

SAFETY ON MACHINERY

Introduction

Misuse of power driven plant and machinery can result in serious bodily injuries. Whilst such plant and machinery is mostly found inside workshops, they could also be used in various non-workshop environment.

Dangers from plant and machinery can arise in two ways. The first is possibly the easier to recognise - MACHINERY HAZARDS, including traps, impact, contact, entanglement etc. The second way is by NON-MACHINERY HAZARDS, which include electrical failure, exposure to chemical sources, pressure, temperature, noise, vibration and radiation. This guidance addresses on the machinery hazards related to such equipment and the safety measures in controlling these hazards. Other non-machinery hazards are dealt with in other guidelines under their respective headings.

Under the Occupational Safety and Health Regulation, plant/machinery must be installed and maintained so that it is safe & without risks to the safety and health of persons and that dangerous parts of the plant/machinery are effectively guarded.

Machinery Hazards

The major hazards of most mechanical equipment lie with their dangerous moving parts. The followings are classified as dangerous moving parts of plant and machinery.

- Revolving shafts, couplings, spindles, mandrels, bars and flywheels
- In-running nips between pairs of rotating parts
- In-running nips of the belt and pulley type
- Projections on revolving parts
- Discontinuous rotating parts
- Revolving beaters, spiked cylinders and revolving drums
- Revolving mixer arms in casings fitted with openings
- Revolving worms and spirals in casings fitted with openings
- Revolving high-speed cages in casings fitted with openings
- Revolving cutting tools
- Reciprocating cutting tools
- Reciprocating press tools and dies
- Reciprocating needles
- Closing nips between platen motions
- Projecting belt fasteners and fast running belts
- Nips between connecting rods or links, and rotating wheel cranks or discs
- Traps arising from the traversing carriages of self-acting machines

Methods of Preventing Machinery Hazards

Safety by Design

The most effective method of preventing machinery-related accidents is to eliminate the cause of danger by design as far as is reasonably practicable.

“Intrinsic Safety” is a process by which the designer eliminates danger at the design stage with consideration for the elimination of dangerous parts, making parts inaccessible, reducing the need to handle work pieces in the danger areas, provision of automatic feed devices, and enclosure of the moving parts of the machine. Designers should also ensure that machines fail to safety and not to danger.

During design stage, designers should consider the safety of operatives during cleaning and maintenance operations. Routine adjustments, lubrication etc. should be carried out without the removal of safeguards or dismantling of machinery components.

Guarding of Machinery

Another practicable way is to install proper guards and/or safety devices to those dangerous moving parts. The guarding of dangerous moving parts of machinery is mandatory and is regulated by Part II of the Occupational Safety & Health Regulation (Cap. 509) and the Factories and Industrial Undertakings (Guarding and Operation of Machinery) Regulation (Cap. 59). See below for various types of machine guarding.

Other Supplementary Measures

Besides guarding of machinery, supplementary measures such as machine layout, proper supervision, good housekeeping, protective clothing etc. will also be essential in preventing machinery-related accidents.

To ensure that plant and machinery to be purchased is intrinsically safe, Finance Office had set up a tick box system on the special safety requirements when requisition order is raised by user departments. User departments are required to tick in the relevant box when requisition order for plant or machinery is raised so that such safety requirements could be included in the purchase order. The supplier will be held responsible for all claims arisen from failing to comply with the requirements.

Types of Machine Guarding

Dangerous parts of a machine can be guarded by a number of ways, the selection of which will depend upon the needs of the operations. Some common ways of guarding the dangerous parts of a machine include:

Fixed Guards

A fixed guard by its design and construction, prevents access to the dangerous part of a machine. Such a guard has no moving parts associated with nor is it dependent upon the machine on which it is fitted. A fixed guard is most suitable for guarding prime movers, transmission machinery and points of operation where manual feeding and withdrawal of materials are not necessary. Furthermore, if opening in the fixed guard is required, it must be limited in size relative to the distance between such an opening and the point of operation on the machine. The specifications can be obtained in the Factories and Industrial Undertakings (Guarding and Operation of Machinery) Regulation.

Adjustable Guards

An adjustable guard is comprised of a fixed guard with adjustable elements which the machine operator has to set into position to suit the operation. They are widely used on woodwork and toolroom machines. Where adjustable guards are used, the operators should be fully trained on how to make proper adjustments to obtain maximum protection.

Interlocking Guards

An interlocking guard is designed to operate in such a manner that the machine on which it is installed cannot be operated unless the interlocking guard is in a closed position; and the guard cannot be opened unless the machine is not in motion or its removal from a closed position causes the machine to cease its motion at once. The interlocking features are normally achieved by means of a combination of electrical interlock to control the operation of machinery and mechanical interlock to control the opening of the guard.

Automatic Guards

This type of guard is designed to remove an operator or his/her hands from the point of dangerous area of a machine before trapping can occur at the point of operation. The guard is actuated by the movement of the dangerous moving part of machinery when the machine cycle is initiated and is arranged so that the machine will not move until the guard is in the safe position. A version of this type of guard moves across the work area as the machine operation is initiated, preventing any contact with the machine in the area. This type is sometimes known as a "weep-away" guard.

Trip Guards

This type of guard automatically stop or reverse the machine before the operative reaches the dangerous area of a machine. They rely upon sensitive trip mechanisms, either mechanically or electronically (e.g. photoelectric cell, electric eye), and on the machine being able to stop quickly (which may be assisted by a brake).

Two-hand Control Devices

Two-hand controls are used on machines on cyclic operations where the work is placed in the machine and the machine struck on. They are applicable only to machines with a single operator and the control buttons must be positioned more than a hand-span apart. The control circuit should be arranged so that both controls must be activated simultaneously to start the cycle and that both controls must be released after each cycle before the next cycle can be initiated. Release of either button during the dangerous part of the cycle must stop or reverse the machine movement. For guarding against the perverse ingenuity of some operators, it is important to install a time mechanism in a two-hand control device so that the controls must be engaged simultaneously before a cycle of operation can be set in motion.

Construction of Guards

Every guard must be rigid and of substantial construction, and the materials incombustible. Wherever practicable, guards should be made from solid material in preference to perforated or open mesh construction.

Maintenance of Guards

Regular and frequent checks of machine guards should be conducted to ensure that they are in a good stage of repair and are kept in position. All automatic guards, interlocking guards, two-hand control devices, etc. should be regularly inspected and functional tested by a responsible and competent person, and that a record should be kept of the results and any action taken.

Training of Operators

Under the PolyU health and safety training policy, it is the supervisor's duty to ensure that each and every staff under his/her control has been properly trained so that they can carry out their duties safely without endangering themselves or others.

Operators of machines should have been properly trained to the extent that he is proficient in the work and on the operation of the machines, and have been fully instructed as to the dangers that can arise in the use of the machine and the precautions to be observed. Inexperience operators should be properly supervised.

Working Environment

Machines should be sufficiently spaced out in a workshop to minimise hazards related to overcrowding and facilitate access for operation, supervision, maintenance, adjustment and cleaning.

The floor area around machines should be maintained in good and level condition, and be free of loose material or slippery substances. Cables and pipes should be placed with sufficient spacing and headroom to allow safe access and to avoid tripping.

Adequate lighting should be provided for working with machines. Artificial lighting should be placed or shaded in ways to prevent direct rays of light from impinging on the eyes of the operator while he is operating the machine.