

#### ♦ Administration Controls

**Safe Operating Procedures** – required for each robot system include instructions on setting up, safety precautions, maintenance/care, power supply requirements, lockout and safe operation.

**Safety 'Permit to Work'** – detail the type of work to be carried out, by whom, the safety precautions, the time limit and the specific operating procedures required for most systems. This must be signed by an authorised person.

**Training** – required prior to maintaining, operating or teaching others how to operate robot systems.

**Further assistance on the guarding of industrial robots can be found in Australian Standards:**

- AS 2939 – Industrial robot systems – safe design and usage
- AS 4024 – Safeguarding of machinery – general principles.

Where can I find more help?

## WORKPLACE SERVICES

Call us on  
1300 365 255

**Adelaide Office**  
Level 3, 1 Richmond Road  
KESWICK SA 5035

Visit our website

www.**Eric**.sa.gov.au

#### Statewide Emergency

Serious accidents and incidents report number  
1800 777 209 (24 hour service)

Further Australian Standards are available from:

Standards Australia  
63 Greenhill Rd, Wayville  
Telephone – 1300 654 646  
[www.standards.com.au](http://www.standards.com.au)

Further publications in the Machine Guarding suite are available from Workplace Services and include:

Machine Guarding – Booklet  
Machine Guarding – Risk Assessment Form  
Machine Guarding – Metal Fabrication Industry Brochure  
Machine Guarding – Design and Types Brochure  
Machine Guarding – Woodworking Industry Brochure



Department for Administrative  
and Information Services  
Workplace Services

## INDUSTRIAL ROBOTS

# Machine Guarding



MAJOR WORKPLACE HAZARDS



Government  
of South Australia

## MACHINE GUARDING – INDUSTRIAL ROBOTS

Industry is increasingly using robots to carry out hazardous tasks. However, in doing so other hazards may be created. Appropriate training, risk minimisation strategies, guarding and controls must be put in place to prevent worker injury.

*“Industrial robot means a multifunctional manipulator (and its controllers) that is capable of handling materials, parts, tools or specialised devices through variable programmed motions for the performance of a variety of tasks”.*

*OHS&W Regulations 1995 1.1.5 (1)*

## RISK ASSESSMENT & CONTROL

The *Occupational Health, Safety and Welfare Regulations 1995 Division 3.3*, requires that a **Hazard Identification** and **Risk Assessment** be conducted prior to operating any type of guard.

If an **assessment** identifies a **risk** it must be **eliminated** or, where that is not reasonably practicable – the risk must be **minimised**.

## HAZARDS

When identifying industrial robot operating hazards consider:

- ♦ **Access to the work space** – entering the work space of a robot when barriers/guards are not in place may create ‘trapping’ and ‘impact’ hazards.
- ♦ **Maintenance and programming** – most accidents occur when employees enter the work space of the robot during maintenance or programming.
- ♦ **Stored energy** – a stationary robot, when powered up, may suddenly activate without warning.

- ♦ **Chemicals** – breakdown of processes or hydraulics could result in substances being flung outside the guarded area.
- ♦ **Electrical** – electrocution and electromagnetic interference can affect control systems that rely upon software, correct programming and calibration.
- ♦ **Environmental** – certain applications may create dust, ionizing radiation or flammable and explosive atmospheres.
- ♦ **Installation** – design requirements and layout of robot equipment, utilities and facilities can be hazardous if inadequately installed.
- ♦ **Malfunctions** – or unintended movement due to human error, inadvertent startup, hydraulic failure, ignoring safety controls, runaways etc. Controls and software generally prevent these.
- ♦ **Human Error** – unfamiliarity with a robot’s redundant motions can lead to individuals placing themselves in hazardous positions while programming the robot or performing maintenance.

## RISK CONTROL

A **Risk Assessment** of an unguarded industrial robot may identify the ‘degree of possible harm’ to be ‘HIGH’ (potentially lethal) and the ‘probability of occurrence’ to be ‘HIGH’.

For this reason robots must be **guarded by at least one** of the following methods:

- ♦ **Guards**
  - ♦ Fixed Guards
  - ♦ Interlocked Guards
  - ♦ Presence Sensing Devices

*For further information on these guard types refer to the Workplace Services publication, ‘Machine Guarding – Design & Types’.*

## ♦ Lockout Systems

The best way to safeguard a robot is to:

- ♦ remove the power
- ♦ lock out and tag
- ♦ release (or block) any stored power

Lockout systems can vary; however, each must be of the latch type. This ensures that if tripped, the robot can only be reset manually from the main control panel.

**Captive Key Interlock** – a transferable key for the latch is matched to the isolation switch on the control panel. This can only be removed and used, once the control is in the ‘off’ position.

**Software Interlocking** – lockout systems can be routed via software controls that have read-only programs.

**Park Position Interlock** – a limit switch detects when a robot has returned to a safe ‘park’ position. If the robot moves from the park position, brakes are automatically applied and the power is removed.

**Energy Release/Control** – a facility to release pressure through hydraulic and pneumatic accumulators. Consider run-down time and the effects of gravity, particularly if the robot malfunctions.

**Emergency Stops** – stop the machine as soon as possible and apply a brake, isolating power systems (*eg, pneumatic, electric, hydraulic, etc*). Each robot must have at least one emergency stop.

**Multi-Station** – robots or production line systems usually have a sequence of movements that are too complex to individually isolate each robot. In this case, the robots are treated as one large robot and entry or malfunction causes all robots to stop.