
Auxiliary Drives		
Drive motors		
Drive belts		
Gearbox shaft		
Exhaust hot surfaces		
Driven section		
Discharge area		
Water Collection		
Sediment pits and ponds		
Triple interceptors		
Other		

Attachment C - Guarding Integrity Review Checklist

This checklist should be used at scheduled intervals to review the integrity of your Guarding program and is available in electronic format through the CMPA.

Site	Date	
General Requirements		Action: yes/no
Do the guards prevent workers' body parts from making contact with moving parts?		
Are guards signposted to indicate isolation requirements?		
Are the guards firmly secured and not easily removable?		
Are guards distinguishable from other plant and equipment?		
Are guards provided for all moving parts of the machine including auxiliary parts?		
Do the guards ensure no object will fall into the moving parts?		
Do the guards permit safe, comfortable and relatively easy operation of the machine?		
Do the guards restrict access or egress from the machine/equipment?		
Can the machine be lubricated without removing the guard?		
Is there a system for shutting down the machinery before guards are removed?		
Mechanical Hazards - Point of Operation:		
Is there a point-of-operation guard provided for the machine?		
Does it keep the operator's hands, fingers and body out of the danger area?		
Is there evidence the guards have been tampered with or removed?		
Could you suggest a more practical, effective safeguard?		
Could changes be made to eliminate the point-of-operation hazard entirely?		
Mechanical Hazards - Power transmission apparatus		
Are there any unguarded gears, sprockets, pulleys or flywheels on the apparatus?		
Are there any exposed belts or chain drives?		
Are there any exposed set screws, key ways and collars, etc.?		
Are starting and stopping controls within easy reach of the operator?		
If there is more than one operator, are separate controls provided?		
Non Mechanical Hazards		
Have controls been established to guard workers against dust and noise hazards?		
Training and Instruction of operational and maintenance persons		
Do workers have the necessary training in how to use the guards and why?		
Have workers been trained in what circumstances guards can be removed?		
Is there a procedure for Lockout/Tagout applicable to all plant and equipment?		
Is there a procedure to follow if guards are damaged, missing or inadequate?		
Where several workers work on the same machine, are multiple lockout devices used?		
Are workers trained in the requirements of Lockout/Tagout?		

Attachment D – Guarding Example Photo Gallery

Conveyor Guarding



- Example of a well guarded conveyor with adequate protection up from tail drum and down from head drum with easily accessible lanyard.

Transfer Conveyor



- Example of a well guarded transfer conveyor with easily accessible lanyard.

Tail Drum - Fixed Distance Guard within a Fence Guard.



- *Conveyor tracking bolts protruding*
- *Distinguishable colour*
- *"Isolate drive before removing guard" signage*

Tail Drum - Fixed Distance Guard



- *Hangs from top, bolt on at base of frame*
- *Provides clearance for cleaning*
- *"Isolate drive before removing guard" signage*

Conveyor Return Roller - Fixed Distance Guard



- *Appropriate signage*
- *Ample clearance for aggregate spills*
- *Aperture size of mesh allows <30mm aggregates to fall*

Conveyors - Fixed Distance Guard



- *Complete coverage of all access points to conveyor*

Conveyor Under Side - Fence Guard



- *Restricts access to anywhere under conveyor*
- *Allows for hose down and cleaning*

Head Chute - Fixed Enclosure Guard



- *Hinged door to provide access to chute*
- *Secured with bolt*
- *Appropriate signage*

Head Drum – Fixed Enclosure Guard and Fixed Distance Guard



- *Fixed Enclosure Guard on Head Drum and Chute*
- *Fixed Distance Guard on conveyor head*

General – all Guards



- *Clear signage identifying conveyor number and isolation zone*

Primary Hopper



- *Swinging gate barrier used as part of the lockout regime when working in feed bins or hoppers*
- *Deflectors plates to restrict falling materials*
- *Yellow bollards provide direction to bin*

Motor Drive Shafts - Fixed Distance Guard



- *Utilises rubber mounting to reduce vibration*
- *Provides view of shaft*

Motor Pulleys - Fixed Distance Guard



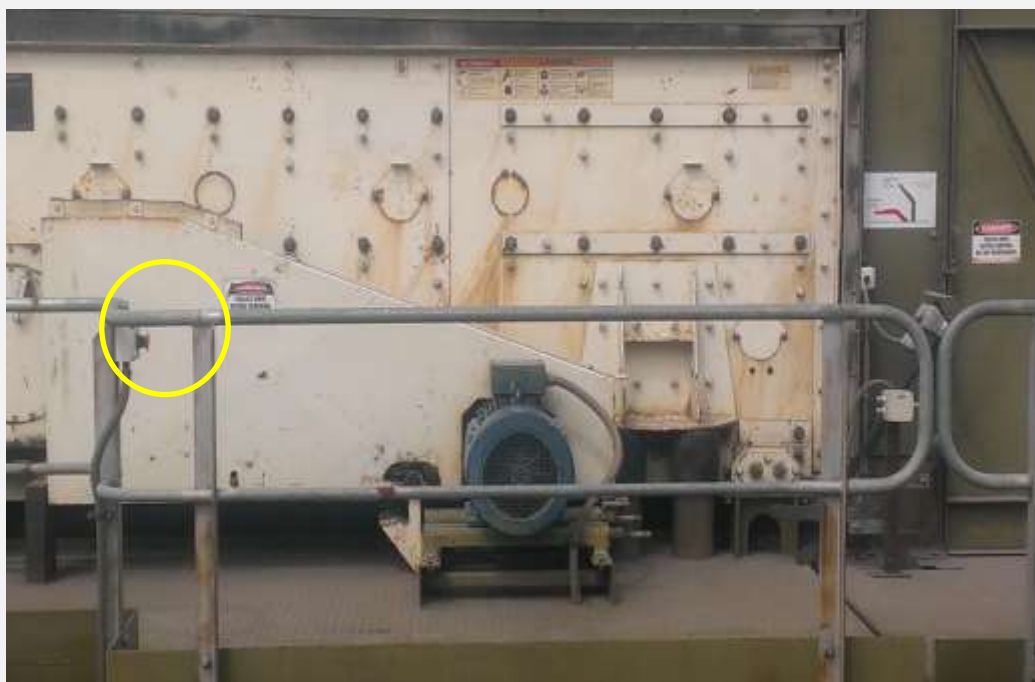
- *Low aperture mesh provides view of vee belts*
- *Easily accessible and clearly identifiable emergency stop button*

Coil Springs Fixed Enclosed Guard



- *Utilising rubber to cater for movement*

Drive Belts on Screen - Fixed Enclosed Guard



- *Suitable width of catwalk remains inclusive of area to place Guard during maintenance*
- *Easily accessible and clearly identifiable emergency stop button*

Transformer - Fence Guard



- *High Voltage Signage*
- *Padlocked gate*

Fence Guard General



- *Restricting access to large areas of plant whilst allowing hose down and cleaning*

Waste Water Pit



- *Appropriate signage*
- *Provides full fall protection*

Radial Stacker - Lanyard



- *Lanyard around perimeter accessible from all points of potential entry*

Radial Stacker - Fixed Distance Guard



- *Lanyard around perimeter accessible from all points of potential entry*
- *Fixed enclosure guard on wheel drive*

Cement Silo - Fence Guard



- *Restricts access to silo*
- *Appropriate signage*

Gravity Take up on Conveyor - Fixed Distance Guard



- *Easily distinguishable in yellow paint*

Tail Drum Guard – Fixed Distance Guard



- *Tail drum Guard covers all nip and shear points*
- *Provision is made for clean-up max 200mm*
- *Servicing is carried out without removal of the guard*

Primary Crushers Openings



- *Feed chutes have wing walls*
- *Feed openings are guarded*
- *Feed chutes have energy dissipation devices*
- *Control room windows are guarded against fly rocks*

Fence Guard Transformer Power Packs, Fans, Hydraulic hoses, pumps



- *Fittings are protected from damage*
- *Pump shafts are guarded*
- *Fan blades are guarded*

Electrical Cable



- *Fully enclosed at any potential impact point*

Pit Bins and Openings



- *Entry point barrier to prevent unauthorised access*
- *Bin surface grated or gridded to prevent engulfment*
- *Wheel stops prevent front end loader from entering bin*

Side Bin



- *Front wall barrier to prevent unauthorised access*
- *Swinging gate barrier used as part of the lockout regime when working in feed bins or hoppers*

Pit and Side Bins



- *Heavy mesh grid covers to prevent access*

Over flow chute on Head Drum



- *Fixed Distance Guard with overflow chute coming from head drum*

Over flow chute on Head Drum



- *Fixed Distance Guard with overflow chute coming from head drum*

Cable Ties



- *Cable ties being used to temporarily secure a Fence Guard*

Mat Black Guards



- *The viewing section of some guards are painted mat black to facilitate visual inspection*

CMPA