

Risk Assessment and Guarding Principles



A risk assessment must be carried out to identify the hazards relating to equipment, including the potential for injury, the possible severity and the likelihood of occurrence for each hazard identified. This will help with the identification of the most suitable guarding arrangements.

Principal features for the design of guards include:

- Strong construction
- Use of robust materials
- Be suitable for the conditions in which they are used
- To allow moving machinery to be seen where necessary e.g. through a mesh guard
- Avoid the introduction of additional risks
- Prevent by-pass or rendering non-operational
- Be designed, located and installed to ensure that access to dangerous machinery is prevented by any person, their body parts or clothing

The following hierarchy of control measures, ranked in the order that they should be implemented, must be in place to protect all dangerous parts of machinery:

- Close Fitting Fixed Guards
- Perimeter / Distance Guards
- Pressure Mats and Induction Loops
- Light Beams and Light Curtains
- Protection Appliances Such as Jigs, Holders and Push Sticks

In addition to preventing access to dangerous parts of moving machinery, guarding may also be required to provide protection from extreme temperatures of machinery, the potential for ejected particles and the potential for falls into storage hoppers, silos, etc.

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Close Fitting Fixed Guards

Where possible dangerous parts of moving machinery should be close guarded to prevent people being able to work inside the guarded area. Typical examples include the head and tail end of conveyors, any transition points and crusher drives:

Fixed Guards

- Must be held in place with fastenings which require a tool to release them. This excludes cable ties and wire or other such bindings.
- Where nip/trap points are present and therefore guards are fitted to the underside of conveyors, there may be a risk of spillage accumulating within the guard; the guard mesh should be of a size sufficient to allow spillage to fall through (where safe to do so), whilst preventing access to the moving parts within the guard.
- Should be designed so that lubrication and adjustment can be carried out without removing guards wherever possible.



Note: There is no requirement (unless environmental) to guard the full length of conveyors if there are no nip points, this can add additional loading from weight, wind, etc. creating risk where this loading has not been factored into the design of the equipment. Emergency pullwires / stop buttons should however be readily accessible throughout the length of the conveyors.



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Perimeter / Distance Guards

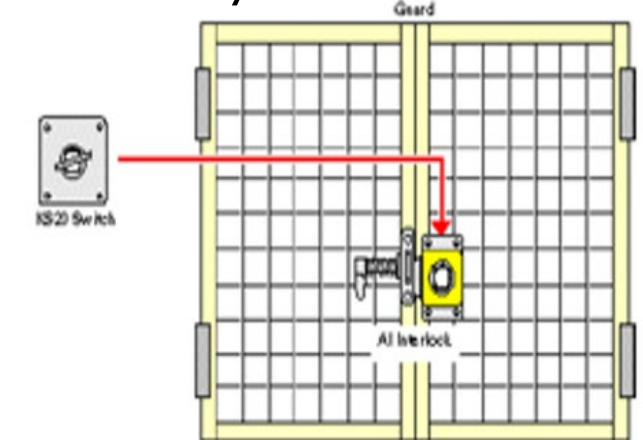
Where it is not practical to install close fitting / fixed guards, then perimeter / distance guards are the next in the hierarchy. These guards should be secured to a solid foundation or adjacent structure. The height of the guards above surrounding ground level should be a minimum of two metres.

Where regular access is required for process requirements or maintenance, gates shall be installed which are secured in place during normal operations. Risk assessment shall consider if interlocks are also required to provide additional protection to prevent any parts moving whilst those parts can be accessed. Where the working area is large enough for someone to go unnoticed and be shut inside and there is a significant risk of contact with moving machinery, captive key interlock systems must be used; these systems release a safety key for retention by the person entering the danger area. Where more than one person is involved in the work, an additional safety key will be required for each person to keep them safe at all times. This individual key requirement for additional workers can be achieved using an isolation clasp and padlock arrangement on the electrical isolator, following LOTOTO procedures. For lower risk areas, where frequent access is required, more simple electrical interlocks may be considered; however, all interlock systems must operate on the mains voltage, rather than control circuitry, disconnecting all three electrical phases.

Remote greasing lines should be provided to enable lubrication of bearings to be carried out without entering the guarded area.



Trap key interlock systems



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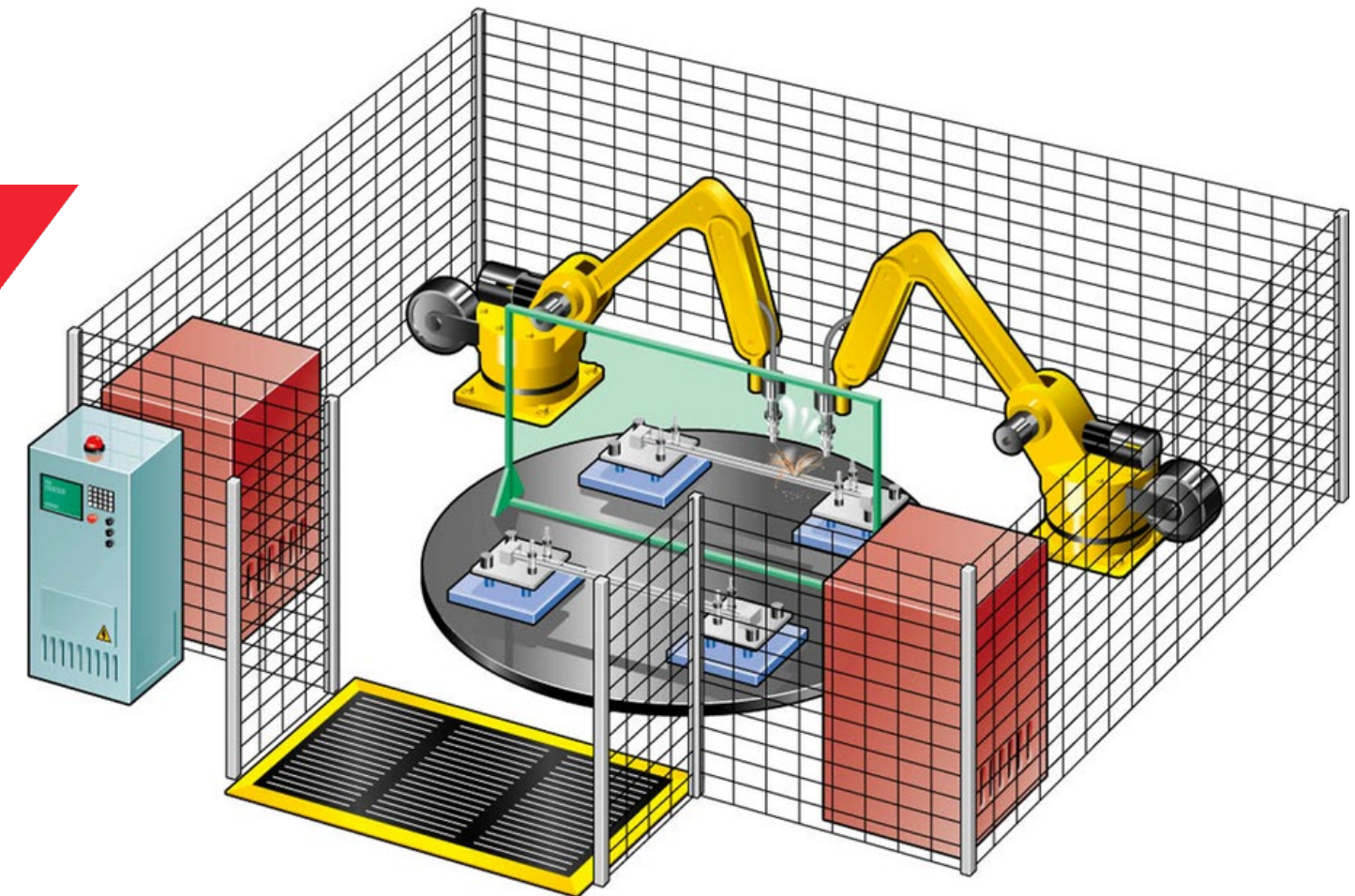


Pressure Mats and Induction Loops

Protection devices, such as pressure mats, induction loops, light beams and curtains are further down the hierarchy of control as they do not prevent access to equipment, but stop its movement before contact is made. They are not widely used in our industry, however they can be used where regular access is required to lower risk areas and there are no nip points and no access to higher risk automated equipment. They can also be used as a secondary protection device inside distance guarded areas to further minimise the risk of injury from contact with moving machinery, for example enclosures for robots.

Adequate information, instruction, supervision and training is always important, even if the hazard is protected by hardware measures, however, they are especially important when the risk cannot be adequately eliminated by the hardware measures.

WARNING: Such protection devices should only be used in specialised circumstances, where adequate protection cannot be achieved with close or distance guarding alone, and only after consultation with a Health and Safety Specialist.



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Light Beams and Light Curtains

Where the configuration of machinery means the risk of injury is low and regular access is required, for example for quality control purposes, consideration can be given to the use of light beams / curtains. Typical applications include access points to linear conveyors on production lines, where there are no nip points or access to higher risk automated equipment.

Care must be taken to ensure access is restricted to areas of higher risk and machinery must require positive action to restart, ensuring the area is clear and safe with no one left in a danger area, rather than starting automatically.



Light curtains are commonly used trip devices. They operate by detecting an obstruction in the path taken by a beam or beams of light. Interruption of the light beam(s) while the machine is operational results in a signal being given for the machine to stop. The speed of stopping should be calculated to ensure any dangerous parts have come to rest before they can be reached by the operator. It is important that light curtains are positioned correctly (as with any other guard), and that operators cannot crawl under, climb or reach around a light curtain to access hazardous moving parts or areas. It is recommended light beams include an emitter at one end and receiver at the other, rather than relying on a reflected beam, as hi-vis personal protective equipment has been known to cause such systems to malfunction.

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Protection appliances such as Jigs, Holders and Push Sticks

These are generally found in workshops and are used with equipment where cutting blades are exposed, for example bench and band saws. They are at the bottom of the hierarchy of control because they do not prevent access to hazardous moving machinery.

Where they are used, it is essential that personnel are authorised and competent. The dangerous moving parts of machinery should be guarded so far as possible and operators should be trained in pre-use inspection and the setting of the tools to minimise the risk of injury. High standards of housekeeping and exclusion zones should be maintained around workshop tools so far as possible.

All workshop tools should be fitted with readily accessible emergency stop devices.



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All Guards should be subject to an initial commissioning examination and subsequent routine inspection regime to ensure they are - and remain - fit for purpose.

Suitable information, instruction, training and supervision must be in place to ensure all personnel are aware of, and understand the necessary Safe Systems of Work.

Where possible, guarding arrangements should be installed to allow routine adjustment and maintenance of the guarded machinery without the need to remove the guard. (e.g. Remote greasing points, External adjusters for tracking). If this is not possible then a strict safe system of work should be enforced.

Before the removal of guards for the purpose of carrying out cleaning, maintenance or adjustment on any machinery, the power source should be isolated and locked off.

Isolation and lock off should be considered from ALL forms of energy in static and mobile plant, i.e.:

- Electrical
- Pneumatic
- Hydraulic
- Mechanical / Gravity

All forms of stored ('potential') energy should be assessed and safely dissipated / released / locked before the removal of guards from machinery.

All relevant personnel shall be trained in isolation and lock-off procedures to include a practical demonstration of the isolation and lock off. On completion of training, a record of training shall be completed and filed.

Isolation lock off shall only be carried out by individuals using their own personal isolation padlocks.

Automatic isolation systems such as 'key exchange systems', which disconnect all three electrical phases, may be considered to provide effective electrical isolation, and may be used for repeated activities of short duration inside guarded enclosures.

Where it is necessary for numbers of personnel to enter guarded areas, all individuals will fit their own lock by means of a multi hasp. Pull wires and emergency stops are not considered as providing sufficient isolation.

No employee or contractor should remove any isolation padlock other than the one allocated to them personally.

Spare or duplicate keys are prohibited.

When work is expected to last longer than one shift or day, it is recommended that the responsible person for operations (Manager, Foreman, or Electrician) should fit a Passover padlock to the multi-hasps to ensure the equipment remains locked between the shift change.

The use of "Manager in Charge" locks is encouraged; whereby the relevant manager / supervisor adds his / her own locks to the isolation, only removing them on completion of the works, after all safeguards have been restored and other isolation locks removed.