# CONFINED SPACES

## Code of Practice

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# FOREWORD

This Code of Practice on how to manage the risks associated with confined spaces in workplaces is an approved code of practice under section 274 of the *Work Health and Safety Act* (WHS Act).

An approved code of practice is a practical guide to achieving the standards of health, safety and welfare required under the WHS Act and the *Work Health and Safety Regulations 2011* (the WHS Regulations).

A code of practice applies to anyone who has a duty of care in the circumstances described in the code. In most cases, following an approved code of practice would achieve compliance with the health and safety duties in the WHS Act, in relation to the subject matter of the code. Like regulations, codes of practice deal with particular issues and do not cover all hazards or risks that may arise. The health and safety duties require duty holders to consider all risks associated with work, not only those for which regulations and codes of practice exist.

Codes of practice are admissible in court proceedings under the WHS Act and Regulations. Courts may regard a code of practice as evidence of what is known about a hazard, risk or control and may rely on the code in determining what is reasonably practicable in the circumstances to which the code relates.

Compliance with the WHS Act and Regulations may be achieved by following another method, such as a technical or an industry standard, if it provides an equivalent or higher standard of work health and safety than the code.

An inspector may refer to an approved code of practice when issuing an improvement or prohibition notice.

This Code of Practice is based on the draft code of practice developed by Safe Work Australia as a model code of practice under the Council of Australian Governments' *Inter-Governmental Agreement for Regulatory and Operational Reform in Occupational Health and Safety* for adoption by the Commonwealth, state and territory governments.

A draft of that model code of practice was released for public consultation on 7 December 2010 and was endorsed by the Workplace Relations Ministers' Council on 10 August 2011.

# SCOPE AND APPLICATION

This Code of Practice provides practical guidance on how to meet the requirements under the WHS Regulations in relation to work carried out in a confined space. It applies to persons conducting a business or undertaking who have management or control of a confined space, and to designers, manufacturers or suppliers of plant or structures that include, or are intended to include, a confined space.

This Code of Practice will help determine when a space is a 'confined space' for the purposes of the WHS Regulations, what the potential hazards are and how to eliminate or minimise the risks when carrying out work in a confined space.

This Code of Practice can also be used by workers and their health and safety representatives interested in understanding the hazards and risks associated with confined spaces.

### *How to use this Code of Practice*

In providing guidance, the word 'should' is used in this Code of Practice to indicate a recommended course of action, while 'may' is used to indicate an optional course of action.

This Code of Practice also includes various references to provisions of the WHS Act and Regulations which set out the legal requirements. These references are not exhaustive. The words 'must', 'requires' or 'mandatory' indicate that a legal requirement exists and must be complied with.

# 1. INTRODUCTION

Confined spaces pose dangers because they are usually not designed to be areas where people work. Confined spaces often have poor ventilation which allows hazardous atmospheres to quickly develop, especially if the space is small. The hazards are not always obvious and may change from one entry into the confined space to the next.

The risks of working in confined spaces include:

- loss of consciousness, impairment, injury or death due to the immediate effects of airborne contaminants
- fire or explosion from the ignition of flammable contaminants
- difficulty rescuing and treating an injured or unconscious person
- asphyxiation resulting from oxygen deficiency or immersion in a free-flowing material, such as liquids, grain, sand, fertiliser or water.

## 1.1 WHAT IS A CONFINED SPACE?

A confined space is determined by the hazards associated with a set of specific circumstances and not just because work is performed in a small space.

**Regulation 5:** A confined space means an enclosed or partially enclosed space that:

- is not designed or intended primarily to be occupied by a person; and
- is, or is designed or intended to be, at normal atmospheric pressure while any person is in the space; and
- is, or is likely to be, a risk to health and safety from:
    - an atmosphere that does not have a safe oxygen level,
    - contaminants, including airborne gases, vapours and dusts, that may cause injury from fire or explosion, or
    - harmful concentrations of any airborne contaminants, or
    - engulfment.

Confined spaces are commonly found in vats, tanks, pits, pipes, ducts, flues, chimneys, silos, containers, pressure vessels, underground sewers, wet or dry wells, shafts, trenches, tunnels or other similar enclosed or partially enclosed structures, when these examples meet the definition of a confined space in the WHS Regulations.

### *What is not a confined space for the purposes of the WHS Regulations?*

A confined space does not include a mine shaft or the workings of a mine.

The following kinds of workplaces are also generally not confined spaces for the purposes of the WHS Regulations:

- places that are intended for human occupancy and have adequate ventilation, lighting and safe means of entry and exit, such as offices and workshops
- some enclosed or partially enclosed spaces that at particular times have harmful airborne contaminants but are designed for a person to occupy, for example abrasive blasting or spray painting booths
- enclosed or partially enclosed spaces that are designed to be occasionally occupied by a person if the space has a readily and conveniently accessible means of entry and exit via a doorway at ground level, for example:
    - a cool store accessed by a LPG forklift to move stock – although the use of a LPG forklift in a cool store can be hazardous, the door at ground level means that once the alarm is raised, escape and rescue can happen quickly
    - a fumigated shipping container with a large ground level opening will facilitate easy escape and rescue.

Trenches are not considered confined spaces based on the risk of structural collapse alone, but will be confined spaces if they potentially contain concentrations of airborne contaminants that may cause impairment, loss of consciousness or asphyxiation.

## 1.2 WHO HAS HEALTH AND SAFETY DUTIES IN RELATION TO A CONFINED SPACE?

A **person conducting a business or undertaking** has the primary duty under the WHS Act to ensure, so far as is reasonably practicable, that workers and other persons are not exposed to health and safety risks arising from the business or undertaking.

The WHS Regulations include specific obligations on a person conducting a business or undertaking who has management or control of a confined space.

**Designers, manufacturers and suppliers of plant or structures** that include a space that is intended, or is likely to become, a confined space must eliminate the need for any person to enter a confined space and eliminate the risk of inadvertent entry or, if this is not reasonably practicable, ensure safe means of entry and exit and minimise risks to the health and safety of any person who enters the confined space.

**Officers**, such as company directors, have a duty to exercise due diligence to ensure that the business or undertaking complies with the WHS Act and Regulations. This includes taking reasonable steps to ensure that the business or undertaking has and uses appropriate resources and processes to eliminate or minimise risks that arise from entry into confined spaces.

**Workers** must take reasonable care for their own health and safety and that their work does not adversely affect the health and safety of other persons. Workers must comply with any reasonable instructions given relating to confined space entry permits, risk control measures and emergency procedures, and should carry out work in a confined space in accordance with any relevant information and training provided to them.

Emergency service workers are not required to comply with some requirements (WHS Regulations 67 and 68) for entering confined spaces when either rescuing a person or providing first aid to a person in the space.

## 1.3 WHAT IS REQUIRED IN MANAGING RISKS?

Duties in relation to confined spaces include:

- managing health and safety risks associated with a confined space, including risks when entering, working in, on or near a confined space, as well as the risk of inadvertent entry
- ensuring, so far as is reasonably practicable, that a worker does not enter a confined space until all the duties in relation to the confined space have been complied with, for example entry permit requirements
- establishing first aid and rescue procedures to be followed in the event of an emergency in the confined space.

The WHS Regulations also set out requirements for specific controls measures including communication and safety monitoring, signs, isolation of connected plant and services, and controls to maintain a safe atmosphere within the confined space.

**Regulation 34-38:** In order to manage risk under the WHS Regulations, a duty holder must:

- identify reasonably foreseeable hazards that could give rise to the risk
- eliminate the risk so far as is reasonably practicable
- of it is not reasonably practicable to eliminate the risk – minimise the risk so far as
  is reasonably practicable by implementing control measures in accordance with the
  hierarchy of control
- maintain the implemented control measure so that it remains effective
- review, and if necessary revise, risk control measures so as to maintain, as far as is
  reasonably practicable, a work environment that is without risks to health and
  safety.

This Code includes guidance on how to manage the risks associated with a confined space by following a systematic process that involves:

- identifying hazards associated with confined spaces
- assessing the risks associated with these hazards
- implementing risk control measures
- reviewing risk control measures.

Guidance on the general risk management process is available in the ***Code of Practice: How to Manage Work Health and Safety Risks***.

**Section 47:** The WHS Act requires that you consult, so far as is reasonably practicable, with workers who carry out work for you who are (or are likely to be) directly affected by a work health and safety matter.

**Section 48:** If the workers are represented by a health and safety representative, the consultation must involve that representative.

Consultation with workers and their health and safety representatives is a critical part of managing work health and safety risks.

You must consult your workers who are involved in carrying out work in or near a confined space during the process of identifying hazards, assessing risks and implementing control measures.

It is often more effective to involve a team of people in the risk management process to draw on a range of knowledge and experience, for example knowledge of:

- the particular confined space under assessment
- any work methods that will be used in or near the confined space
- confined space hazards and control measures.

***Consulting, co-operating and co-ordinating activities with other duty holders***

**Section 46:** If more than one person has a duty in relation to the same matter, each person with the duty must, so far as is reasonably practicable, consult, co-operate and co-ordinate activities with all other persons who have a work health or safety duty in relation to the same matter.

Sometimes more than one person conducting a business or undertaking will have the same duty in relation to a confined space. For example, a person who owns the plant or structure that contains the confined space will have management or control of the confined space. A contractor engaged to carry out work in the same space will also have management or control of the confined space at the time that work is being carried out. In these situations, effective communication, co-operation and co-ordination of activities between duty holders is essential to ensure that risks associated with the confined space are eliminated or minimised as far as is reasonably practicable.

Further guidance is available in the ***Code of Practice: Work Health and Safety Consultation, Co-operation and Co-ordination***.

## 1.4 HOW TO DETERMINE WHETHER A SPACE IS A CONFINED SPACE

A confined space is determined by the structure and a specific set of circumstances. The same structure may or may not be a confined space depending on the circumstances when the space is entered. Entry to a confined space is considered to have occurred when a person's head or upper body enters the space.

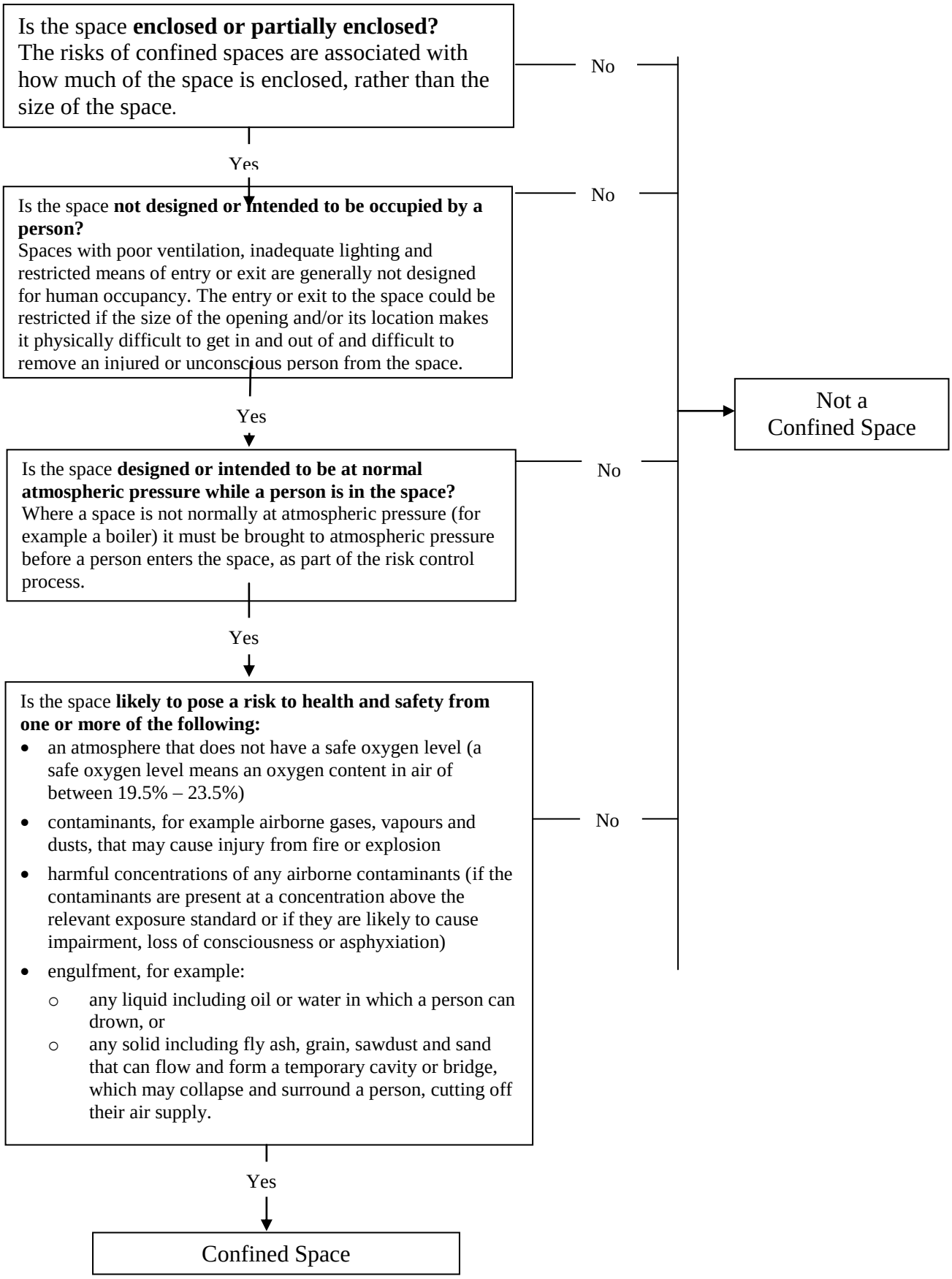
A space may become a confined space if work that is to be carried out in the space would generate harmful concentrations of airborne contaminants.

Temporary control measures such as providing temporary ventilation or achieving a satisfactory pre-entry gas test will not cause a confined space to be declassified. For a confined space to be declassified as a non-confined space, it needs to have

undergone sufficient changes in structure and use to eliminate all inherent hazards that define a confined space.

The following flowchart will help to determine whether a space is a 'confined space' for purposes of the WHS Regulations.

**Appendix A** provides examples to illustrate how a confined space is determined.


Is the space **enclosed or partially enclosed?**
The risks of confined spaces are associated with how much of the space is enclosed, rather than the size of the space.
No
Yes
Is the space **not designed or intended to be occupied by a person?**
Spaces with poor ventilation, inadequate lighting and restricted means of entry or exit are generally not designed for human occupancy. The entry or exit to the space could be restricted if the size of the opening and/or its location makes it physically difficult to get in and out of and difficult to remove an injured or unconscious person from the space.
No
Yes
Is the space **designed or intended to be at normal atmospheric pressure while a person is in the space?**
Where a space is not normally at atmospheric pressure (for example a boiler) it must be brought to atmospheric pressure before a person enters the space, as part of the risk control process.
No
Yes
Is the space **likely to pose a risk to health and safety from one or more of the following:**
• an atmosphere that does not have a safe oxygen level (a safe oxygen level means an oxygen content in air of between 19.5% – 23.5%)
• contaminants, for example airborne gases, vapours and dusts, that may cause injury from fire or explosion
• harmful concentrations of any airborne contaminants (if the contaminants are present at a concentration above the relevant exposure standard or if they are likely to cause impairment, loss of consciousness or asphyxiation)
• engulfment, for example:
o any liquid including oil or water in which a person can drown, or
o any solid including fly ash, grain, sawdust and sand that can flow and form a temporary cavity or bridge, which may collapse and surround a person, cutting off their air supply.
No
Yes
Confined Space
Not a Confined Space

# 2. ROLE OF DESIGNERS, MANUFACTURERS AND SUPPLIERS

The design, manufacture or modification of any plant or structure that includes a confined space can significantly affect the risks associated with confined spaces. Thoughtful design can eliminate the need to enter a confined space or eliminate the risk of inadvertent entry. The design stage should consider the whole life cycle of the plant or structure, from manufacture and use through to demolition and disposal

## 2.1 ELIMINATING OR MINIMISING THE NEED TO ENTER A CONFINED SPACE

**Regulation 64:** A designer, manufacturer, importer or supplier of a plant or structure, and a person who installs or constructs a plant or structure must eliminate the need to enter a confined space and eliminate the risk of inadvertent entry. If this is not reasonably practicable, then:

- the need for any person enter the space must be minimised so far as is reasonably practicable
- the space must be designed with a safe means of entry and exit, and
- the risk to the health and safety of any person who enters the space must be eliminated or minimised as far as is reasonably practicable.

The following features should be incorporated in the design and manufacturing stages:

- provision of outlets and facilities for cleaning, to eliminate the need for entry
- use of lining materials that are durable, require minimal cleaning and do not react with materials contained in the confined space
- design of the structure and mechanical parts to provide for safe and easy maintenance, to reduce the need for persons to enter.

## 2.2 ENTRY AND EXIT

If it is not reasonably practicable to eliminate the need to enter the confined space or the risk of inadvertent entry, then any risk associated with entry to and exit from the space must be minimised. Entry to and exit from a confined space is safer when openings (access points) are large and located in a position that allows for persons and equipment to pass easily through them.

Where relevant, the following features should be incorporated at the design, manufacture and installation stages:

- Access points (including those within the confined space, through divisions, partitions or obstructions) should be large enough to allow people wearing the necessary protective clothing and equipment to pass through, and to permit the rescue of all people who may enter the confined space.
- A safe means of access to and within the confined space, such as fixed ladders, platforms and walkways should be provided. Further guidance is available in ***AS 1657 Fixed platforms, walkways, stairways and ladders – Design, construction and installation***.
- Access points should be unobstructed by fittings or equipment that could impede rescue and should also be kept free of any obstructions during work in the confined space. If equipment such as electrical cables, leads, hoses and ventilation ducts are required to pass through an access hole, a second access point may be needed.
- There should be enough access points to provide safe entry to and exit from the confined space. For example, the spacing of access holes on sewers (or in the case of large gas mains, the absence of such access holes over considerable lengths) may affect both the degree of natural ventilation and the ease with which persons can be rescued.

# 3 HOW TO IDENTIFY THE HAZARDS

Identifying hazards involves finding all of the things and situations that could potentially cause harm to people. The types of substances previously stored in a confined space (however briefly) will indicate the sorts of hazards that may be present. Substances stored in a confined space may result in a lack of oxygen, airborne contaminants or a flammable atmosphere within the confined space. Other hazards may arise from work activities, products or by-products in or around the confined space.

**Regulation 34:** In managing the risks associated with a confined space, the person conducting the business or undertaking must identify reasonably foreseeable hazards that could give rise to the risk.

## 3.1 WHAT HAZARDS ARE ASSOCIATED WITH A CONFINED SPACE?

### *Restricted entry or exit*

Small entrances and exits make it difficult to rescue injured workers or to get equipment in or out of the confined space. In some cases, entrances and exits may be very large but their location can make them difficult to access. For example, accessing pits or openings high up in silos may require the use of ladders, hoists or other devices, and escape and rescue from such spaces may be difficult in emergency situations.

### *Harmful airborne contaminants*

The following table illustrates the kinds of harmful atmospheres that may be present in a confined space, and how they may be created.

| Source | Examples |
|---|---|
| Substance stored in the confined space or its by-product(s) | • build-up of hydrogen sulphide in sewers and pits<br>• release of toxic substances e.g. hydrogen sulphide in tanks of decomposing organic material, especially when the material is disturbed |
| Work performed in the confined space | • use of paints, adhesives, solvents or cleaning solutions<br>• welding or brazing with metals capable of producing toxic fumes<br>• exhaust fumes from engines used in the confined space<br>• painting or moulding glass-reinforced plastics |

| Source | Examples |
|---|---|
| Entry of natural contaminants e.g. groundwater and gases into the confined space from the surrounding | • acid groundwater acting on limestone with the potential to produce dangerous accumulations of carbon dioxide<br>• methane released from groundwater and from decay of organic matter |
| Release of airborne contaminants | • when sludge, slurry or other deposits are disturbed or when scale is removed |
| Manufacturing process | • residues left in tanks, vessels etc., or remaining on internal surfaces can evaporate into a gas or vapour |
| Entry and accumulation of gases and liquids from adjacent plant, installations, services or processes | • the contamination of underground confined spaces by substances from plant in the vicinity of the confined space<br>• carbon monoxide from the exhaust of LPG-powered forklifts operating in, or in the vicinity of, the confined space |

***Unsafe oxygen level***

Air normally contains 21% oxygen by volume, although oxygen levels of 19.5% — 23.5% by volume are considered to be safe.

Some situations can cause the level of oxygen to dramatically decrease, leading to an oxygen-deficient atmosphere and possible asphyxiation. This may occur, for example, if oxygen in the atmosphere is:

- displaced by gases produced during biological processes, for example, methane in a sewer
- displaced during purging of a confined space with an inert gas to remove flammable or toxic fumes
- depleted inside metal tanks and vessels through surface oxidation (for example, when rust forms)
- consumed during combustion of flammable substances
- absorbed or reacts with grains, wood chips, soil or chemicals in sealed silos.

Too much oxygen can increase the risk of fire or explosion. Oxygen-enriched atmospheres may occur if:

- chemical reactions cause the production of oxygen, for example certain reactions with hydrogen peroxide
- there is a leak of oxygen from an oxygen tank or fitting while using oxy-acetylene equipment.

### *Fire and explosion*

A fire or explosion requires the presence of three elements: an ignition source, air and a fuel (gas, vapour or mist) capable of igniting. A flammable atmosphere is one in which the flammable gas, vapour or mist is likely to exceed 5% of its lower explosive limit (LEL).

Flammable atmospheres in confined spaces may result from the evaporation of a flammable residue, flammable materials used in the space, a chemical reaction (such as the formation of methane in sewers), or from the presence of combustible dust (such as that in flour silos).

If an ignition source, such as a sparking electrical tool or static on a person, is introduced into a space containing a flammable atmosphere, an explosion is likely to result.

### *Engulfment*

Engulfment means to be swallowed up in or be immersed by material, which may result in asphyxiation. Examples of materials that may pose a risk of engulfment include plastics, sand, liquids, fertiliser, grain, coal, coal products, fly ash, animal feed and sewage. Stored materials such as sand and grain can form a crust or bridge when a container is emptied from below, leaving the top layer in place. Workers walking on the bridge or working below the bridge on the floor of the container may be engulfed if a bridge collapses (see **Figure 1**).

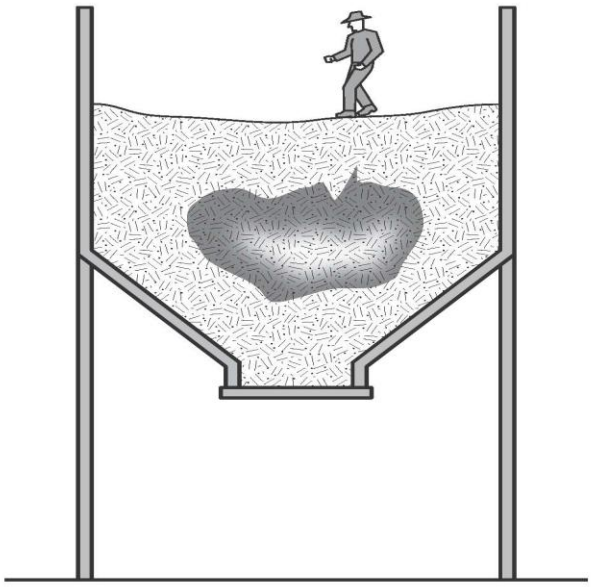


**Figure 1:** ***Example of 'bridging' which may result in engulfment***

## 3.2 OTHER HAZARDS

### *Uncontrolled introduction of substances*

The uncontrolled introduction of substances such as steam, water or other liquids, gases or solids may result in drowning, being overcome by fumes or other harm depending on the nature of the substance.

Vehicles and LPG forklifts operating close to the opening of the confined space can cause a build-up of exhaust gases, including carbon monoxide, in the space.

### *Biological hazards*

Contact with micro-organisms, such as viruses, bacteria or fungi, may result in infectious diseases, dermatitis or lung conditions such as hypersensitivity pneumonitis. Sewers, grain silos and manure pits are examples of confined spaces where biological hazards may be present.

### *Mechanical hazards*

Exposure to mechanical hazards associated with plant may result in entanglement, crushing, cutting, piercing or shearing of parts of a person's body. Sources of mechanical hazards include plant such as augers, agitators, blenders, mixers and stirrers.

### *Electrical hazards*

Electrical hazards may cause electrocution, shocks or burns, and can arise from cables, transformers, capacitors, relays, exposed terminals and wet surfaces where electrical circuit and electrically powered plant are used.

### *Skin contact with hazardous substances*

The nature of a confined space could give rise to an increased likelihood of skin contact with surface contaminants. Skin contact with hazardous substances may result in immediate health effects such as burns, irritation or allergic dermatitis, or longer-term systemic effects.

### *Noise*

Noise generated in a confined space from the use of plant, the work method or process may be amplified due to reflections off hard surfaces. Exposure to hazardous noise may result in hearing loss, tinnitus and other non-auditory health effects. Hazardous noise may also prevent workers hearing warning signals and distract workers from their work.

Further guidance is available in the ***Code of Practice: Managing Noise and Preventing Hearing Loss at Work***.

### *Manual tasks*

Hazards arising from manual tasks may be exacerbated by physical constraints associated with working in a confined space. Additional hazards may arise from the use of personal protective equipment that restricts movement, grip and mobility.

Further guidance is available in the ***Code of Practice: Hazardous Manual Tasks***.

### *Radiation*

The health effects associated with radiation depend on the type of radiation involved. Sources of radiation include radioactive sources, x-rays, lasers, welding flash, radio frequency and microwaves.

### *Environmental hazards*

Environmental hazards associated with work in a confined space may cause or contribute to harm. Examples of environmental hazards include:

- heat or cold stress arising from the work, process or conditions
- slips, trips and falls arising from slippery surfaces or obstacles
- inadequate lighting.

Further guidance is available in the ***Code of Practice: Managing the Work Environment and Facilities***.

### *Hazards outside the confined space*

Where the confined space has a vertical opening, there is a risk that people could fall in.

Traffic hazards are a concern where confined space entrances or exits are located on footpaths or roads. There is the potential for workers entering or exiting the space to be struck and injured by vehicle traffic.

Work done outside the space, but near openings to it, can contaminate the atmosphere inside the space. A common example is the exhaust gases from an internal combustion engine. There may also be potential for fire or explosion where hot work is done in areas next to confined spaces that contain flammable atmospheres.

### *Additional physiological and psychological demands*

Working in a confined space may impose additional physiological and psychological demands over and above those encountered in a normal working environment. Consideration should be given to a worker's:

- physical ability
- ability to work in a restrictive space (for example claustrophobia)
- ability to wear the personal protective equipment required to do the work (for example respirators).

# 4. HOW TO ASSESS THE RISKS

A risk assessment involves considering what could happen if someone is exposed to a hazard and the likelihood of it happening.

**Regulation 66:** A person conducting a business or undertaking must assess health and safety risks associated with the identified hazards of the confined space.
The risk assessment for a confined space must be undertaken by a competent person and be recorded in writing. The risk assessment must be reviewed and revised whenever any risks change.
**Regulation 77:** Where the risk assessment is made in connection with work to be undertaken in the confined space, a copy must be kept for 28 days, or if a notifiable incident occurs, for 2 years after the incident occurs.

When undertaking a risk assessment to determine the risks requiring control the following factors should be considered:

- the atmosphere in the confined space, including whether testing or monitoring is to be undertaken
- the risk of engulfment of a person
- all proposed work activities, particularly those that may cause a change to the conditions in the confined space.
- the number of persons occupying the space
- the soundness and security of the overall structure and the need for lighting and visibility
- the identity and nature of the substances last contained in the confined space
- any risk control measures needed to bring the confined space to atmospheric pressure
- the number of persons required outside the space:
    - to maintain equipment essential for the task being undertaken within the confined space
    - to provide continuous communication with the persons within the confined space, and
    - to properly initiate emergency response procedures
- risks associated with other hazards, such as noise or electricity
- arrangements for emergency response, for example first aid and resuscitation

- the physiological and psychological demands of the task and the competency of persons involved in the tasks or emergency response duties
- the adequate instruction of persons in any required procedure, particularly those that are unusual or non-typical, including the use and limitations of any personal protective equipment and other equipment to be used
- the availability and adequacy of appropriate personal protective equipment and emergency equipment for all persons likely to enter the confined space.
- the need for additional risk control measures, including:
    - prohibiting hot work in adjacent areas
    - prohibiting smoking and naked flames within the confined space and adjacent areas
    - avoiding contamination of breathing air from operations or sources outside the confined space, for example, from the exhaust of an internal combustion engine
    - prohibiting movement of equipment in adjacent areas, for example forklifts
    - prohibiting spark-generating equipment, clothing and footwear
- whether purging or cleaning in the confined space is necessary
- whether hot work is necessary
- conditions that could impede entry and exit or the conduct of the tasks in the confined space, for example, plant layout, dimensions, manual handling and ergonomic aspects of the task activity.

### *Atmospheric testing and monitoring*

Testing and monitoring the atmosphere in a confined space is a routine part of determining appropriate control measures.

**Regulation 50:** A person conducting a business or undertaking must ensure that air monitoring is carried out to determine the airborne concentration of a substance or mixture to which an exposure standard applies if:

- there is uncertainty whether or not the airborne concentration of the substance or mixture exceeds the relevant exposure standard, or
- monitoring is necessary to determine whether there is a risk to health.

Any air monitoring in a confined space should be carried out by a competent person using a suitable, correctly calibrated gas detector. It may be necessary to test the atmosphere for:

- oxygen content
- airborne concentration of flammable contaminants
- airborne concentration of potentially harmful contaminants (for example, hydrogen sulphide and carbon monoxide ).

A person's senses should never be used to determine if the air in a confined space is safe. Many toxic or flammable gases and unsafe oxygen levels cannot be detected using one's senses.

Initial testing should be done from outside the confined space by inserting a sample probe and/or portable gas detection device at appropriately selected access holes, nozzles and openings. Because contaminants can settle at different levels, each part of the confined space should be tested – side to side and top to bottom (see **Figure 2**).

For example, some gases (such as hydrogen sulfide) are heavier than air and in unventilated areas will settle to the bottom of the space, while other gases (such as methane) are lighter than air and will collect at the top of the space. Testing should be carried out on a sufficient number of points to accurately reflect areas of the space that is likely to be accessed.

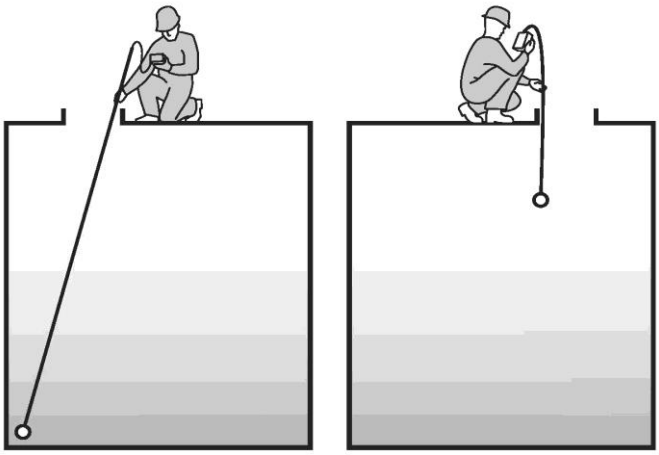


**Figure 2:** ***Atmospheric testing of remote regions and different levels within the confined space.***

Lighter gases may be vented into the breathing zone of the person conducting the tests. Some gases may be dissolved in liquids and released when the liquid is disturbed or a crust over the liquid is broken and it may therefore be necessary to agitate liquids before monitoring.

If it is necessary to enter the space to test remote regions away from entrances or access holes, then air-supplied respiratory equipment should be worn and the entry must be undertaken in accordance with the WHS Regulations using a confined space entry permit.

Re-testing and continuous monitoring of the air may be necessary if the risk assessment indicates that conditions may change due to the work being done or the disturbance of hazardous material in the confined space.

### *Generic risk assessment*

A single (or generic) risk assessment may be carried out for a class of confined spaces in a number of different work areas or workplaces where the confined spaces are the same. This will only be appropriate if all of the hazards being covered are the same. A risk assessment must be carried out on individual confined spaces if there is any likelihood that a worker may be exposed to greater, additional or different risks.

A confined space entry permit may be used as a record of the risk assessment.

# 5. HOW TO CONTROL THE RISKS

The most important step in the risk management process involves controlling risks by eliminating them so far as is reasonably practicable, or if that is not possible, by minimising the risks so far as is reasonably practicable.

## 5.1 THE HIERARCHY OF RISK CONTROL

The ways of controlling risks are ranked from the highest level of protection and reliability to the lowest. This ranking is known as the *hierarchy of risk control.* The WHS Regulations require duty holders to work through this hierarchy to achieve the highest level of protection that is reasonably practicable in the circumstances.

### *Eliminate the risk*

The most effective control measure is to eliminate the risk, for example, by eliminating the need to enter a confined space.

### *Minimise the risk*

If it is not reasonably practicable to eliminate the risk, you must minimise the risks so far as is reasonably practicable by:

- substituting the hazard giving rise to the risk with something that is safer
- isolating the hazard from any person exposed to it, or
- implementing engineering controls.

If there is a remaining risk, it must be minimised so far as is reasonably practicable by implementing administrative controls, and if a risk still remains, then suitable personal protective equipment must be provided and used. These two types of control measures, when used on their own, tend to be least effective in minimising risks because they rely on human behaviour and supervision.

Some risk control measures are mandatory for confined spaces.

**Regulation 66:** In managing risks associated with a confined space, all relevant matters must be considered, including:

- whether the work can be carried out without the need to enter the confined space
- the nature of a confined space
- if the hazard is associated with any airborne contaminant or unsafe level of oxygen
- the work to be carried out in the confined space, the range of methods by which the work can be carried out, and the proposed method
- the type of emergency procedures required.

## 5.2 ELIMINATE THE NEED TO ENTER A CONFINED SPACE

Risks associated with work in a confined space must be eliminated so far as is reasonably practicable, and therefore the first question is: can the work be carried out without entering the confined space?

Work could be carried out from outside the confined space by:

- installing fixed or temporary cleaning devices for example spray balls using high-pressure hoses inserted through an access hatch to clean the inside of a tank
- using remote cameras or a mirror attached to a probe for internal inspection of vessels
- using remotely operated rotating flail devices, vibrators or air purgers to clear blockages in silos
- using a hook, long-handled clasp or magnet on a string to retrieve an object dropped into a confined space.

## 5.3 MINIMISE THE RISKS

If entering a confined space cannot be avoided, then a safe system for working inside the space must be implemented. The identified hazards will help determine what controls are needed to minimise any risk associated with work in the confined space. Under the WHS Regulations, the following matters must be considered:

### *The nature of the space*

The nature of a confined space may contribute to the risks associated with it, for example:

- whether the number, size and location of entrances and exits are adequate to enable the rapid exit and rescue of workers from the space
- the temperature of the space so that it will not cause heat stress
- adequate lighting, if there is poor visibility.

### *The concentration of oxygen or airborne contaminants*

The level of oxygen and airborne contaminants is a significant contributor to the risk of working in a confined space, therefore:

- the level of oxygen should be maintained at a safe level and any airborne contaminants in the space are minimised by ventilating prior to and/or during entry

- any changes that may occur to oxygen or airborne contaminants are determined by testing the atmosphere
- where the atmospheric conditions cannot be maintained at a safe level, appropriate respiratory protective equipment must be provided.

***The work and work method***

Consideration should be given to whether the proposed work or work process will introduce any new hazards or contribute to the risks of working in the confined space. Ignition sources must not be introduced into a space that contains a flammable atmosphere.

Work processes should:

- minimise the release of harmful airborne contaminants into the space
- reduce the time spent in the space or the number of people that have to enter the space
- eliminate the risk of engulfment.

Consider any risks associated with the use of personal protective equipment (PPE) in a confined space. Using PPE may introduce new risks for those working in the space, for example the weight or discomfort of protective clothing and hearing protection.

***Emergency procedures***

When things go wrong in a confined space, people may be exposed to serious and immediate danger. Effective arrangements for raising the alarm and carrying out rescue operations in an emergency are essential (refer to **Chapter 6 of this Code**).

## 5.4 ENTRY PERMITS

A confined space entry permit provides a formal check to ensure all elements of a safe system of work are in place before people are allowed to enter the confined space. It also provides a means of communication between site management, supervisors and those carrying out the work and ensures that the person conducting the business or undertaking has checked and authorised the entry to the confined space and it is safe to proceed.

**Regulation 67:** A person conducting a business or undertaking must not allow or direct a worker to enter a confined space to carry out work unless the person has issued a confined space entry permit for the work.

The permit must be completed in writing by a competent person and:

- specify the confined space to which the permit relates
- record the names of persons permitted to enter the confined space and the period of time that the work will be carried out
- set out risk control measures based on the risk assessment, and
- contain space for an acknowledgement that work in the confined space has been completed and all persons have left the space.

**Regulation 77:** The permit must be kept until the work is completed, or if a notifiable incident occurs, for at least 2 years after the confined space work to which the permit relates is completed.

A competent person is one who has acquired through training, qualification or experience, the knowledge and skills to carry out this task.

A confined space entry permit must be issued for each entry into the confined space. Each permit only applies to one confined space and allows one or more workers to enter that space. A competent person who directs and supervises the work should be nominated and authorised to issue the permit on behalf of the business or undertaking.

A confined space entry permit is also required when a person enters a confined space to conduct the initial hazard identification or risk assessment. The permit may need to be revised after the risk assessment is completed. The confined space entry permit must list the following:

| **Requirement** | |
|---|---|
| Confined space to which the permit applies | • The permit form should be designed and completed in such a way as to enable clear identification and recording of the space that each permit applies to.<br>• A single permit can be used for multiple entries into a space and can be used where there is more than one access point into a single space. |
| Name of any worker permitted to enter the space | |

| Requirement | |
|---|---|
| Period of time that the permit is in operation | • A permit may be required for varying periods of time depending on the time required to complete the work being carried out in a confined space.<br>• The permit should be re-validated if the person with direct control of work in the space changes, a break in work continuity occurs, changes are made to the work that introduce hazards not addressed by the current permit, or new controls measures are needed. |
| Measures to control the risk | • List the control measures that must be implemented before work commences, for example the isolation of plant and services, purging, ventilation, atmospheric testing, cleaning and signage.<br>• List the control measures that must be implemented or continued while work is being done in the space, e.g. ventilation, continuous monitoring, respiratory protective equipment and personal protective equipment.<br>• List any equipment to be taken into the |

The entry permit must be used as a written record that all workers have exited the confined space on completion of the work. It should be displayed in a prominent place to facilitate signing and clearance. Each worker must be able to understand the entry permit.

The information on the entry permit may be used as a suitable record of the risk assessment that has been carried out. An example of an entry permit is provided at **Appendix B**.

## 5.5 ISOLATION

All potentially hazardous services should be isolated prior to any person entering the confined space.

Isolate to prevent:

- the introduction of contaminants or conditions through piping, ducts, vents, drains, conveyors, service pipes and fire protection equipment
- the activation or energising of machinery in the confined space
- the activation of plant or services outside the confined space that could adversely affect the space (for example heating or refrigerating methods)
- the release of any stored or potential energy in plant
- the inadvertent use of electrical equipment.

If liquids, gases or vapours could enter the confined space the pipe work should be physically isolated.
Isolation measures, for example physically locking, tagging, closing and blanking (see **Figure 3)** should be supervised or checked at each isolation point. Isolation measures should be supported by systems to ensure that the isolation measures are not removed until all work is complete and all workers have left the space.

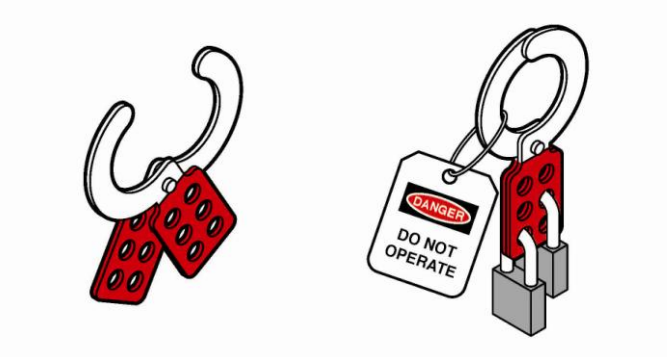



**Figure 3**: ***Example of tag and lockout with the padlocks of two workers.***

Methods of isolation from materials, contaminants or conditions include isolating in accordance with one of the methods described below or by an alternative method ensuring at least an equivalent level of safety:

- Removing a valve, spool piece or expansion joint in piping leading to the confined space (as close as practicable to the space) and blanking or capping the open end of the piping (see **Figure 4**). The blank or cap should be tagged to indicate its purpose. Blanks or caps should be made of a material that is compatible with the liquid, vapour or gas with which they are in contact. The material should also have sufficient strength to withstand the maximum operating pressure, for example surges, which can build up in the piping.

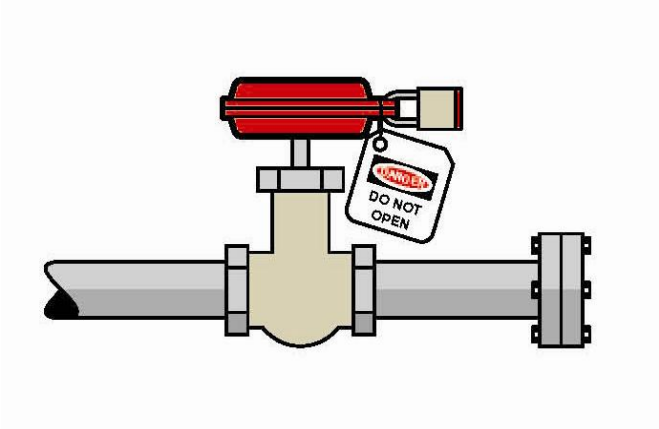



**Figure 4: *Open end of pipe capped. Nearest valve closed locked and tagged.***

- Inserting a suitable full-pressure spade or blank in piping between the flanges as close as practicable to the confined space (see **Figure 5**). The full-pressure spade or blank should be tagged to indicate its purpose.

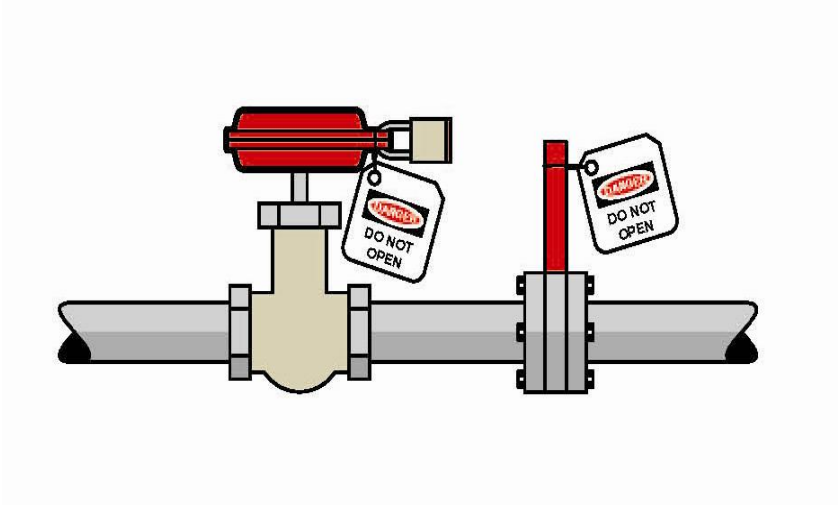



**Figure 5:** ***Insertion of full pressure spade or blank. Nearest valve closed, locked and tagged. Spade is also tagged to indicate its purpose.***

- Closing, locking and tagging at least two valves in the piping leading to the confined space (see **Figure 6**). A drain or vent valve between the two closed valves should be locked open to atmosphere as part of this method.

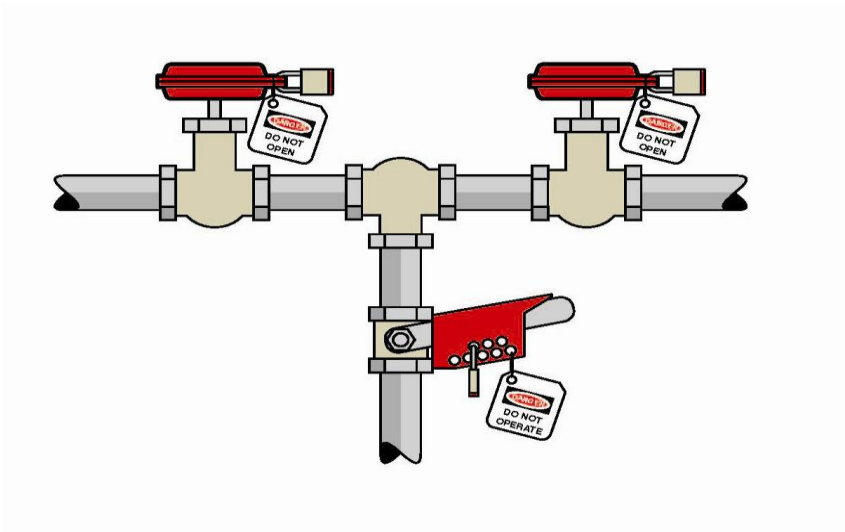



**Figure 6:** ***Closing, locking and tagging at least two valves***

Before entry is permitted to any confined space that can move, or in which agitators, fans or other moving parts that may pose a risk to workers are present, the possibility of movement should be eliminated.

Equipment or devices with stored energy, including hydraulic, pneumatic, electrical, chemical, mechanical, thermal or other types of energy, should be reduced to a zero energy condition so that no energy is left in devices and systems that could cause injury or illness.

If the confined space has agitators, blades and other moving equipment, consider chocking, wedging, chaining or removing these parts. Alternatively de-energise the equipment, lockout and tag out machinery, mixers, agitators and other equipment containing moving parts in the confined space. This may require additional isolation, blocking or de-energising of the machinery itself to guard against the release of stored energy.

When a lock is used, the key should be kept in the possession of the person placing the lock. Spare keys should not be accessible except in emergencies. The tag should indicate that a person is in the confined space and that such isolation should not be removed until all people have left the confined space.

Examples where this procedure may be used include:

- an open circuit breaker or open isolating switch supplying electrical power to equipment with hazardous moving parts
- where a power source cannot be controlled readily or effectively, requiring a belt or other mechanical linkage to be disconnected and tagged.

## 5.6 ATMOSPHERE

A safe atmosphere must be ensured, so far as is reasonably practicable, during work in a confined space. A safe atmosphere in a confined space is one that:

- has a safe oxygen level
- is free of airborne contaminants or any airborne contaminants are in concentrations below their allowable exposure standard (if any)
- any flammable gas or vapour in the atmosphere is at concentrations below 5% of its LEL.

A safe atmosphere can be achieved within the confined space using methods such as cleaning, purging and ventilation.

### *Purging*

Purging is done using an inert gas, such as nitrogen, to clear flammable gases or vapours before work in the confined space begins.

After purging, the confined space should be adequately ventilated with sufficient fresh air to ensure that the inert gas is removed. Purging should be done in a way that ensures any

contaminants removed from the confined space are expelled to a location where they present no further risk. Atmospheric testing should be carried out before entry to check that the ventilation has been effective.

When flammable contaminants are to be purged, purging and ventilation equipment designed for use in hazardous areas must be used. A hazardous area is an area in which an explosive atmosphere is present, or may be expected to be present, in quantities that may require special precautions for the construction, installation and use of potential ignition sources.

The WHS Regulations prohibit pure oxygen or gas mixtures with oxygen in concentration greater than 21% by volume being used for purging or ventilating a confined space because of the risk of increased flammability.

The space must be purged where a risk assessment identifies the potential for the confined space to contain an unacceptable level of contaminants.

### *Ventilation*

Ventilation of a confined space with fresh air, by natural, forced or mechanical means, may be necessary to establish and maintain a safe atmosphere and temperature for as long as anyone is in the confined space.

If the confined space has sufficient openings then natural ventilation may be adequate, but in most cases mechanical ventilation is likely to be needed.

Consideration should also be given to where the fresh air is drawn from and where the exhaust air is finally vented to, so that the fresh air is not contaminated either by exhaust air or by other pollutants, and the exhaust air does not cause other risks.

Mechanical ventilation may be either local exhaust ventilation (LEV) or dilution ventilation. LEV is effective where the source of contaminant generation is localised, the extraction point can be located close to the source and adequate make-up air is available (for example, capture or extraction of welding fume).

Where dilution ventilation is used, air needs to be introduced in a way that will ensure effective circulation throughout the confined space, taking account of the configuration of the space, the position of the openings and the properties of the contaminants.

During operations likely to generate contaminants, mechanical ventilation equipment may not be adequate or sufficiently reliable to maintain contaminants at acceptable levels or to ensure a safe oxygen level. Where mechanical ventilation equipment is likely to be necessary to maintain acceptable contaminant levels in a confined space, the equipment should:

- be monitored to ensure continuous operation while the confined space is occupied
- have the controls (including any remote power supply) clearly identified, tagged and protected to guard against unauthorised interference.

### *Flammable gases and vapours*

**Regulation 72:** A person conducting a business or undertaking must, while work is being carried out in a confined space, ensure that the concentration any flammable gas, vapour or mist in the atmosphere of the space is less than 5% of its LEL, so far as is reasonably practicable.

If it is not reasonably practicable, and the concentration of any flammable gas, vapour or mist in the atmosphere of the confined space:

- is equal to or greater than 5% but less than 10% of its LEL—the person must ensure that any worker is immediately removed from the space unless a suitably calibrated, continuous-monitoring flammable gas detector is used in the space; or
- is equal to or greater than 10% of its LEL—the person must ensure that any worker is immediately removed from the space.

Where a flammable atmosphere may exist in a confined space and there is a risk of fire and explosion, all ignition sources in the vicinity must be eliminated.

Examples of potential ignition sources, both inside and outside the space, include:

- open flames and hot surfaces
- electrical equipment
- internal combustion engines
- metal tools striking metal surfaces
- spark-producing equipment for example grinding wheels
- static electricity.

### *Respiratory protective equipment*

If it is not reasonably practicable to ensure the confined space contains a safe oxygen level, or safe levels of airborne contaminants, then appropriate respiratory protective equipment must be provided. The respiratory protective equipment should be provided and worn in situations where there is no exposure standard for a substance, or where the substance is present in an unknown concentration.

Respiratory protective equipment refers to a range of breathing equipment, including air-supplied and self-contained breathing

apparatus. The appropriate respiratory protective equipment should be based on the level and type of contaminants and the work to be done. Whenever there is any doubt about the type of respiratory protective equipment required, a conservative approach should be adopted (for instance, use air-supplied respiratory equipment).

Further guidance is available in ***AS/NZS 1715: Selection, use and maintenance of respiratory protective devices***.

## 5.7 COMMUNICATION AND SAFETY MONITORING

**Regulation 69:** The person conducting a business or undertaking must ensure that a person must not enter a confined space to carry out work unless a system of work is provided that includes:

- continuous communication with the worker from outside the confined space
- monitoring conditions within the confined space by a standby person who is in the vicinity of the confined space, and if practicable, observing the work being carried out.

A communication system is needed to enable communication between people inside and outside the confined space and to summon help in an emergency.

Depending on the conditions in the confined space, communication can be achieved by voice, radio, hand signals or other suitable methods.

Before a worker enters a confined space, a standby person must be assigned to continuously monitor the wellbeing of those inside the space, if practicable observe the work being carried out and initiate appropriate emergency procedures when necessary (see ***Figure 7***).

The standby person should:

- understand the nature of the hazards inside the particular confined space and be able to recognise signs and symptoms that workers in the confined space may experience
- remain outside the confined space and do no other work which may interfere with their primary role of monitoring the workers inside the space
- have all required rescue equipment (for example, safety harnesses, lifting equipment, a lifeline) immediately available
- have the authority to order workers to exit the space if any hazardous situation arises
- never enter the space to attempt rescue.

## 5.8 ENTRY AND EXIT PROCEDURES

For the entire period the confined space entry permit is valid, procedures should be in place to indicate when any worker is in the space, for example by using tags, a system of signing in and out on the entry permit, or having a standby person record who is in the space.

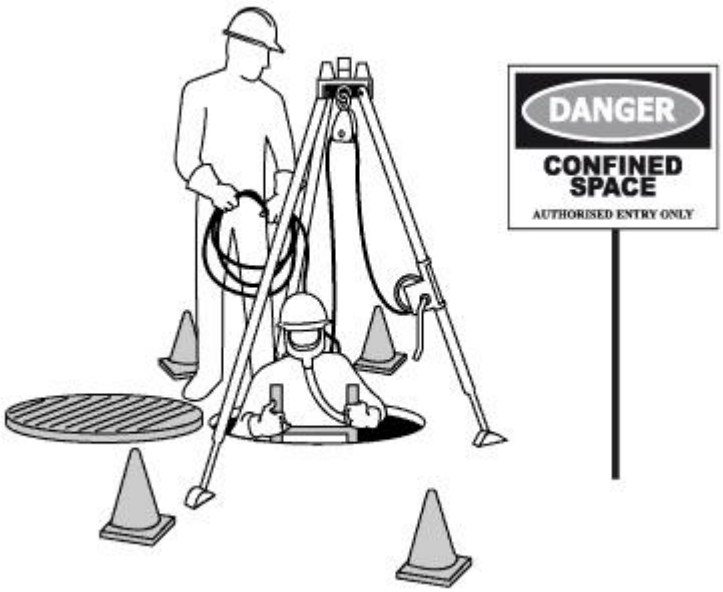



**Figure 7:** ***Standby person monitoring the confined space with rescue equipment and sign in place***

## 5.9 SIGNS AND BARRICADES

Before any work in relation to a confined space starts, signs must be erected to prevent entry of persons not involved in the work.

Signs must warn against entry by people other than those who are listed on the confined space entry permit, and must be placed at each entrance to the confined space. Signs must be in place while the confined space is accessible, including when preparing to work in the space, during work in the space and when packing up on completion of the work.

Signposting alone should not be relied on to prevent unauthorised entry to a potential confined space. Security devices, for example locks and fixed barriers, should be installed.

## 5.10 INFORMATION, INSTRUCTION AND TRAINING

Workers and their supervisors must have the skills and knowledge to understand the hazards associated with working in the confined space, the contents of any confined space entry

permit, and the control measures implemented for their protection.

Training should be provided to workers who:

- enter or work in confined spaces
- undertake hazard identification or risk assessment in relation to a confined space
- implement risk control measures
- issue entry permits
- act as a standby person or communicate with workers in a confined space
- monitor conditions while work is being carried out
- purchase equipment for confined space work
- design or lay out a work area that includes a confined space.

**Regulation 76:** The training provided to relevant workers must cover:

- the nature of all hazards associated with a confined space
- the need for, and appropriate use of, risk control measures
- the selection, use, fit, testing and storage of any personal protective equipment
- the contents of any relevant confined space entry permit
- emergency procedures.

Re-training or refresher training should be provided as appropriate for a particular workplace. The frequency of this training should depend on how often workers are required to carry out tasks associated with entry to or work in confined spaces.

Records of all training provided to workers in relation to confined space work must be kept for 2 years.

## 5.11 MAINTENANCE OF CONTROL MEASURES

Proper maintenance of control measures is an integral part of any safe system of work. Maintenance may involve visual checks, inspections, testing of equipment, preventative maintenance and remedial work. Equipment that should be regularly inspected includes:

- atmospheric testing and sampling equipment
- personal protective equipment including respirators
- ventilation equipment
- safety harness and lines
- emergency rescue equipment.

# 6. EMERGENCY PROCEDURES

**Regulation 74:** A person conducting a business or undertaking must establish first aid and rescue procedures to be followed in an emergency and ensure those procedures are practised as necessary to ensure that they are efficient and effective. First aid and rescue procedures must be initiated from outside the confined space as soon as practicable in an emergency.
The person conducting a business or undertaking must also ensure that openings for entry and exit are of a sufficient size to allow emergency access; openings are not obstructed; and any plant, equipment and personal protective equipment provided for first aid or emergency rescue are maintained in good working order.

When establishing emergency procedures, the following factors must be taken into account to manage risks associated with confined spaces:

- whether the work can be carried out without the need to enter the confined space
- the nature of the confined space
- any changes in hazards associated with the concentration of oxygen or the concentration of airborne contaminants in the confined space
- the work to be carried out in the confined space, the range of methods by which the work can be carried out and the proposed method of working
- the type of emergency and rescue procedures required.

Consideration should also be given to the following:

| Relevant considerations | Questions |
|---|---|
| Location of the confined space | What is the geographic location of the space, how accessible is it in an emergency and how far away is it from appropriate medical facilities? |
| Communications | How can workers working inside the space communicate to people outside in an emergency?<br>Exactly how will the alarm be raised and by whom?<br>Planning needs to ensure that rescue and emergency personnel can access the workplace during night shift, weekends and holiday periods. |

| Relevant considerations | Questions |
|---|---|
| Rescue and resuscitation equipment | What kinds of emergencies are contemplated?<br>The provision of suitable rescue and resuscitation equipment will depend on the potential emergencies identified. Selected rescue equipment should be kept in close proximity to the confined space so that it can be used immediately. |
| Capabilities of rescuers | Are rescuers properly trained, sufficiently fit to carry out their task and capable of using any equipment provided for rescue (e.g. breathing apparatus, lifelines and fire-fighting equipment)?<br>How will rescuers be protected during the emergency operation? |
| First aid | Is appropriate first aid available for immediate use?<br>Are trained first aid personnel available to make proper use of any necessary first aid equipment? |
| Local emergency services—if they are to be relied on for rescue | How will the local emergency services (e.g. fire brigade) be notified of an incident?<br>What information about the particular dangers in the confined space will be given to them on their arrival?<br>Have prior arrangements been made with local emergency services to ensure they are able to respond in a reasonable time and have the specialist confined space retrieval equipment readily available? |

First aid and rescue procedures must be rehearsed with relevant workers to ensure that they are efficient and effective.

Rescue should be performed from outside the confined space, if possible. Workers performing rescue must be adequately trained. Rescuers must be provided with and wear appropriate respiratory protective equipment if they enter a confined space in an emergency.

If a person inside a confined space has been overcome by lack of oxygen or airborne contaminants, it should always be assumed that entry for rescue is unsafe unless air-supplied respiratory protective equipment is used.

Potential problems with the size of entrances and exits must be addressed when developing emergency and rescue procedures. Where openings are found to be inadequate, their size should be

increased, or an alternative safe means of entry and exit should be provided.

# 7. HOW TO REVIEW CONTROL MEASURES

Control measures that have been implemented must be reviewed, and if necessary, revised to make sure they work as planned and to maintain, so far as is reasonably practicable, a work environment that is without risks to health and safety.

**Regulation 38:** A person conducting a business or undertaking must review and as necessary revise risk control measures:

- when the control measure does not minimise the risk so far as is reasonably practicable
- before a change at the workplace that is likely to give rise to a new or different health and safety risk that the control measure may not effectively control
- if a new hazard or risk is identified
- if the results of consultation indicate that a review is necessary
- if a health and safety representative requests a review.

Control measures may be reviewed using the same methods as the initial hazard identification step.

In undertaking the review, consult workers involved in the confined space work and their health and safety representatives and consider the following questions:

- Are the control measures working effectively in both their design and operation?
- How effective is the risk assessment process? Are all hazards being identified?
- Are workers actively involved in the risk management process? Are they openly raising health and safety concerns and reporting problems promptly?
- Have new work methods or new equipment made the job safer?
- Are safety procedures being followed?
- Has instruction and training provided to workers been successful?
- If new legislation or new information becomes available, does it indicate current controls may no longer be the most effective?
- Is any change planned to any plant or structure that may create a confined space or change the nature of an existing confined space?
- Has an incident occurred as a result of work carried out in a confined space?

If problems are found, go back to any point in the risk management process, review the information and revise any decisions about controls measures.

# APPENDIX A – CONFINED SPACE CRITERIA

| | **Confined space criteria** | | | | | | **Confined space?** |
|---|---|---|---|---|---|---|---|
| **Description of the space and activity** | A<br>**Is the space enclosed or partially enclosed** | B<br>**Is the space not designed or intended to be occupied by a person** | C<br>**Is the space designed or intended to be, at normal atmospheric pressure while any person is in the space** | D<br>**Does the space present a risk from:**<br>Harmful airborne, flammable contaminants | <br><br>An unsafe oxygen level | <br><br>Engulfment | **If the answer to A, B, C and at least one of D is yes, then the space is a confined space.** |
| Sewer with access via a vertical ladder | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | Yes |
| Dislodging grain from a silo with sole access through a manhole at the top | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | Yes |
| Cleaning spilled cadmium pigment powder in a shipping container | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | Yes |
| Inspecting a fuel tank in the wing of an aircraft | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | Yes |

| | Confined space criteria | | | | | | Confined space? |
|---|---|---|---|---|---|---|---|
| Dislodging a sludge blockage in a drain pit | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | Yes |
| Internal inspection of a new, clean tank prior to commissioning | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | No |
| Internal inspection of an empty cement silo through a door at ground level | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | No |
| Stocktake using an LPG forklift in a fruit cool store | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | No |
| Installing insulation in a roof cavity | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | No |

## APPENDIX B – SAMPLE CONFINED SPACE ENTRY PERMIT

# Confined space entry permit

## General

**Location of work** _____

**Description of work** _____

_____

_____

## Control measures

### *Isolation*

Space needs to be isolated from:

| | Location/method |
|---|---|
| Water/gas/steam/chemicals | |
| Mechanical/electrical drives | |
| Auto fire extinguishing systems | |
| Hydraulic/electric/gas/power | |
| Sludge/deposits/wastes | |

Locks and/or tags have been affixed to isolation points Yes ☐ No ☐

### *Atmosphere:*

The atmosphere in the confined space has been tested:

*Result of tests:*

| | | |
|---|---|---|
| Oxygen | _____ | % |
| Flammable gases | _____ | % LEL |
| | _____ | % LEL |
| Other gases | | |
| | _____ | ppm (less than ppm) |
| | _____ | ppm (less than ppm) |

*SAMPLE ONLY*

Other airborne contaminants: _____

_____

_____

The conditions for entry are as marked below:

| | | |
|---|---|---|
| 1. With supplied air breathing apparatus | Yes ☐ | No ☐ |
| 2. Without respiratory protection | Yes ☐ | No ☐ |
| 3. With escape unit | Yes ☐ | No ☐ |

## *Hot work*

| | | |
|---|---|---|
| Area clear of all combustibles including atmosphere | Yes ☐ | No ☐ |
| Type of appropriate fire prevention equipment available: _____ | | |
| Suitable access and exit | Yes ☐ | No ☐ |
| Hot work is permitted | Yes ☐ | No ☐ |

## *Personal protective equipment*

The following safety equipment must be worn:

| | **Type** |
|---|---|
| Respiratory protection | |
| Harness/lifelines | |
| Eye protection | |
| Hand protection | |
| Footwear | |
| Protective clothing | |
| Hearing protection | |
| Safety helmet | |

Communication equipment _____

Other _____

_____

_____

## *Other precautions*

Warning notices/barricades Yes ☐ No ☐

All persons have been trained Yes ☐ No ☐

Is continual air monitoring required Yes ☐☐☐☐No ☐

_____

_____

_____

_____

_____

_____

## *Emergency response*

Procedures/Equipment _____

_____

_____

_____

_____

_____

## *Standby person*

Standby personnel requirements: _____

_____

_____

_____

## Authority to enter

***The control measures and precautions appropriate for the safe entry and execution of the work in the confined space have been implemented and persons required to work in the confined space have been advised of and understand the requirements of this written authority.***

Signed (*person in direct control*): _____

Date: _____ Time: _____

This written authority is valid until: _____

Date: _____ Time: _____

## Persons authorised to enter confined space

***I have been advised of and understand the control measures and precautions to be observed with the entry and work in the confined space.***

| ***Entry*** | | | **Exit** | | |
|---|---|---|---|---|---|
| ***Name*** | **Date** | **Time** | **Name** | **Date** | **Time** |
| | | | | | |
| | | | | | |
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## Withdrawal of written authority

All persons and equipment accounted for Yes ☐ No ☐

Equipment checked and restored correctly Yes ☐ No ☐

Signed (*person in direct control*):

Date: Time:

Remarks or comments about the work:

# MANAGING THE RISK OF FALLS AT WORKPLACES

## Code of Practice

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## FOREWORD

This Code of Practice on how to manage the risk of falls in the workplace is an approved code of practice under section 274 of the *Work Health and Safety Act* (the WHS Act).

An approved code of practice is a practical guide to achieving the standards of health, safety and welfare required under the WHS Act and the *Work Health and Safety Regulations 2011* (the WHS Regulations).

A code of practice applies to anyone who has a duty of care in the circumstances described in the code. In most cases, following an approved code of practice would achieve compliance with the health and safety duties in the WHS Act, in relation to the subject matter of the code. Like regulations, codes of practice deal with particular issues and do not cover all hazards or risks that may arise. The health and safety duties require duty holders to consider all risks associated with work, not only those for which regulations and codes of practice exist.

Codes of practice are admissible in court proceedings under the WHS Act and Regulations. Courts may regard a code of practice as evidence of what is known about a hazard, risk or control and may rely on the code in determining what is reasonably practicable in the circumstances to which the code relates.

Compliance with the WHS Act and Regulations may be achieved by following another method, such as a technical or an industry standard, if it provides an equivalent or higher standard of work health and safety than the code.

An inspector may refer to an approved code of practice when issuing an improvement or prohibition notice.

This Code of Practice is based on the draft code of practice developed by Safe Work Australia as a model code of practice under the Council of Australian Governments' *Inter-Governmental Agreement for Regulatory and Operational Reform in Occupational Health and Safety* for adoption by the Commonwealth, state and territory governments.

A draft of that model code of practice was released for public consultation on 7 December 2010 and was endorsed by the Workplace Relations Ministers' Council on 10 August 2011.

## SCOPE AND APPLICATION

This Code of Practice applies to all workplaces covered by the WHS Act and Regulations where there is a risk of a fall by a person from one level to another that is reasonably likely to cause injury.

This Code of Practice provides practical guidance to persons conducting a business or undertaking, including those persons who design, construct, import, supply or install plant or structures, on how to manage health and safety risks arising from falls. It includes information on a range of control measures to eliminate or minimise the risks.

***How to use this Code of Practice***

In providing guidance, the word 'should' is used in this Code of Practice to indicate a recommended course of action, while 'may' is used to indicate an optional course of action.

This Code of Practice also includes various references to sections of the WHS Act and Regulations which set out the legal requirements. These references are not exhaustive. The words 'must', 'requires' or 'mandatory' indicate that a legal requirement exists and must be complied with.

# 1. INTRODUCTION

Falls are a major cause of death and serious injury in Australian workplaces. Fall hazards are found in many workplaces where work is carried out at height, for example stacking shelves, working on a roof, unloading a large truck or accessing silos. Falls can also occur at ground level into holes, for example trenches or service pits.

## 1.1 WHO HAS HEALTH AND SAFETY DUTIES IN RELATION TO FALLS?

**A person conducting a business or undertaking** has the primary duty under the WHS Act to ensure, as far as reasonably practicable, that workers and other persons are not exposed to health and safety risks arising from the business or undertaking.

A person conducting a business or undertaking has more specific obligations under the WHS Regulations to manage the risk of a fall by a person from one level to another, including requirements to:

- ensure, so far as is reasonably practicable, that any work involving the risk of a fall is carried out on the ground or on a solid construction
- provide safe means of access to and exit from the workplace
- minimise the risk of falls so far as is reasonably practicable by providing a fall prevention device, work positioning system or a fall arrest system.

**Designers, manufacturers, suppliers, importers and installers** of plant or structures that could be used for work must ensure, so far as is reasonably practicable, that the plant or structure is without risks to health and safety. Designers of plant or structures have an important role in eliminating or minimising the risks of falls in the design stage (see **Chapter 11 of this Code**).

**Officers,** such as company directors, have a duty to exercise due diligence to ensure that the business or undertaking complies with the WHS Act and Regulations. This includes taking reasonable steps to ensure that the business or undertaking has and uses appropriate resources and processes to eliminate or minimise risks of falls from one level to another that are likely to cause injury.

**Workers** have a duty to take reasonable care for their own health and safety and that they do not adversely affect the health and safety of other persons. Workers must comply with any reasonable instruction given by the person conducting the business or undertaking.

## 1.2 THE MEANING OF KEY TERMS

**Fall** means a fall by a person from one level to another.

**Risk of a fall** means a circumstance that exposes a worker while at work, or other person while at or in the vicinity of a workplace, to a risk of a fall that is reasonably likely to cause injury to the worker or other person. This includes circumstances in which the worker or other person is:

- in or on plant or a structure that is at an elevated level
- in or on plant that is being used to gain access to an elevated level
- in the vicinity of an opening through which a person could fall
- in the vicinity of an edge over which a person could fall
- on or in the vicinity of a surface through which a person could fall
- on or near the vicinity of a slippery, sloping or unstable surface.

**Risk control** means taking action to eliminate health and safety risks so far as is reasonably practicable, and if that is not possible, minimising the risks so far as is reasonably practicable. Eliminating a hazard will also eliminate any risks associated with that hazard.

**Competent person** means a person who has acquired through training, qualification or experience the knowledge and skills to carry out the task.

Further definitions relating to fall control measures are listed in **Appendix A**.

## 1.3 WHAT IS REQUIRED TO MANAGE THE RISK OF FALLS?

**Regulation 34-38:** In order to manage risk under the WHS Regulations, a duty holder must:

- identify reasonably foreseeable hazards that could give rise to the risk
- eliminate the risk so far as is reasonably practicable
- if it is not reasonably practicable to eliminate the risk – minimise the risk so far as is reasonably practicable by implementing control measures in accordance with the hierarchy of control
- maintain the implemented control measure so that it remains effective

- review, and if necessary revise, risk control measures so as to maintain, so far as is reasonably practicable, a work environment that is without risks to health and safety.

This Code provides guidance on how to manage the risks of persons falling from one level to another by following a systematic process that involves:

- identifying hazards that may cause injury
- if necessary, assessing the risks associated with these hazards
- implementing risk control measures
- reviewing risk control measures to ensure they are effective.

Guidance on the general risk management process is available in the ***Code of Practice: How to Manage Work Health and Safety Risks***.

### *Consulting workers*

Consultation involves sharing of information, giving workers a reasonable opportunity to express views and taking those views into account before making decisions on health and safety matters.

**Section 47:** The WHS Act requires that you consult, so far as is reasonably practicable, with workers who carry out work for you who are (or are likely to be) directly affected by a work health and safety matter

**Section 48:** If the workers are represented by a health and safety representative, the consultation must involve that representative.

You must consult your workers and their health and safety representatives at every step of the risk management process. By drawing on their experience, knowledge and ideas, you are more likely to identify fall hazards and develop effective control measures.

### *Consulting, co-operating and co-ordinating activities with other duty holders*

**Section 46:** The WHS Act requires that you consult, co-operate and co-ordinate activities with all other persons who have a work health or safety duty in relation to the same matter, so far as is reasonably practicable

Sometimes you may share responsibility for a health and safety matter with other business operators who are involved in the same activities or who share the same workplace. In these situations, you should find out who is doing what and work

together with other duty holders in a co-operative and co-ordinated way so that all risks are eliminated or minimised, so far as is reasonably practicable.

For example, the owner of a transport company with large trucks should consult the goods suppliers as well as the businesses having the goods delivered about how the risk of falls will be controlled during loading and unloading. This may include checking whether suitable equipment is available at each site so that workers do not have to climb on top of loads on the truck and be at risk of falling.

Further guidance is available in the ***Code of Practice: Work Health and Safety Consultation, Co-operation and Co-ordination***.

# 2. MANAGING THE RISK OF FALLS

## 2.1 HOW TO IDENTIFY FALL HAZARDS

You must identify all locations and tasks that could cause injury due to a fall.

This includes access to the areas where work is to be carried out. Tasks that need particular attention are those carried out:

- on any structure or plant being constructed or installed, demolished or dismantled, inspected, tested, repaired or cleaned
- on a fragile surface (for example, cement sheeting roofs, rusty metal roofs, fibreglass sheeting roofs and skylights)
- on a potentially unstable surface (for example, areas where there is potential for ground collapse)
- using equipment to work at the elevated level (for example, when using elevating work platforms or portable ladders)
- on a sloping or slippery surface where it is difficult for people to maintain their balance (for example, on glazed tiles)
- near an unprotected open edge (for example, near incomplete stairwells)
- near a hole, shaft or pit into which a worker could fall (for example, trenches, lift shafts or service pits).

### *Inspect the workplace*

Walk around the workplace and talk to your workers to find out where work is carried out that could result in falls. A checklist may be useful in this process. Key things to look for include:

- surfaces:
    - the stability, fragility or brittleness
    - the potential to slip, for example where surfaces are wet, polished or glazed
    - the safe movement of workers where surfaces change
    - the strength or capability to support loads
    - the slope of work surfaces, for example, where they exceed 7 degrees.
- levels—where levels change and workers may be exposed to a fall from one level to another
- structures—the stability of temporary or permanent structures

- the ground—the evenness and stability of the ground for safe support of scaffolding or a work platform
- the working area—whether it is crowded or cluttered
- entry and exit from the working area
- edges—protection for open edges of floors, working platforms, walkways, walls or roofs
- holes, openings or excavations—which will require guarding
- hand grip—places where hand grip may be lost.

In some situations, advice may be needed from technical specialists, such as structural engineers, to check the stability of structures or load bearing capacity.

***Review available information, including incident records***

You should check your records of previous injuries and 'near miss' incidents related to falls.

Information and advice about fall hazards and risks relevant to particular industries and work activities is also available from regulators, industry associations, unions, technical specialists and safety consultants.

## 2.2 HOW TO ASSESS THE RISK

A risk assessment will help you determine:

- what could happen if a fall did occur and how likely it is to happen
- how severe a risk is
- whether any existing control measures are effective
- what action you should take to control the risk
- how urgently the action needs to be taken.

A risk assessment is unnecessary if you already know the risk and how to control it.

When assessing the risks arising from each fall hazard, the following matters should be considered:

- the design and layout of elevated work areas, including the distance of a potential fall
- the number and movement of all people at the workplace
- the proximity of workers to unsafe areas where loads are placed on elevated working areas (for example, loading docks) and where work is to be carried out above people and there is a risk of falling objects

- the adequacy of inspection and maintenance of plant and equipment (for example, scaffolding)
- the adequacy of lighting for clear vision
- weather conditions—the presence of rain, wind, extreme heat or cold can cause slippery or unstable conditions
- the suitability of footwear and clothing for the conditions
- the suitability and condition of ladders, including where and how they are being used
- the adequacy of current knowledge and training to perform the task safely (for example, young, new or inexperienced workers may be unfamiliar with a task)
- the adequacy of procedures for all potential emergency situations.

***Generic risk assessment***

If you are responsible for a number of different work areas or workplaces and the fall hazards are the same, you may perform a single (or generic) risk assessment. However, you should carry out a risk assessment on individual fall hazards if there is any likelihood that a person may be exposed to greater, additional or different risks.

## 2.3 HOW TO CONTROL THE RISK

There are a number of ways to control the risks of falls. Some control measures are more effective than others. Control measures can be ranked from the highest level of protection and reliability to the lowest. This ranking is known as the *hierarchy of control.* The WHS Regulations require duty holders to work through this hierarchy to choose the control that most effectively eliminates or minimises the risk in the circumstances. This may involve a single control measure or a combination of two or more different controls.

In managing the risks of falls, the WHS Regulations require the following specific control measures to be implemented, where it is reasonably practicable to do so:

1. *Can the need to work at height be avoided to eliminate the risk of a fall?*
    - Carry out any work that involves the risk of a fall on the ground
2. *Can the fall be prevented by working on solid construction?*
    - A building or structure that is used as an existing place of work and includes safe access and egress from which

there is no risk of a fall from one level to another, for example properly constructed stairs with fixed handrails, flat roofs with a parapet or permanently installed guard rails around the edges.

It is usually not necessary to implement additional control measures to manage the risk of falls for workplaces in buildings that already comply with the requirements of the **National Construction Code of Australia**, for example in relation to stairs, mezzanines and balconies.

3. *Can the risk of a fall be minimised by providing and maintaining a safe system of work, including:*
    - providing a fall prevention device (for example, installing guard rails) if it is reasonably practicable to do so, or
    - providing a work positioning system (for example, an industrial rope access system) if it is not reasonably practicable to provide a fall prevention device, or
    - providing a fall-arrest system, so far as is reasonably practicable, if it is not reasonably practicable to provide a fall prevention device or a work positioning system.

In some cases a combination of control measures may be necessary, for example using a safety harness while working from an elevating work platform.

Control measures are needed where there is a risk of injury irrespective of fall height. For low falls, you should assess the risk and provide reasonably practicable measures that reflect the risk. For example, there may be a risk of injury to workers standing on a narrow 1.7 metre high platform next to a production line where they have to work with their back to the open edge or where there is a risk of falling onto an uneven surface with sharp edges or protrusions. In this situation it may be reasonably practicable to install a guard rail along the edge of the platform.

Sometimes it may not be reasonably practicable to provide guard rails, for example at the edges of railway platforms or vehicle inspection pits. Other safe systems of work to provide adequate protection should be implemented, for example brightly painted lines to designate edges.

Work of long duration and higher frequency will usually require control measures higher up the hierarchy to provide adequate protection, for example using a mobile scaffold instead of a ladder.

You should also ensure that the control measures you select do not create new hazards, for example electrical risks from contact with overhead power lines or crushing and entanglement from plant such as elevating work platforms.

### *Implementing and maintaining control measures*

**Regulation 37** You must ensure that the control measures you implement remain effective. This includes checking that the control measures are fit for purpose; suitable for the nature and duration of the work; are installed and used correctly.

To allow the chosen control measures to operate effectively, you should:

- *develop work procedures* on how to correctly install, use and maintain the control measure. The procedures should include a planned program of inspections and maintenance for the control measures. The inspection regime should include details of:
- the equipment to be inspected (including its unique identification)
- the frequency and type of inspection (pre-use checks, detailed inspections)
- action to be taken on finding defective equipment
- means of recording the inspections
- training of users
- the system of monitoring the inspection regime to verify that inspections are carried out appropriately.

The manufacturer and/or supplier of the equipment should be consulted for any product specific requirements. If any signs of wear or weakness are found during the inspection, the components or means of attachment must be withdrawn from use until they are replaced with properly functioning components.

- *provide information, training and instruction* to workers, including procedures for emergency and rescue. You should also cover:
    - the type of control measures used to prevent falls
    - procedures for reporting fall hazards and incidents

- the correct selection, fitting, use, care, inspection, maintenance and storage of fall-arrest and restraint equipment
- the correct use of tools and equipment used in the work (for example, using a tool belt instead of carrying tools)
- control measures for other potential hazards (for example, electrical hazards).

- *provide supervision* by ensuring that workers exposed to a risk of a fall are adequately supervised by a competent person, especially if they are undergoing training or are unfamiliar with the working environment. Check that:
  - only workers who have received training and instruction in relation to the system of work are authorised to carry out the work
  - workers use the fall control measure in the correct manner.

## 2.4 HOW TO REVIEW CONTROL MEASURES

The control measures that are put in place to prevent falls must be reviewed, and if necessary revised, to make sure they work as planned and to maintain an environment that is without risks to health and safety.

**Regulation 38:** A person conducting a business or undertaking must review and as necessary revise fall control measures:

- when the control measure does not control the risk so far as is reasonably practicable
- before a change at the workplace that is likely to give rise to a new or different health and safety risk that the control measure may not effectively control
- if a new hazard or risk is identified
- if the results of consultation indicate that a review is necessary
- if a health and safety representative requests a review.

Control measures may be reviewed using the same methods as the initial hazard identification step.

Consult your workers and their health and safety representatives and consider the following:

- Are the control measures working effectively in both their design and operation?
- Are all fall hazards being identified?

- Are workers using the control measures in accordance with the instruction and training that has been provided?

# 3. WORK ON THE GROUND OR ON A SOLID CONSTRUCTION

## 3.1 WORK ON THE GROUND

Eliminating the need to work at height is the most effective way of protecting workers from the risk of falls. Examples of eliminating the risk by working on the ground include:

- prefabricating roofs at ground level
- prefabricating wall frames horizontally, then standing them up
- using mechanical tarp spreaders to cover loads on trucks from the ground
- fitting outlets, inlets and controls of large tanks and silos near the ground (see **Figure 1**)
- reducing shelving heights so that workers can access items from ground level
- using tools with extendable handles, such as paint rollers (the risk of musculoskeletal disorders will need to be considered when deciding whether to use such tools)
- installing windows that pivot to enable cleaning from a safe position inside a building
- lowering a concert hall chandelier to repair it.

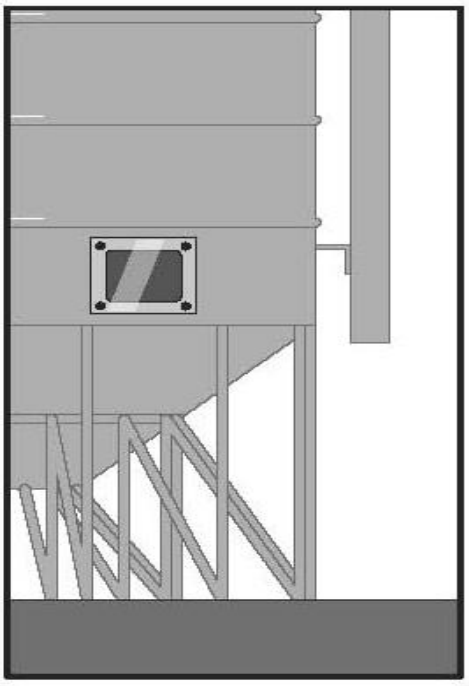

**Figure 1:** *A silo showing sight glass and ground delivery tube*

## 3.2 WORK ON A SOLID CONSTRUCTION

Working on a solid construction provides an environment where the likelihood of a fall may be eliminated. 'Solid construction' means an area that:

- is structurally capable of supporting workers, material and any other loads applied to it
- is provided with barriers around its perimeter and around any openings from or through which a person could fall
- has an even, accessible surface and gradient
- has a safe means of entry and exit.

### *Structural strength*

Different types of work involve different loads on the supporting surface. The surface and its supports must be able to safely carry the expected loads, including workers, materials, tools and equipment. When in doubt, have a structural engineer determine the safe load capacity before use.

### *Barriers*

Barriers (or edge protection) to prevent a person falling over edges and into holes should be provided on relevant parts of a solid construction. These include:

- the perimeters of buildings or other structures
- mezzanine floors (see **Figure 2**)
- openings in floors
- the open edge of a stair, landing, platform or shaft opening (see **Figure 3**).

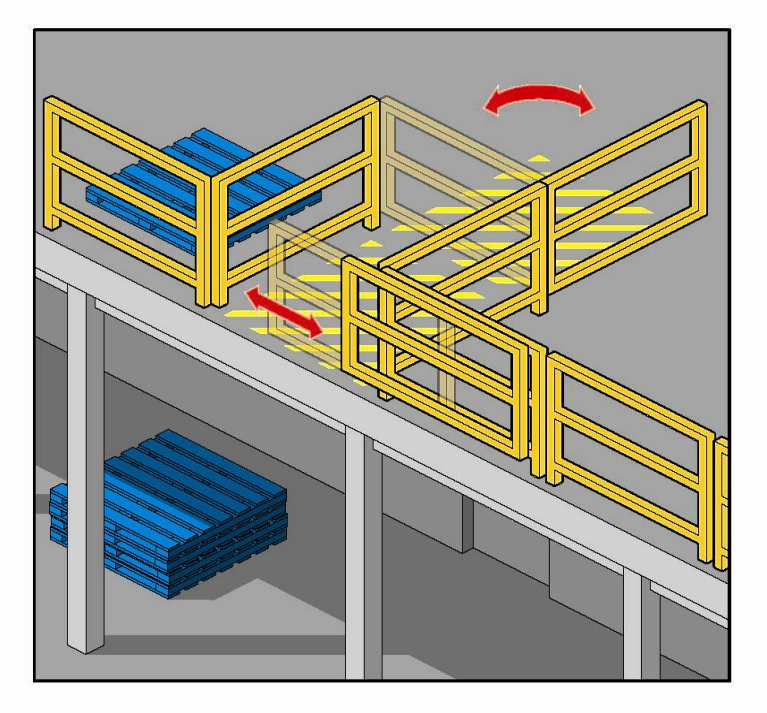

**Figure 2:** *A barrier on a mezzanine floor*

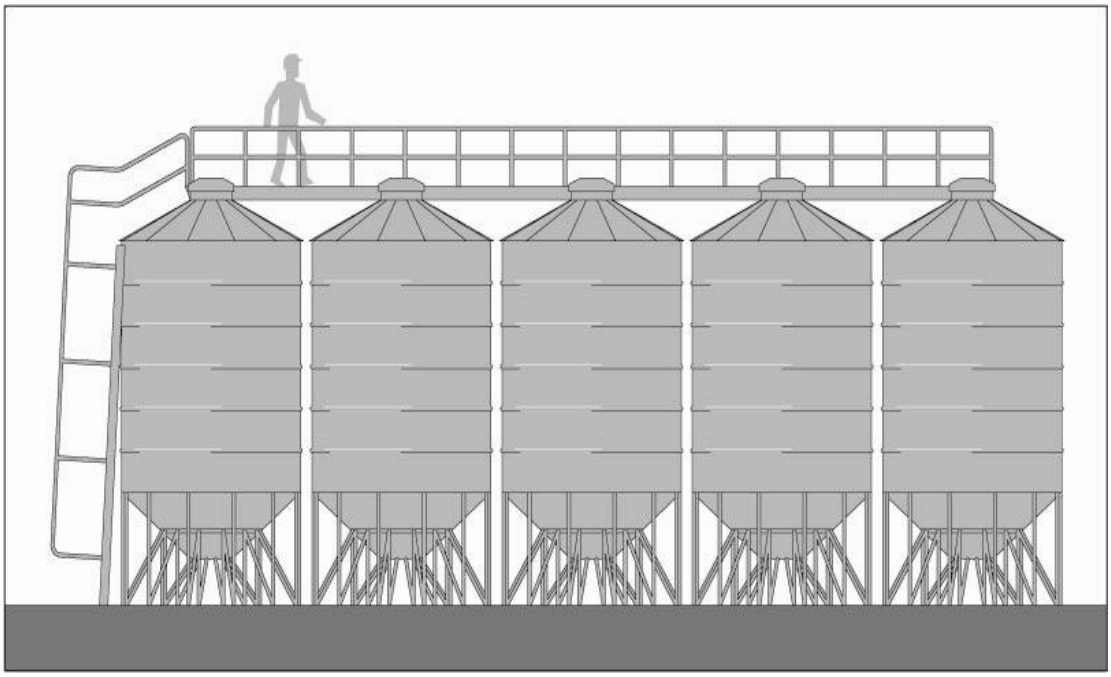

**Figure 3:** *A platform with guard rails installed above silos*

The barrier should be designed and constructed to withstand the force of someone falling against it.

Edge protection should consist of guard rails, solid balustrades or other structural components, for example wire mesh supported by posts and provided with a reinforced top edge. The top of the guard rail or component should be between 900 mm and 1100 mm above the working surface. If a guard rail system is used, it

should also have mid-rails and toe boards or wire mesh infill panels.

If access is required to equipment (for example, a hoist) it should be protected with gates, safety chains or other means to prevent a person falling.

### *Protection of openings and holes*

Holes, penetrations and openings through which a person could fall should be made safe immediately after being formed.

If a cover is used as a control measure, it must be made of a material that is strong enough to prevent persons or objects falling through and must be securely fixed to prevent any dislodgement or accidental removal.

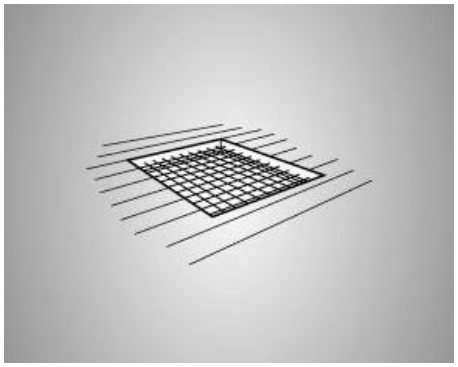

**Figure 4:** *4mm mesh embedded in the concrete floor.* The hole should also be covered to prevent things falling through


**Figure 5:** *Example of the type of danger sign to be affixed to the hole cover*

### *Surface and gradient*

Surfaces of solid construction should be non-slip, free from trip hazards and should generally not exceed 7 degrees (1 in 8 gradient). Cleated surfaces, which provide greater slip-

resistance, should not be steeper than 20 degrees (1 in 3 gradient).

If grid mesh or checker plate flooring is used for walkways and working platforms, ensure that:

- flooring panels are securely fixed and assembled in accordance with manufacturer's specifications
- where possible, they are fitted to the structure prior to it being lifted into permanent position
- each panel is fixed securely before the next panel is placed in position
- during installation, this type of flooring is secured by tack welding, panel grips or other means to prevent movement before being fixed permanently
- if panels of grid mesh or checker plate flooring are removed, edge protection is provided and the gaps left due to removed panels are protected.

***Entry and exit***

The solid construction must have a safe means for people to get to, from and move around the work area, for example permanently installed platforms, ramps, stairways and fixed ladders.

Further guidance is available in ***AS 1657 Fixed platforms, walkways, stairways and ladders – Design, construction and installation***.

Safety considerations include:

- exposure of access systems to the weather (for example, rain can make surfaces slippery and strong winds can cause loss of hand grip)
- the provision of adequate natural or artificial lighting to all access ways
- the clearance of obstructions so that persons are able to move easily to and from the workplace.

Portable ladders should only be used where the use of safer systems is not reasonably practicable.

# 4. FALL PREVENTION DEVICES

A fall prevention device is any equipment that is designed to prevent a fall for temporary work at heights, and once in place does not require any further adjustment by workers using the device.

## 4.1 TEMPORARY WORK PLATFORMS

A 'temporary work platform' is a working platform, other than a permanently installed fixed platform, used to provide a working area for the duration of the job. The design of the platform prevents workers from falling. Temporary work platforms include scaffolds, elevating work platforms, mast climbers, workboxes, building maintenance units, portable or mobile fabricated platforms or any other platform that provides a working area and is designed to prevent a fall.

### *Scaffolding*

Scaffolding can be very effective protection in preventing falls; however, there are specific requirements that apply to some types of scaffold under the WHS Regulations.

**Regulation 225**: A person with management or control of a scaffold must not allow the use of a scaffold from which a person or object could fall more than four metres unless a competent person provides written confirmation that the scaffold has been completed. The person must also ensure that:

- the scaffold and its supporting structure is inspected by a competent person before use, after any incident that could affect its stability (such as a severe storm), after any repairs, and at least every 30 days
- unauthorised access is prevented on scaffolding that is incomplete and left unattended (for example, by attaching danger tags and warning signs at appropriate locations).

Scaffolding work platforms are generally rated as light, medium or heavy duty. Safety considerations include:

- scaffolding conforms to **AS/NZS 4576 *Guidelines for scaffolding* and the AS/NZS 1576 *Scaffolding* series**
- all scaffolding is erected, altered and dismantled by competent persons. Any scaffold from which a person or object could fall more than four metres must be erected, altered and dismantled by or under the direct supervision of a licensed scaffolder

- prefabricated scaffolds are of the same type and not mixed components, unless the mixing of components has been approved by the manufacturer
- safe access to and egress from the scaffold is provided
- edge protection (hand rails, mid-rails and toe boards) is provided at every open edge of a work platform (see **Figure 6**).

*Information, instruction and training for workers using scaffolds*

Where work is performed from a scaffold, you must ensure that the relevant workers understand:

- what loads the scaffold can safely take
- not to make any unauthorised alterations to the scaffold (such as removing guard rails, planks, ties, toe boards and braces)
- that working platforms need to be kept clear of debris and obstructions along their length, and
- that incomplete or defective scaffolds must never be accessed.

Where work is performed using mobile scaffolds, workers should be trained to ensure the scaffold:

- remains level and plumb at all times
- is kept well clear of powerlines, open floor edges and penetrations
- is not accessed until the castors are locked to prevent movement
- is never moved while anyone is on it
- is only accessed using internal ladders (see **Figure 7)**.

**Figure 6**: *Perimeter scaffold with a fully decked working platform, guardrails and toeboards.*

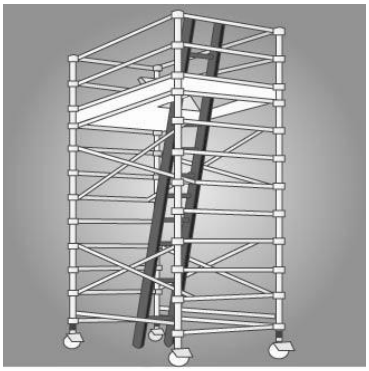

**Figure 7:** *Mobile scaffold with an access ladder and trapdoor to provide the largest possible hazard-free working platform.*

***Light duty suspended scaffold***

A suspended scaffold incorporates a suspended platform that is capable of being raised or lowered when in use (see **Figure 8**). Common types of suspended scaffolds include:

- swing stages which have cradles supported by a single row of suspension ropes
- double rope scaffolds, with cradles supported by two rows of suspension ropes
- work cages which are small cradles supported by one suspension rope only
- false cars, which are specialised forms of suspended scaffolding and are often used in the construction of lifts before lift cars are installed.

There are specific safety considerations for swing stages, including that:

- the working load and specifications are in accordance with AS 1576.4 *Scaffolding – Suspended Scaffolding*
- persons operating light duty suspended stages are trained in safe operation
- persons installing or servicing a light duty suspended stage hold a licence for advanced rigging or advanced scaffolding
- where the swing stage is suspended by two wire ropes to each winch, a safety harness and restraint lanyard is attached to a suitable anchor point of the swing stage.

Further guidance on the safe design, erection and use of scaffolding, including suspended scaffolding, is available in the *Scaffolding Code of Practice [under development].*

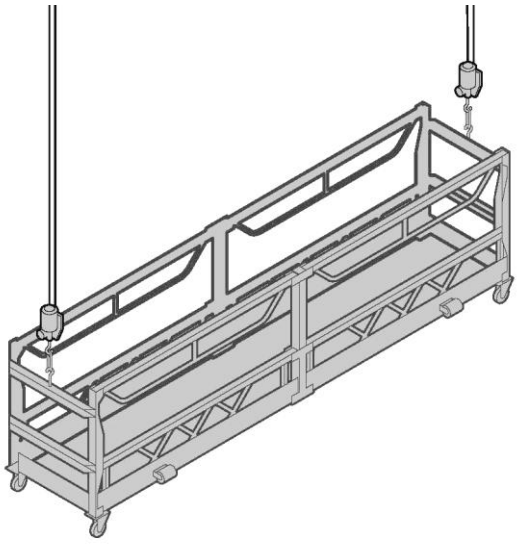

**Figure 8:** *Example of a light duty suspended scaffold with two wire ropes to each winch.* The platform must remain horizontal when moving it up or down.

### *Elevating work platforms*

Elevating Work Platforms (EWPs) include scissor lifts, cherry pickers, boom lifts and travel towers. There are battery powered and internal combustion engine types. Some are designed for hard flat surfaces only, while others are designed to be operated on rough terrain.

Safety considerations include that:

- workers operating the platform are trained and instructed in safe operating procedures for the particular brand and type of equipment, as well as the safe use of fall-arrest equipment and emergency rescue procedures
- the platforms are only used as working platforms and not as a means of entering and exiting a work area unless the conditions set out in **AS 2550.10 Cranes, hoists and winches - Safe use - Mobile elevating work platforms** are met
- unless designed for rough terrain, the platforms are used only on a solid level surface
- the surface area is checked to make sure that there are no penetrations or obstructions that could cause uncontrolled movement or overturning of the platform
- the manufacturer's or supplier's instructions are consulted for information on safe operation

- persons working in travel towers, boom lifts or cherry pickers wear a properly anchored safety harness
- workers are licensed when operating boom-type elevating work platforms with a boom length of 11 metres or more.

**Figure 9:** An example of a boom-type elevating work platform. The safety harness and lanyard assembly are not shown for purposes of clarity. The lanyard should be as short as possible and should be attached directly to the designated anchor point on the EWP, not to the handrail.

**Figure 10:** An example of a scissor-lift elevating work platform.

***Mast climbing work platforms***

Mast climbing work platforms are hoists with a working platform that is used to raise workers and material to a temporary working position. They use a drive system mounted on an extendable mast, which may need to be tied to a building under circumstances prescribed by the manufacturer.

Mast climbing work platforms can be set up in either single-mast or multi-mast configurations. They are generally not suitable for use if the profile of a structure changes at different elevations (for example, if the upper floors of a building 'step' back or balconies protrude from the building).

The erection and dismantling of mast climbing work platforms must be carried out, or be directly supervised, by a person holding an appropriate rigging or scaffolding licence.

Further information on mast climbing work platforms is provided in **AS 2550.16** ***Cranes—Safe Use—Mast climbing work platforms***.

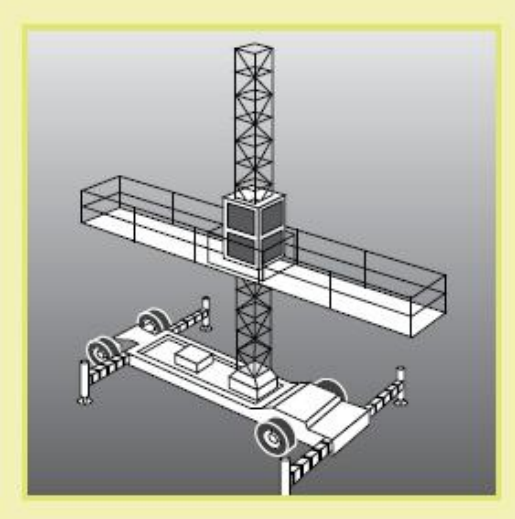

**Figure 11:** *An example of a typical mast climbing work platform.*

***Workboxes***

A workbox is designed to be supported by a crane, hoist, forklift truck or other mechanical device to provide an elevated work area for persons working from the box. It consists of a platform surrounded by an edge protection system and should be designed in accordance with **AS 1418.17** ***Cranes (including hoists and winches) —Design and construction of workboxes***.

Where reasonably practicable, other working platforms, such as an elevating working platform or scaffold, should be used as an alternative to the workbox.

The safety requirements and considerations include that:

- the workbox is not suspended over persons
- the workbox is designed for the task and securely attached to the crane. The workbox, lifting attachments and records should be checked by a competent person before use

- the workbox is fitted with a suitable anchorage capable of withstanding the fall forces specified in AS/NZS 1891.4 *Industrial fall-arrest systems and devices—Selection, use and maintenance*. Workers must be attached to the anchorage by a lanyard and harness unless the workbox is fully enclosed
- workers remain within the workbox while they are being lifted or suspended
- workers do not enter or leave the workbox when it is suspended (except in an emergency)
- the crane is fitted with the means to safely lower it in an emergency or a power supply failure
- the crane is suitably stabilised at all times while the workbox is used
- the crane has 'drive up' and 'drive-down' controls on both the hoisting and luffing motions and those controls are used. No declutching allowing free fall is to be used while a workbox is in use
- an effective means of communication between any person in the workbox and the operator is provided
- the crane is fitted with a safety hook and moused (lashed) accordingly
- the operator remains at the controls of the crane at all times.

For specifications for the use of crane workboxes refer to **AS 2550.1** ***Cranes, Hoists and Winches—Safe Use—General Requirements***.

*Forklifts with a work box*

A workbox fitted to a forklift must be securely attached to the forklift carriage and engineer-designed and constructed in accordance with **AS 2359** ***Powered Industrial Trucks*** (see **Figure 11**).

Safety considerations include that:

- people are not raised on the tynes of forklift trucks or the pallet
- no other device (for example, ladder or pallets) is used to gain additional height (see **Figures 13 and 14**)
- the safety gate is self-locking and kept shut when in the elevated position.

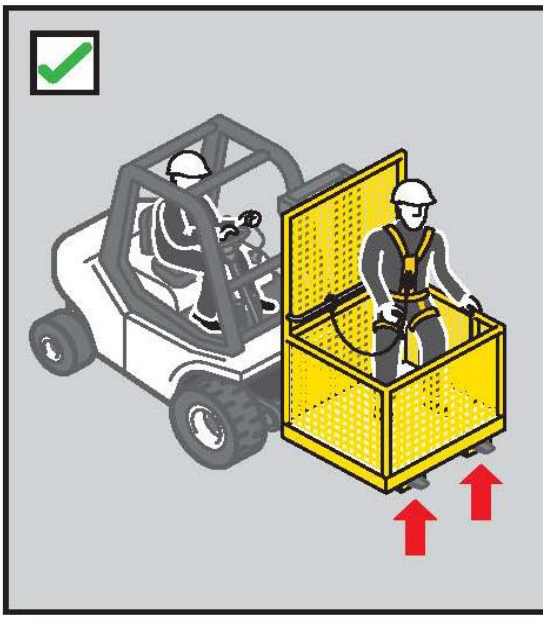

**Figure 12:** An example of an engineer-designed workbox with safety harness and lanyard assembly, correctly positioned on the forklift tynes.

**Figure 13:** Using a forklift as a working platform or to gain extra height by standing on the tynes or a pallet is an unacceptable practice.

**Figure 14:** Unacceptable practice with ladder on forklift.

***Building maintenance units***

Designers of buildings should consider the methods by which maintenance, repairs or cleaning will be undertaken on buildings or structures.

A building maintenance unit is a power-operated suspended working platform that is fixed permanently to a building or structure. It is used for access for building maintenance or window cleaning (see **Figure 15**).

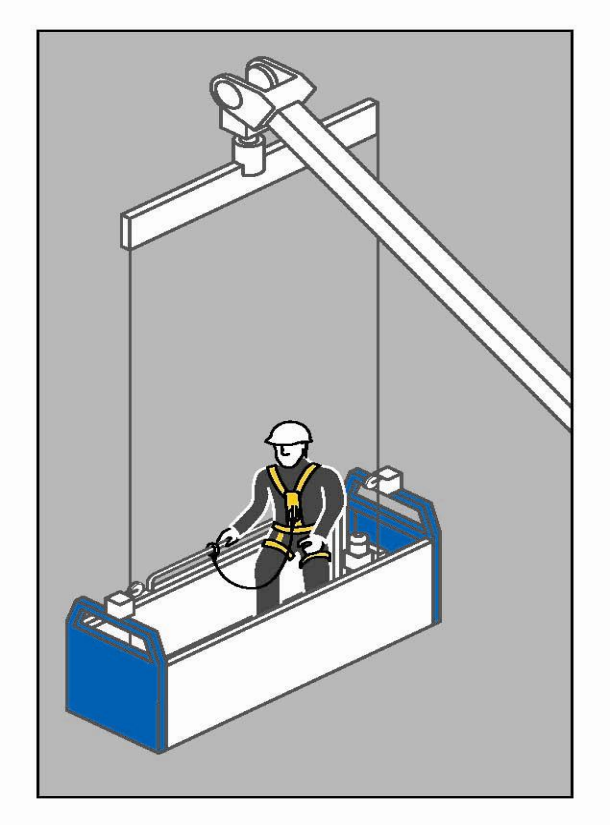

**Figure 15:** *An example of a building maintenance unit with safety harness and restraint line.*

Safety considerations include that:

- the platform has sufficient, clearly designated safety harness anchorage points designed to withstand the forces caused by a fall of any person located anywhere on the platform
- the units are designed in accordance with ***AS 1418.13 Cranes (including Hoists and Winches) —Building Maintenance Units*** and operated by competent persons in accordance with ***AS 2550.13 Cranes—Safe Use—Building Maintenance Units***.

### *Platforms supported by trestle ladders*

Trestle ladder scaffolds are only suitable for use at heights greater than two metres when guard rails and toe boards are incorporated to prevent people and material falling off the working platform. The system (including planks) should be assembled according to the manufacturer's specifications with the complete set of compatible components.

Some trestle ladder scaffolds include outriggers to increase stability (see **Figure 16**). Trestle ladder scaffolds are only suited to light duty tasks such as painting and rendering. Work should only be performed between the trestles. The minimum width of the working platform should not be less than 450 mm.

Alternatives to trestle ladders should be considered, such as small scissor lifts, light duty aluminium mobile scaffolds, boom arms and modular scaffolding.

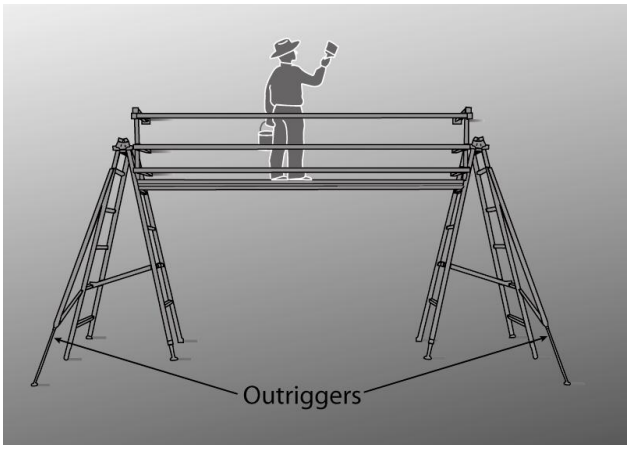


**Figure 16:** *Trestle ladder scaffold with guard rails and outriggers for stability.*

## 4.2 PERIMETER GUARD RAILS

Guard rails may be used to provide effective fall prevention:

- at the edges of roofs
- at the edges of mezzanine floors, walkways, stairways, ramps and landings
- on top of plant and structures where access is required (see **Figure 17**)
- around openings in floor and roof structures
- at the edges of shafts, pits and other excavations.

Guard rails should incorporate a top rail 900mm to 1100 mm above the working surface and a mid rail and a toe board.

Before using a guard rail system you should check that it will be adequate for the potential loads. The required load resistance

will depend on the momentum of a falling person. For example, the momentum of a person falling from a pitched roof will increase as the pitch (or angle) of the roof increases.

Refer to ***AS/NZS 4994—Temporary Edge Protection*** **series** for further guidance.

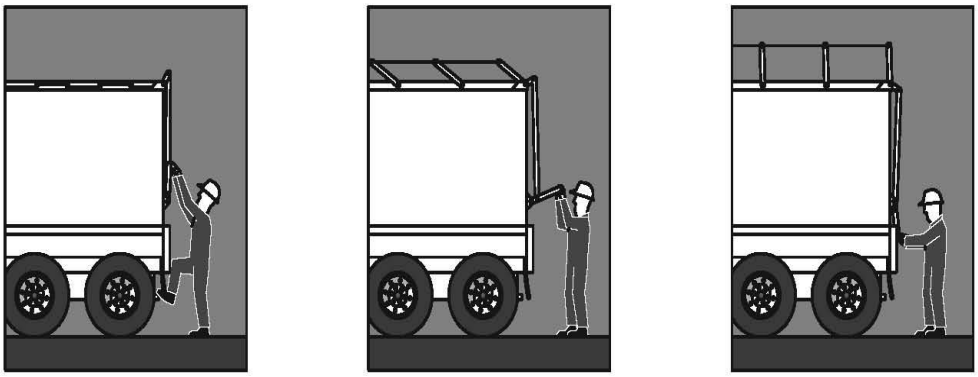

**Figure 17:** *Guard rails installed on top of a tan*ker to enable safe access to tank hatches.

## 4.3 SAFETY MESH

Safety mesh is designed to prevent internal falls through a roof. If securely fixed, safety mesh provides fall protection for roof installers and offers long-term protection against falling for maintenance and repair workers.

Safety mesh does not prevent falls from the edge of a roof or through holes in a roof, so it should always be used in conjunction with appropriate edge protection, guard rails or fall-arrest systems.

Safety mesh should comply with **AS/NZS 4389** ***Safety mesh***, which specifies the minimum requirements for the design, construction, testing and installation of safety mesh for use in domestic, commercial and industrial building applications.

The mesh should be formed from 2 mm diameter wire of not less than 450 MPa tensile strength, welded into a mesh with the longitudinal wires not more than 150 mm apart and the cross wires not more than 300 mm apart.

Safety mesh should be installed in accordance with the manufacturer's instructions by competent persons, who should be protected against the risk of falling by using appropriate control measures such as scaffolding, elevating work platforms or fall-arrest systems.

Particular care is required to ensure that the mesh is securely connected to the structure and the overlap between adjacent sections of mesh is sufficient to generate the necessary strength to resist the force of a person falling onto it. The safety mesh should be covered by the roof cladding as soon as reasonably practicable after it has been installed.

# 5. WORK POSITIONING SYSTEMS

A work positioning system involves the use of equipment that enables a person to work supported in a harness in tension in such a way that a fall is prevented.

Work positioning systems require a high level of competency on the part of the user and supervisors to ensure safe use. Users, including supervisors, should undertake a competency based course of training.

## 5.1 INDUSTRIAL ROPE ACCESS SYSTEMS

Industrial rope access systems are used for gaining access to and working at a workface, usually by means of vertically suspended ropes. Although fall-arrest components are used in the industrial rope access system, the main purpose of the system is to gain access to a work area rather than to provide backup fall protection (see **Figure 18**).

Other methods of accessing a workface should be considered (for example, EWPs or building maintenance units) before rope access systems, as a high level of skill is needed for their safe use.

You should ensure that, where it is necessary for industrial rope access systems to be used:

- operators are competent in the technique
- operators do not work alone, in case they require assistance in an emergency
- industrial rope access systems are installed only in a location where it is possible to provide prompt assistance or rescue if required (refer to Chapter 9 of this Code)
- all equipment is checked regularly by a competent person
- prior to use, all fixed anchorage points are checked by a competent person before attaching the rope access lines
- a back up system is used to protect the operator
- two independently anchored ropes are used for each person
- any person within three metres of an unguarded edge is adequately secured
- all operators wear a full body harness
- supervisors can communicate with workers

- where necessary, appropriate personal protective equipment is used, such as helmets, gloves, hearing protection, goggles and masks
- barricades and signposts are placed on all access areas below the working area and anchorage locations to exclude and alert the public and tradespeople.

Further guidance on industrial rope access systems is available in ***AS/NZS 4488 Industrial rope access systems series***.

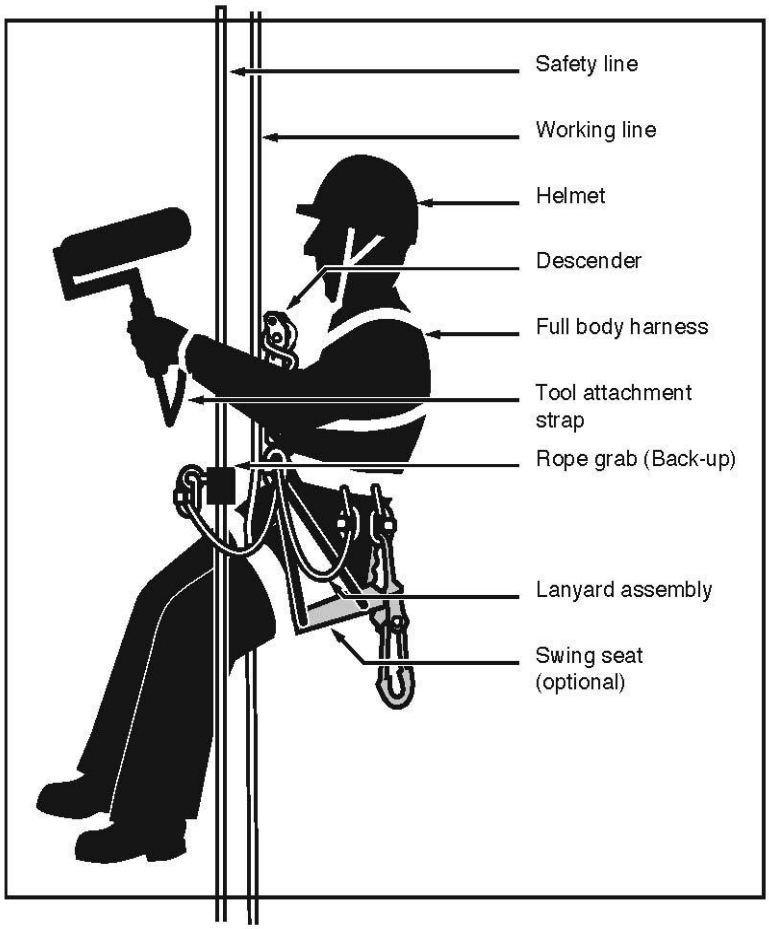


**Figure 18:** *Operator using an ascender in an industrial rope access system.*

## 5.2 RESTRAINT TECHNIQUE

A restraint technique controls a person's movement by physically preventing the person reaching a position at which there is a risk of a fall. It consists of a harness that is connected by a lanyard to an anchorage or horizontal life line. It must be set up to prevent the wearer from reaching an unprotected edge (see **Figure 19**).

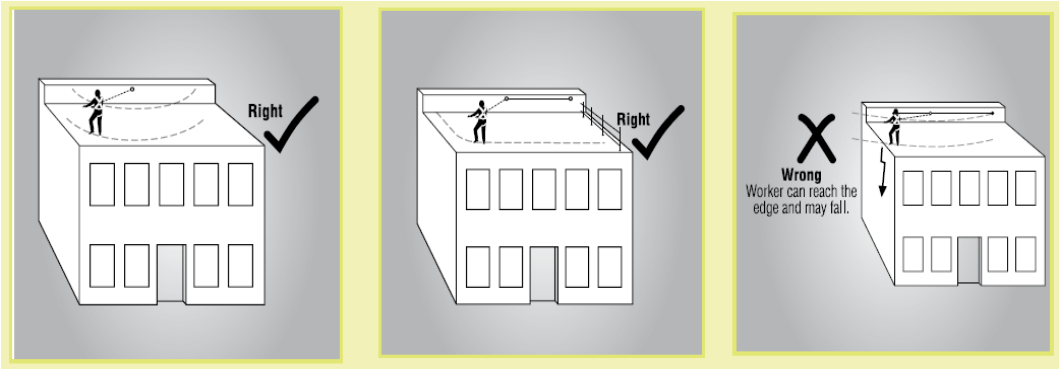


**Figure 19:** *Restraint technique options**.***

A restraint technique is suitable for use where:

- the user can maintain secure footing without having to tension the restraint line and without the aid of any other hand hold or lateral support. When deciding whether secure footing can be maintained, consider:
  - the slope of the surface
  - the supporting material type
  - the surface texture of the surface and whether it is likely to be wet, oily or otherwise slippery
- the horizontal life lines are fitted with an industrial shock absorber when required
- the restraint system conforms with **AS/NZS 1891 *Industrial fall-arrest systems and devices* series**.

Restraint techniques should only be used if it is not reasonably practicable to prevent falls by providing a physical barrier (for example, a guard rail). This is because restraint techniques require a high level of user skill to operate safely and also greater supervision.

A restraint system should be installed by a competent person in accordance with the manufacturer's instructions. Restraint anchorage should be designed for fall-arrest loading.

An individual fall-arrest system should be used instead of restraint techniques if any of the following situations apply:

- the user can reach a position where a fall is possible
- the user has a restraint line that can be adjusted in length so that a free fall position can be reached
- there is a danger the user may fall through the surface, for example fragile roofing material
- the slope is over 15 degrees
- there is any other reasonably likely use or misuse of the system that could lead to a free fall.

# 6. FALL-ARREST SYSTEMS

A fall-arrest system is intended to safely stop a worker falling an uncontrolled distance and reduce the impact of the fall. This system must only be used if it is not reasonably practicable to use higher level controls or if higher level controls might not be fully effective in preventing a fall on their own.

All equipment used for fall-arrest should be designed, manufactured, selected and used in compliance with the AS1891 series of standards.

Key safety considerations in using fall arrest systems are:

- the correct selection, installation and use of the equipment
- that the equipment and anchorages are designed, manufactured and installed to be capable of withstanding the force applied to them as a result of a person's fall
- that the system is designed and installed so that the person travels the shortest possible distance before having the fall stopped
- that workers using a fall-arrest system wear adequate head protection to protect them in the event of a fall
- that if the equipment has been used to arrest a fall it is not used again until it has been inspected and certified by a competent person as safe to use.

## 6.1 CATCH PLATFORMS

A catch platform is a temporary platform located below a work area to catch a worker in the event of a fall. The platform should be of robust construction and designed to withstand the maximum potential impact load. Scaffolding components may be used to construct fixed and mobile catch platforms (see **Figure 20**).

Catch platforms should:

- incorporate a fully planked-out deck
- be positioned so the deck extends at least two metres beyond all unprotected edges of the work area, except where extended guard railing is fitted to the catch platform
- be positioned as close as possible to the underside of the work area—the distance a person could fall before landing on the catch platform should be no more than one metre

- always be used with an adequate form of edge protection.

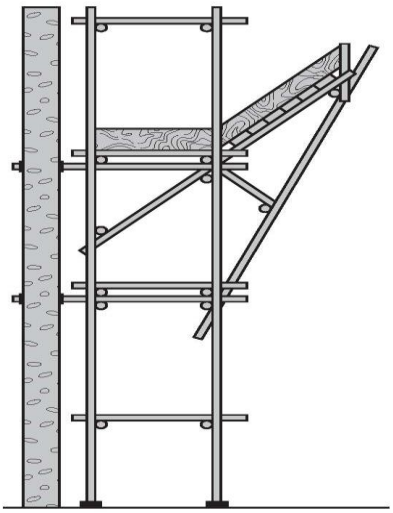

**Figure 20:** *An example of a catch platform below a work area*.

## 6.2 INDUSTRIAL SAFETY NETS

Safety nets can provide a satisfactory means of protection while allowing workers maximum freedom of movement. They should not be used to enter or exit a work area or as a working platform.

If safety nets are used, you should ensure that:

- safety nets are securely anchored before any work starts
- safety nets are constructed of material strong enough to catch a falling person or thing
- safety nets are hung as close as is practicable to the underside of the working area, but no more than two metres below the working area
- perimeter safety nets used where there is no edge protection extend at least 2.5 metres beyond the leading edge of the working area
- the safety net has sufficient tension and clearance to prevent a falling person contacting any surface or structure below the net
- material is not allowed to accumulate in suspended safety nets
- no welding or oxy cutting is performed above safety nets
- safety nets are inspected, particularly after installation, relocation or repair

- safety nets are stored correctly in dry, shaded areas with good air circulation.

## 6.3 INDIVIDUAL FALL-ARREST SYSTEMS

Individual fall-arrest systems consist of some or all of the following components:

- anchorages
- lifelines
- inertia reel
- lanyard of fixed length
- retractable lifelines
- rope grabs
- wire grabs
- rail system
- shock absorbers, both personal and industrial
- harness
- snap hooks (double or triple action to prevent rollout)
- karabiners (double or triple action to prevent rollout)
- rescue equipment.

Individual fall-arrest systems rely on workers wearing and using them correctly, and therefore workers who will use such a system must be trained in its safe use. They should only be used where it is not reasonably practicable to use higher level control measures.

Relevant Australian/New Zealand Standards for personal fall-arrest equipment require that they be permanently marked or labelled to indicate their purpose, correct use, limitations and other relevant information aimed at reducing misuse of the equipment.

***Anchorage points***

Each anchorage point should comply with the requirements in ***AS/NZS 1891:4 Industrial fall-arrest systems and devices – selection, use and maintenance***.

All anchorages should be tested and approved by a competent person before use—a visual inspection may not reveal the structural integrity of the anchor point (i.e. the bolt may have failed below the concrete surface).

Each anchorage point should be located so that a lanyard of the system can be attached to it before the person using the system moves into a position where the person could fall.

*Inspect the system components*

Each component of the system and its attachment to an anchorage must be inspected by a competent person:

- after it is installed but before it is used
- at regular intervals
- immediately after it has been used to arrest a fall.

Inspection of all components should be conducted in accordance with the manufacturer's specifications and the relevant standards. If any signs of wear or weakness are found during the inspection, the components or means of attachment should be withdrawn from use until they are replaced with properly functioning components.

*Limit free fall distance*

Fall-arrest systems, incorporating a lanyard, should be installed so that the maximum distance a person would free fall before the fall-arrest system takes effect is two metres. There should be sufficient distance between the work surface and any surface below to enable the system, including the action of any shock absorber to fully deploy (see **Figure 21**). To work out whether there is enough distance available, you should take into account:

- the worker's height
- the height and position of the anchorage point
- the length of the lanyard
- any slack in the horizontal life line
- any stretching of the lanyard or horizontal life line when extended by a fall
- the length of the energy absorber when extended by a fall.

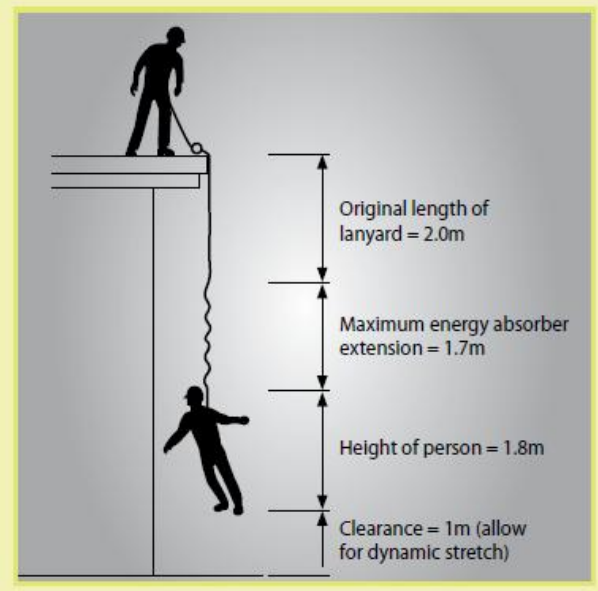


**Figure 21:** *Total fall distance before this particular configuration would be effective in arresting a fall is 6.5m.*

Lanyards should **not** be used in conjunction with inertia reels as this can result in an excessive amount of free fall prior to the fall being arrested.

***Use suitable harnesses***

In most cases, a full body harness should be worn. Harnesses must be correctly fitted. Workers should connect the fall-arrest line to the attachment point on their harness (dorsal attachment point or the chest connection) that will provide the best protection in the situation it is being used. Consideration should be given to the potential fall distance, potential impact with the structure, body position after a fall and the need to interact with equipment such as rope-grabs.

***Maintain minimum of slack in fall-arrest lanyard***

There should be a minimum of slack in the fall-arrest lanyard between the user and the attachment. The anchorage point should be as high as the equipment permits. Avoid work above the anchor point, as this will increase the free fall distance in the event of a fall, resulting in higher forces on the body and greater likelihood of the lanyard snagging on obstructions.

***Use inertia reels correctly***

When considering the use of inertia reels, bear in mind that they might not be effective in certain situations. For example, if a worker falls down the inclined surface of a steeply pitched roof, the inertia reel line may keep extending from the reel—it may not lock.

Inertia reels should not be used as working supports by locking the system and allowing it to support the user during normal work. They are not designed for continuous support.

Vertical and self-retracting anchorage lines can be used as a risk control measure in connection with work performed from boatswains' chairs and ladders. Where such lines are used, only one person may be attached to any one line.

***Use compatible components***

The use of non-compatible components may lead to 'roll-out' with some hook/karabiner configurations, resulting in injury or death to the user. The hazard cannot always be avoided by using components produced by the same manufacturer under the one brand name. If you are unsure whether components of a fall-arrest system are compatible you should contact the manufacturer for further information.

Snap hooks should be of the double action type, requiring at least two consecutive deliberate actions to open. Snap hooks should not be connected to each other as this could prevent the

safe operation of the snap hook (for example, roll-out may occur). Some double action hooks are susceptible to roll-out. Screw gate karabiners or hex nut connectors may sometimes be appropriate. Further guidance is provided in **AS/NZS 1891 *Industrial fall-arrest systems and devices***.

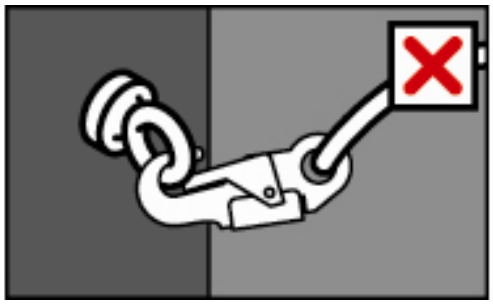

**Figure 22:** *Roll-out on a small diameter eyebolt.*

***Ensure prompt rescue in event of fall***

A person conducting a business or undertaking who implements a fall-arrest system as a control measure must establish emergency and rescue procedures. The rescue of a worker who is suspended in a full body harness must occur promptly to prevent suspension intolerance.

A worker should not use a fall-arrest system unless there is at least one other person on the site who can rescue them if they fall.

***Hazards with individual fall-arrest systems***

If a person using an individual fall-arrest system falls, the system may act as a pendulum, and in some situations the user may hit the ground (called 'swing down': see **Figure 23**) or swing back onto the building or structure (which is called 'swing back': see **Figure 24**).

Swing down can occur if the lanyard slides back along the perimeter edge of the roof until it is vertical. When this happens, the person may hit the ground, or the lanyard may break as a result of its contact with the edge of the roof.

Measures to address 'swing down' include:

- the installation of guard rails
- placing the anchorage point at a right angle to the position of the lanyard at the perimeter edge (for example, by using a mobile anchorage)
- the installation of a second anchorage point and belay devices (intermediate anchorages).

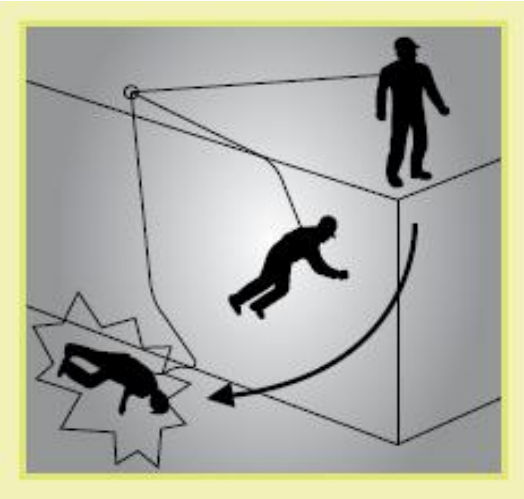

**Figure 23:** During 'swing down' the length of the lanyard and positioning of the anchor allow contact with the ground.

**Figure 24:** During 'swing back' the length of the lanyard and positioning of the anchor contact may allow the worker to hit the structure.

## 6.4 ANCHORAGE LINES OR RAILS

Anchorage lines or rails are temporary or permanent fall-arrest systems, which can be installed to provide continuous fall protection for persons using ladders or climbing towers. These can be used on plant, such as tower cranes, as well as buildings or structures.

Safety considerations include that:

- temporary systems comply with the ***AS/NZS 1891*** series of standards
- the locking device is attached to the frontal attachment point of the harness and the lanyard assembly is a maximum of 300 mm length
- the point of connection onto the ladder by the climber is near the base of the ladder to allow the connection before ascending begins and also to provide continuous connection to the disconnecting point when at a safe higher level
- free fall is limited to a maximum of 600 mm
- permanent systems are of wire or rail construction and are installed according to the manufacturer's instructions

After a fall, remove the system from service and have it inspected by a competent person before it is used again.

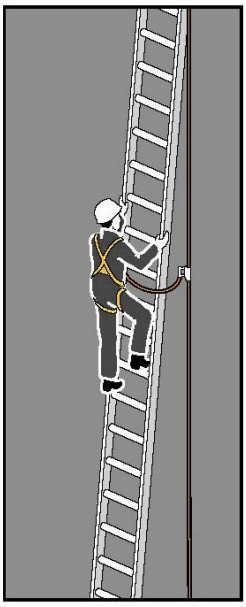

**Figure 25:** *With the use of an anchorage line system, the person climbing has continuous fall protection by being attached to the anchorage line and harness*.

***Double lanyards***

An alternative to anchorage lines or rails is the use of a double lanyard (also known as a twin tail or 'Y' lanyard). **Figure 26** shows how the use of a double lanyard means that the person climbing can always be connected to the ladder or structure.

However, double lanyards are easy to misuse—there should be no back hooking, they should not be wrapped around the body or passed between the legs, the chest connection should never be higher than the highest attachment point, they are not suitable for frequent use (because of possible misuse or muscle injury) and the ladder or structure points must be capable of arresting forces generated by a fall with the double lanyard. Adequate training should be provided on their use.

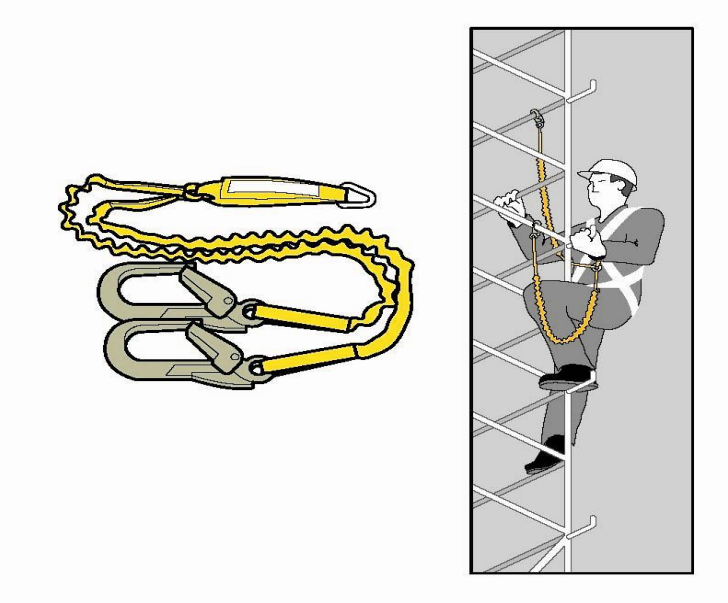

**Figure 26**

***Left****: An example of a double lanyard. These must have double action connectors.*

***Right:*** *Person climbing with a double lanyard.*

***Note*** *that in this application the connectors will slide down to the lowest point on the rail and likely be subject to side loading. Side loading can be controlled by using soft connections such as slings or the use of hooks rated to withstand side loading.*

# 7. LADDERS

Ladders are primarily a means of access and egress. Many falls take place when people are working from ladders. In addition, when using a ladder:

- the working width and movement is limited
- the time involved in moving and setting up ladders is often underestimated when planning work
- the working position on ladders is often uncomfortable (the need to stretch sideways, work above shoulder height and stand on narrow rungs for a long time) and may cause musculoskeletal disorders.

For these reasons, you should consider whether an elevating work platform or scaffolding would be safer and more efficient.

## 7.1 PORTABLE LADDERS

Extension or single ladders should generally only be used as a means of access to or egress from a work area. They should only be used as a working platform for light work of short duration that can be carried out safely on the ladder.

### *Selecting ladders*

If ladders are used they must be selected to suit the task to be undertaken. In doing this, you should consider the duration of the task, the physical surroundings of where the task is to be undertaken and the prevailing weather conditions.

Ladders should have a load rating of at least 120 kg and be manufactured for industrial use.

### *Positioning ladders*

Any ladder used at a workplace must be set up on a solid and stable surface, and set up so as to prevent the ladder from slipping. Single and extension ladders can be prevented from slipping by:

- placing ladders at a slope of 4:1, and setting up stepladders in the fully opened position
- securing ladders at the top or bottom, or if necessary, at both ends (see **Figure 27**).

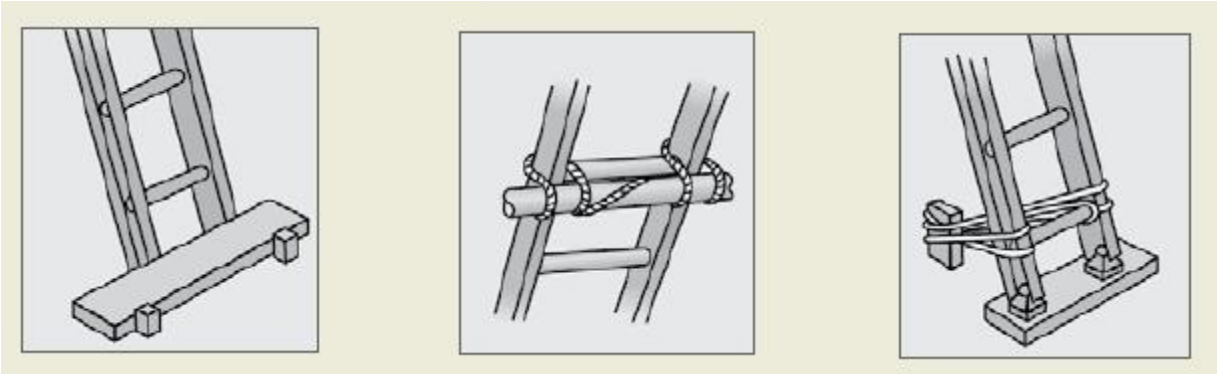

**Figure 27**: *Some effective ways of securing a ladder*

***Access or egress***

Where fixed or extension ladders are used for access or egress, you should check that:

- there is a firm, stable work platform, free from obstructions, to step onto from the ladder
- the ladder extends at least one metre above the stepping-off point on the working platform
- fall protection is provided at the stepping-off point where people access the working platform.

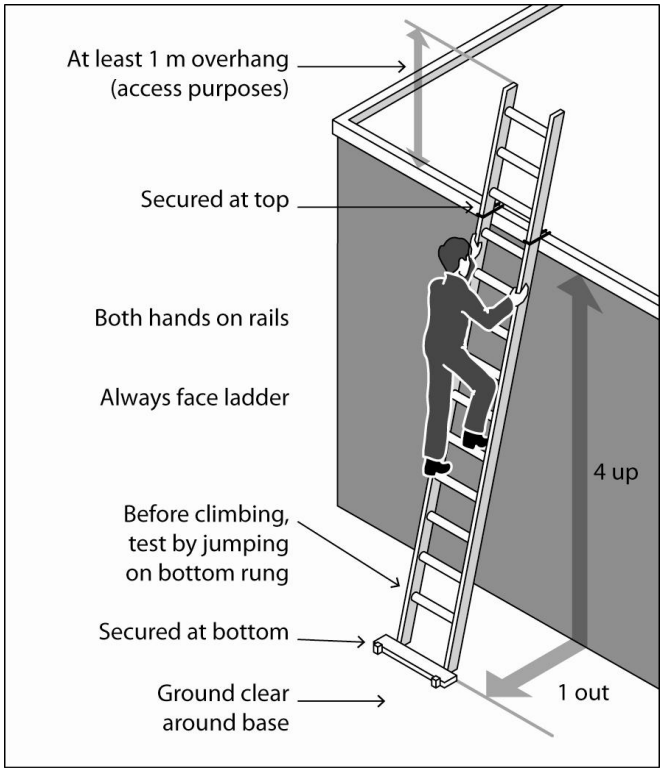


**Figure 28:** *Example of acceptable ladder use*

### *Safe Use of Ladders*

When a ladder is used, you should check that:

- the ladder is in good condition—the ladder should be inspected for faults, such as broken rungs, stiles and footing before it is used
- damaged ladders are removed from service
- the ladder is set up on firm, stable and level ground
- the ladder is the correct height for the task to avoid reaching or stretching
- the ladder is not too close or too far from the support structure—the distance between the ladder base and the supporting structure should be about one metre for every four metres of working ladder height (4:1 ratio)
- the ladder is secured against displacement (i.e. slipping or sliding) and/or there is another person holding the base of the ladder
- the ladder is not placed so that the weight of the ladder and any person using the ladder is supported by the rungs
- all the locking devices on the ladder are secure
- materials or tools are not carried while climbing the ladder—use a tool belt or side pouch
- only light duty work is undertaken while on the ladder, where three points of contact can be maintained and tools can be operated safely with one hand
- slip resistant base, rungs or steps are provided
- slip resistant shoes are worn
- ladders are not used without additional appropriate precautions:
    - in access areas or doorways—if necessary, erect a barrier or lock the door shut
    - on scaffolding or an elevating work platform to get extra height
    - next to power lines unless the worker is trained and authorised and the appropriate ladder is being used
    - in very wet or windy conditions
    - next to traffic areas, unless the working area is barricaded.

**Figure 29:** *A step platform can provide a stable work surface*

When using ladders, it is not safe to:

- use metal or metal reinforced ladders when working on live electrical installations
- carry out work such as arc welding or oxy cutting
- work over other people
- allow anyone else to be on the ladder at the same time.

Except where additional and appropriate fall protection equipment is used in conjunction with the ladder, it is not safe to:

- use a stepladder near the edge of an open floor, penetration or beside any railing
- over-reach (the centre of the torso should be within the ladder stiles throughout the work)
- use any power or hand tool requiring two hands to operate, such as concrete cutting saws and circular saws
- use tools that require a high degree of leverage force which, if released, may cause the user to over-balance or fall from the ladder, such as pinch bars
- face away from the ladder when going up or down, or when working from it
- stand on a rung closer than 900 mm to the top of a single or extension ladder

- stand higher than the second tread below the top plate of any stepladder (with the exception of three-rung step ladders).

Guidance on the selection, safe use and care of portable ladders is set out in **AS/NZS 1892 *Portable ladders* series**. The manufacturer's recommendations on safe use should also be followed.

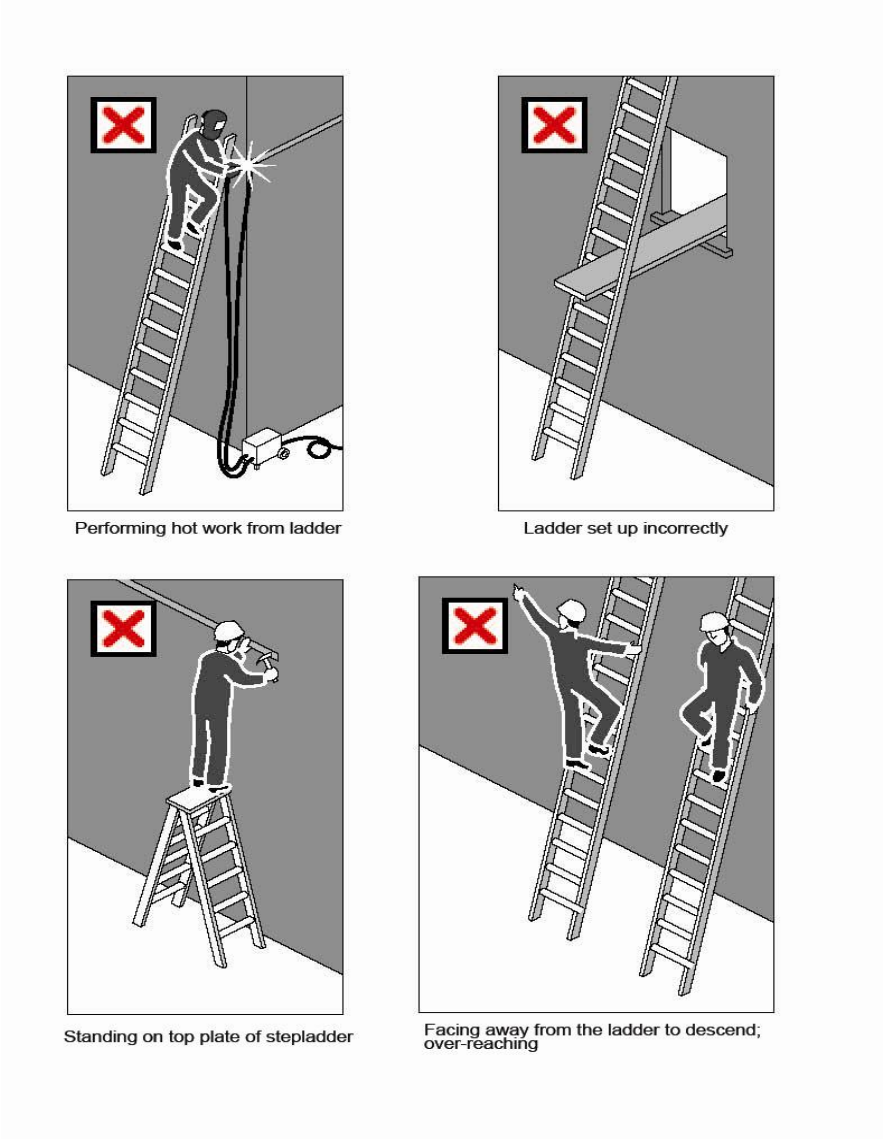


**Figure 30:** *Examples of unsafe ladder use*

## 7.2 FIXED LADDERS

Fixed ladders should be installed in accordance with ***AS 1657 Fixed Platforms, Walkways, Stairways and Ladders—Design, Construction and Installation***.

Ladder cages in fixed ladders do not stop a fall but simply funnel a fall and, in some cases, more injuries can occur from striking the protective backguards on the way down. The cages may also hinder rescues. Therefore, fixed ladders with angles exceeding

75 degrees to the horizontal should be fitted with a permanent or temporary fall-arrest system (anchorage lines or rails).

The angle of slope should not be less than 70 degrees to the horizontal and not greater than 75 degrees to the horizontal. **In no case should the ladder overhang the person climbing the ladder**. If the angle is more than 75 degrees, a safe system of work to prevent falls should be provided such as a permanent fall-arrest system or a full body harness with double arm lanyard.

A specifically designed rescue procedure should be developed for use in ladder cage situations. Training in rescue procedures should occur before using the fixed ladder.

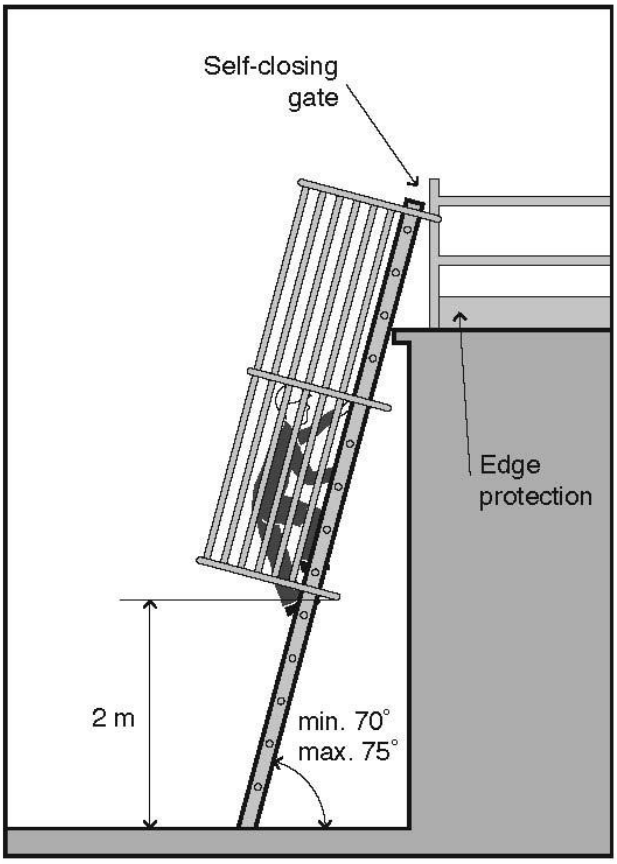


**Figure 31:** *Example of a fixed ladder fitted with a ladder cage*

## 7.3 LADDER MAINTENANCE

Ladders should be regularly inspected by a competent person in accordance with the manufacturer's recommendations. Ladders with any of the following faults must be replaced or repaired:

- fibreglass stiles cracked, chipped or severely faded with fibres exposed
- timber stiles warped, splintered, cracked or bruised
- metal stiles twisted, bent, kinked, crushed or with cracked welds or damaged feet
- rungs, steps, treads or top plates that are missing, worn, damaged or loose
- tie rods missing, broken or loose
- ropes, braces, or brackets that are missing, broken or worn
- timber members that are covered with opaque paint or other treatment that could disguise faults in the timber
- missing, loose, bent or worn fasteners, i.e. rivets, bolts and pins
- worn or damaged feet, including non-slip material.

# 8. ADMINISTRATIVE CONTROLS

Administrative controls may be used to support other control measures and may include 'no go' areas, permit systems, the sequencing of work and safe work procedures. Using administrative controls exclusively to minimise the risk of falls is only appropriate when it is not reasonably practicable to use a higher order control.


**Figure 32:** *Example of a sign for a 'no go' area*

### *'No go' areas*

'No go' areas can be an effective method of making sure people are not exposed to hazards. They require clear signs warning people not to access the hazardous area. They can be used to highlight the risks of entry to an area where there is an unguarded hazard, or to areas where work is being undertaken overhead and there is a risk of falling objects.

Relevant information and instruction should be provided about 'no go' areas with adequate supervision to ensure that no unauthorised worker enters the 'no go' area.

Barriers should be used in conjunction with signs to cordon-off areas where there is a risk of falling or being hit by falling objects. They should be highly visible and securely fixed to prevent displacement.

### *Permit systems*

Permit systems allow only competent persons trained in the use of relevant control measures to work in an area where there is a hazard. Examples include:

- tagging all access points to a scaffold to restrict unauthorised access during erection and

dismantling, with 'only licensed scaffolders permitted on an incomplete scaffold'

- requiring permits for access to areas where travel restraint systems or fall-arrest systems are to be used.

### *Organising and sequencing of work*

Work should be organised so that people do not interfere with other workers or increase the risk to themselves or others. For example, you can sequence jobs so that different trades are not working above or below each other at the same time. Plan the work so tasks are not performed for extended periods from a ladder, or so that work at height is minimised in extremely hot or cold weather.

### *Safe work procedures*

An administrative control may be as simple as a safe work procedure that describes the steps involved in safely undertaking a task. It may also include any particular training, instruction and the level of supervision required. For example, a safe work procedure to reduce the risk of falls when entering or exiting vehicles may include instructing drivers to not jump down from the cab and always maintain three points of contact when climbing into or out of the cab (see **Figure 33**).

**Figure 33:** *Diagrams showing the correct procedure for climbing in and out of trucks*

If relying on administrative controls, it may be necessary to provide a high level of supervision to ensure that the safe work procedure is being adhered to.

# 9. EMERGENCY PROCEDURES FOR FALLS

Whenever there are risks from working at height, appropriate emergency procedures and facilities, including first aid, must be established and provided. Typical injuries from falls can include unconsciousness and occluded airway, impalement, serious head or abdominal injuries and fractures.

A person using a fall-arrest system could suffer suspension intolerance as a result of a fall. The WHS Regulations contain a specific provision to address the need for emergency and rescue procedures for such situations.

**Regulation 80**: A person conducting a business or undertaking who implements a fall-arrest system as a measure to control risk must establish emergency and rescue procedures.
The procedures must be tested so that they are effective. Workers must be provided with suitable and adequate information, instruction and training in relation to the emergency procedures.

## 9.1 EMERGENCY PROCEDURES

In developing emergency procedures, the different types of emergency and rescue scenarios that might arise should be considered. Information from the risk assessment will help in this task.

**Regulation 42**: You must ensure that workers have access to first aid equipment and facilities for the administration of first aid. You must also ensure that workers are trained to administer first aid or that workers have access to persons who are trained in first aid.

Further guidance is available in the ***First Aid in the Workplace Code of Practice [under development]***.

**NOTE:** Regulation 761 of the WHS Regulations prescribes Part 2 (First Aid) of the *Occupational Health and Safety Code of Practice 2008* for the purposes of sub item 23(1) of Schedule 2 to the *Work Health and Safety (Transitional and Consequential Provisions) Act 2011*. That Part is taken to be an approved code of practice approved for the purposes of the WHS Act.

The emergency procedures for falls may be incorporated into the emergency plan required for the workplace under the WHS Regulations.

When establishing emergency procedures, you should take into account the following:

| Relevant considerations | Questions |
|---|---|
| Location of the work area | Is the work at height being undertaken in a remote or isolated place? How accessible is it in an emergency and how far away is it from appropriate medical facilities?<br>Can the rescue of a person after an arrested fall be provided immediately, without the need to rely on emergency services? |
| Communications | How can workers working at height communicate in an emergency? |
| Rescue equipment | What kinds of emergencies may arise? The provision of suitable rescue equipment will depend on the nature of the work and the control measures used, for example, an emergency rapid response kit with man-made fibre rope, according to AS/NZS 4142.3 *Fibre ropes—Man-made fibre rope for static life rescue lines* .<br>Selected rescue equipment should be kept in close proximity to the work area so that it can be used immediately. |
| Capabilities of rescuers | Are rescuers properly trained, sufficiently fit to carry out their task and capable of using any equipment provided for rescue (e.g. breathing apparatus, lifelines and fire-fighting equipment)?<br>Have emergency procedures been tested to demonstrate that they are effective? |
| First aid | Is appropriate first aid available for injuries associated with falls?<br>Are trained first aiders available to make proper use of any necessary first aid equipment? |
| Local emergency services—if they are to be relied on for rescue | How will the local emergency services (e.g. ambulance) be notified of an incident? What is the likely response time? |

## 9.2 SUSPENSION INTOLERANCE

Suspension intolerance can occur with a fall-arrest system when a person has an arrested fall and is suspended in an upright, vertical position with the harness straps causing pressure on the leg veins. The lower legs' capacity to store large amounts of blood reduces the return of blood to the heart, slowing the heart rate, which can cause the person to faint. This may lead to renal failure and eventually death, depending on a person's susceptibility. This condition may be worsened by heat and dehydration.

The quick rescue of a person suspended in a full body harness, as soon as is possible, is vital. For this reason, workers should be capable of conducting a rescue of a fallen worker and be familiar with onsite rescue equipment and procedures.

Workers and emergency response workers must be trained in the rescue procedures and be able to recognise the risks of suspension intolerance and act quickly in the rescue of a person.

### *Preventing suspension intolerance*

To prevent suspension intolerance occurring as a result of an arrested fall, you should ensure that:

- workers never work alone when using a harness as fall protection
- workers use a harness, which allows legs to be kept horizontal
- the time a worker spends in suspension after a fall is limited to less than five minutes. When a suspension is longer than five minutes, foothold straps or a way of placing weight on the legs should be provided.
- workers are trained to do the following when they are hanging in their harness after a fall:
    - move their legs in the harness and push against any footholds, where these movements are possible. In some instances, the harness design and/or any injuries received may prevent this movement
    - move their legs as high as possible and the head as horizontal as possible, where these movements are possible.

### *Training for rescues*

The training for rescuing workers who have fallen should address the following factors:

- the rescue process should start immediately
- training frequency should take into account the worker's competence and their ability to retain competence through regular exposure to the equipment and skills needed to perform a rescue
- workers should not put themselves at risk during a rescue.

# 10. DESIGN OF PLANT AND STRUCTURES

## 10.1 DESIGN CONSIDERATIONS

Consideration of the potential risk of falls early when designing plant or structures can result in the elimination of such risks. Where elimination is not possible, one way to minimise risks at the design stage is to integrate fall prevention systems into the design.

Safety considerations at the design stage should include:

- safe entry to and exit from any work area
- designing permanent guard rails or other forms of edge protection (for example, parapet walls) for permanent fall prevention on roofs
- future maintenance requirements, especially in relation to sloping building exteriors and windows, to ensure maintenance can be carried out safely
- specifying the strength of roof members and other points to which guard rail, or anchor points for work positioning systems will be fixed
- safer building design generally, with, for example:
    - low-level mounting of roof vents
    - the location of air conditioning units and other roof-mounted plant, such as satellite dishes, away from edges
    - the location of air conditioning and similar plant at ground level
    - the specification of non-fragile material for the roof
    - the use of permanent safety mesh
    - safer gutters, for example, installing large volume gutters and down pipes to minimise the need to access the roof for cleaning, locating the gutters at ground level or away from edges, or the removal of gutters altogether, with a smooth transition from the roof to the walls with the gutters at ground level.
- specific safety requirements for particular workers doing subsequent installation, maintenance or repair work. These groups include:
    - people installing and maintaining antennae and satellite dishes

- contractors servicing air conditioning equipment on the roof
- window and gutter cleaners and repairers

- designing the pre-fabrication of structures on the ground before they are lifted into position.

## 10.2 PLANT

Safety considerations at the design stage could include:

- providing adequate steps and hand rails on vehicles (see **Figure 34)**
- incorporating a fall prevention system in silos and overhead conveyors
- ensuring workers who will be maintaining or cleaning the plant are able to do so safely
- considering the safety of passengers.

**Section 22** Designers must provide information to each person who is provided with the design that includes information on the purpose for which the plant was designed and how to use the plant safely.

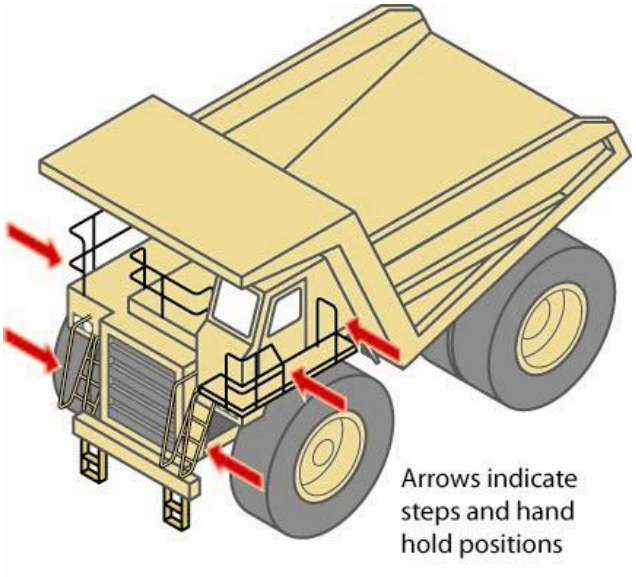


**Figure 34:** *Dump trucks*

## 10.3 BUILDINGS AND STRUCTURES

Designers or constructors of buildings or structures must ensure, so far as is reasonably practicable, that workers involved with the construction, use or subsequent maintenance are not exposed to the risks associated with work at height. Therefore, at the design and planning stage, it is important to consider providing fall prevention systems as part of the building or structure.

As it is unlikely that all design work on larger projects will be carried out by one designer, consultation, co-operation and co-ordination should occur between the builder and other designers to ensure the safe interaction of the different design aspects.

When risks remain in the design work, information must be included with the design to alert others to the risks. Providing information about safety issues is a key component to ensure proper, adequate and suitable design and installation.

The design and planning for the construction stage should include:

- reducing the risk for those working at heights, such as the installation of guard rails to perimeter structural members prior to erection
- reducing the time spent working at heights by pre-fabricating modules on the ground, before lifting them into position
- sequencing of the work to be performed at heights
- the location and condition of access roads, for example to enable a crane to place building materials in the most appropriate and accessible location, rather than the materials being moved manually
- preparation of the ground or floor below the work area. It should be compacted and level to support plant or equipment, such as cranes and scissor lifts
- identification of underground services including drainage, for example for the safe setting up of cranes
- provision of permanent safety mesh.

### *Planning for building maintenance*

During the planning stage, consideration should also be given to the methods by which maintenance, repairs or cleaning will be undertaken on a building or structure, for example:

- designing window cleaning bays or gangways integrated into the structural frame
- designing permanent anchorage and hoisting points into structures where maintenance needs to be undertaken at height.

### *Planning the site layout*

When planning the site layout, the following factors should be considered:

- the preparation of firm, level surfaces below work areas for the support of plant and equipment, such as scissor lifts or mobile scaffolds
- the site and condition of access roads to enable plant to place material in and pick it up from the most favourable positions, thereby reducing, for example, the need for manual handling at height
- safe access to and egress from work areas and amenities, including the provision and placement of stairways, ladders, catwalks, guardrails and barriers
- the need for adequate means of escape and rescue in the event of an emergency.

# APPENDIX A – TERMS USED IN FALL CONTROL MEASURES

**Anchorage:** means a secure point for attaching a lanyard, lifeline or other component of a travel restraint system or fall-arrest system. Anchorages require specific load and impact capacities for their intended use.

**Double or triple action device: i**s a self-closing hook or karabiner with a keeper latch which will automatically close and remain closed until manually opened. These units have a minimum of at least two distinct and deliberate consecutive actions to manually open them.

**Free fall:** is any fall or part of a fall where the person falling is under the unrestrained influence of gravity over any fall distance, either vertically or on a slope on which it is not possible to walk without the assistance of a handrail or hand line.

**Inertia reel:** (also known as a self-retracting lanyard or fall-arrest block) is a type 2 or 3 fall-arrest device that arrests a fall by locking onto a line and at the same time allows freedom of movement.

**Karabiners:** these are metal types of connectors that can be attached to anchorage points. They come in a variety of sizes, shapes and locking mechanisms to suit various applications. They should be self-closing and self- or manual-locking and capable of being opened only by at least two consecutive deliberate manual actions.

**Lanyard:** an assembly consisting of a line and components which will enable connection between a harness and an anchorage point and will absorb energy in the event of a fall.

**Personal energy absorber (or deceleration device):** means a device which reduces the deceleration force imposed when a fall is suddenly arrested, and correspondingly reduces the loadings on the anchorage and the person's body. The energy absorber may either be a separate item or manufactured as part of the lanyard.

**Restraint line:** is the line securing workers to a point of anchorage and is used to prevent a person from reaching a point from which he or she could fall.

**Static line:** is a horizontal or substantially horizontal line to which a lanyard may be attached and which is designed to arrest a free fall.

**Total fall distance:** is the total distance a person is likely to fall during both the free and restrained parts of a fall and includes the maximum dynamic extension of all supporting components.

# APPENDIX B – REFERENCES AND OTHER INFORMATION SOURCES

## Australian Standards and Australian/New Zealand Standards

AS 1418.13 *Cranes (including Hoists and Winches) – Building Maintenance Units*
AS/NZS 1576 *Scaffolding* series
AS/NZS 1657 *Fixed platforms, walkways, stairways and ladders—Design, construction and installation*
AS/NZS 1891.1 *Industrial fall-arrest systems and devices—Harnesses and ancillary equipment*
AS/NZS 1891.2 supp:1-2001 *Industrial fall-arrest systems and devices—Horizontal lifeline and rail systems—Prescribed configurations for horizontal lifelines (Supplement to AS/NZS 1891.2:2001)*
AS/NZS 1891.3 *Industrial fall-arrest systems and devices—Fall-arrest devices*
AS/NZS 1891.4 *Industrial fall-arrest systems and devices—Selection, use and maintenance*
AS/NZS 1892 *Portable ladders* series
AS/NZS 4142.3 *Fibre ropes—Man-made fibre rope for static life rescue lines*
AS/NZS 4389 *Safety mesh*
AS/NZS 4488 *Industrial rope access systems* series
AS/NZS 4488.2 *Industrial rope access systems—Selection, use and maintenance*
AS/NZS 4576 *Guidelines for scaffolding*

AS 2550.16 *Cranes—Safe Use—Mast climbing work platforms*
AS/NZS 4994 Temporary edge protection series

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## British Standards Institution

*BSEN 1263-1:2002 Safety nets: Safety requirements, test methods*
*BSEN 1263-2:2002 Safety nets: Safety requirements for the positioning limits*
Internet address: www.bsi-global.com