

Code of Practice for Working Safely at Heights



Contents

Section A : General Requirements

1. Introduction	3
1.1 Scope	3
1.2 Purpose	3
1.3 Terms and Definitions	4
2. Fall Prevention Plan	5
2.1 Principles of a Fall Prevention Plan	5
2.2 Fall Prevention Plan Coverage	5
2.3 Fall Prevention Plan Component List	5
3. Components of a Fall Prevention Plan	6
3.1 Policy for Fall Prevention	6
3.2 Responsibilities	6
3.3 Risk Management	7
3.4 Risk Control Measures	9
3.5 Safe Work Procedures	11
3.6 Use of Personal Protective Equipment	12
3.7 Inspection and Maintenance	12
3.8 Instruction and Training	13
3.9 Accident/ Incident Investigation	14
3.10 Emergency Response	15
4. Permit-to-work System	16
4.1 Principles	16
4.2 Requirements and Scope	17
4.3 Implementation	17

Section B : Fall Control Measures

5. Access to and Egress from Work Areas	19
5.1 Access and Egress Risk and Assessment	19
5.2 Access and Egress Safety Considerations	19
5.3 Roof Access	20
5.4 Access to Top of Vehicles/ Containers	20
6. Fall Prevention Systems	21
6.1 Edge Protection, Perimeter Guard-railing	21
6.2 Guarding of Openings	24
6.3 Scaffolds	24
6.4 Tower Scaffolds	25
6.5 Mobile Elevated Work Platforms	27
6.6 Suspended Scaffold	29
6.7 Mast Climbing Work Platforms	30

7. Anchorage and Lifelines	31
7.1 Application	31
7.2 Anchorage	31
7.3 Lifelines	32
7.4 Lifeline Devices	34
8. Travel Restraint Systems	35
9. Personal Fall Arrest Systems	37
9.1 Fundamentals of Personal Fall Arrest Systems	37
9.2 Limitations of Fall Arrest Systems	38
9.3 Instruction and Training for Workers Using Personal Fall Arrest Systems	39
9.4 Hazards of Fall Arrest Systems	39
9.5 Rescue of Persons Using Personal Fall Arrest Systems	40
9.6 Components of a Personal Fall Arrest System	40
10. Work Positioning Systems	47
10.1 Work Positioning Belts	47
10.2 Industrial Rope Access Systems	48
11. Ladders and Step Platforms	50
11.1 Safety Guidelines for Ladders	50
11.2 Portable Ladders	52
11.3 Fixed Ladders	54
12. Hazards of Working on Rooftops	55
12.1 Working on Rooftops	55
12.2 Working on Pitched Roofs	55
12.3 Working on Fragile Roofs	57
Appendix A: Sample Fall Prevention Plan	59
Appendix B-1: Flow Chart for Permit-to-work	64
Appendix B-2: Sample Permit-to-work (for WAH)	65
13. Acknowledgements	67
14. List of References	68
15. Other Useful Contacts	69

Section A: General Requirements

1. Introduction

1.1 Scope

1.1.1 This Code of Practice shall apply to all work at heights activities across all industry sectors.

1.1.2 The Code provides guidance for the practitioner to manage work at heights activities through:

- Risk management framework;
- Development and implementation of a Fall Prevention Plan; and
- Permit-to-work system.

1.2 Purpose

1.2.1 This Code of Practice has been prepared to enhance the standard of work at heights safety at workplaces.

1.2.2 The Code illustrates a variety of fall control measures and work practices that can be adopted when the risk of falling from heights, or into depth, is present. The control measures outlined in this Code do not represent the only acceptable means of achieving the standard to which the Code refers.

1.2.3 The Code provides guidance and clarifications on the Workplace Safety and Health (WSH) (Work at Heights) Regulations and should be read in conjunction with relevant WSH regulations, standards and WSH Council guidelines on work at heights safety.

1.3 Terms and Definitions

- 1.3.1** “Administrative controls” means policies and procedures for safe work practices.
- 1.3.2** “Anchorage” means a place, a fixing or a fixture to which a lifeline or lanyard is connected for fall restraint or fall arrest.
- 1.3.3** “Authorised manager” means a person appointed by his employer or the principal as the competent person to carry out the duties of an authorised manager for work at heights.
- 1.3.4** “Competent person” means a person who has sufficient experience and training to perform the work required to be carried out, and has passed such courses as the Commissioner for Workplace Safety and Health may require for that work.
- 1.3.5** “Fall arrest system” means equipment and/ or material that is designed for the purpose of preventing, or reducing the severity of injury to a person in the event of a fall such as safety harness systems. Restraint belts are used in a travel restraint system and are not to be used in a fall arrest system.
- 1.3.6** “Fall prevention plan” means a site-specific plan prepared by a competent person for the purpose of reducing or eliminating the risk of falls by ensuring that all reasonable fall prevention measures and methods have been implemented, prior to the commencement of work.
- 1.3.7** “Fall prevention system” means material and/or equipment that is designed for the purpose of preventing a person falling from height.
- 1.3.8** “Permit-to-work” or “Permit” refers to a document routed through the permit-to-work system to be endorsed by the authorised persons and displayed at the area where the approved work is being carried out.
- 1.3.9** “Responsible person”, in relation to a person who carries out or is to carry out any work at height, means —
- a) his employer; or
 - b) the principal under whose direction he carries out or is to carry out any such work.
- 1.3.10** “Safety Assessor” means a person appointed by his employer or the principal as the competent person to carry out the duties of a safety assessor for work at heights.
- 1.3.11** “Travel restraint system” means a system consisting of a full-body harness or restraint belt, attached to one or more lanyards, each of which is attached to an anchorage line or anchorage point, designed to restrict the travelling range of a person wearing the full-body harness or restraint belt so that the person cannot get into a position where the person could fall off an edge of a surface or through a surface.

2. Fall Prevention Plan

2.1 Principles of a Fall Prevention Plan

- 2.1.1** A fall prevention plan is a documented site-specific plan prepared for the purpose of reducing or eliminating risk of falls.
- 2.1.2** The fall prevention plan may consist in parts of existing documentation (e.g., risk assessment). Factories required to have a safety and health management system may use the required documents to constitute a fall prevention plan. Such documents should fulfil the following:
- Address fall from heights hazards comprehensively;
 - Relevant to the specific workplace/ work site covered in the fall prevention plan; and
 - Readily available at the workplace/ work site covered in the fall prevention plan.
- 2.1.3** The fall prevention plan has to:
- Establish clear individual responsibilities for fall prevention at factories or work sites;
 - Integrate fall prevention into factories' Safety and Health Management System for enhancement and sustenance of work at heights safety;
 - Provide a systematic approach for eliminating or reducing risk of falling from heights;
 - Ensure that all reasonable fall prevention and protection measures and methods have been taken prior to commencement of working at heights; and
 - Ensure the adoption of a holistic approach to fall prevention and work at heights safety.
- 2.1.4** The fall prevention plan is to be developed by a competent person and approved by an authorised manager or an equivalent competent person. Provisions must also be made for adequate supervision to ensure that the plan is being implemented at the workplace.
- 2.1.5** The fall prevention plan shall be monitored and reviewed periodically to ensure its relevance and effectiveness. It must also be properly documented and kept readily available at the workplace.
- 2.1.6** A sample template of a fall prevention plan is provided in Appendix A; the fall prevention plan can be customised to better suit the factories' needs and nature of work at heights tasks.

2.2 Fall Prevention Plan Coverage

- 2.2.1** The fall prevention plan should be customised to address the unique conditions at individual workplaces.

2.3 Fall Prevention Plan Component List

- 2.3.1** A comprehensive fall prevention plan should include (but not be limited to) the following components:
- a) Policy for fall prevention;
 - b) Responsibilities;
 - c) Risk management;
 - d) Risk control measures;
 - e) Procedures;
 - f) Use of personal protection equipment;
 - g) Inspection and maintenance;
 - h) Training;
 - i) Incident investigations; and
 - j) Emergency response.

3. Components of a Fall Prevention Plan

3.1 Policy for Fall Prevention

- 3.1.1 A policy for fall prevention will set clear and unambiguous terms on the organisation's approach and commitment towards fall prevention.
- 3.1.2 Top management with executive or site responsibility shall define, endorse and document its policy for fall prevention. The policy for fall prevention shall be appropriate to the needs, nature and scale of the organisation's activities and work at height risks.
- 3.1.3 The organisation shall establish a policy which demonstrates its commitment to prevent falls from height incidents, comply with applicable legal and other requirements.
- 3.1.4 It is important that the policy for fall prevention is understood, implemented and maintained at all levels of the organisation. The policy for fall prevention should be reviewed periodically and amended as and when necessary.

3.2 Responsibilities

- 3.2.1 Top management needs to ensure that sufficient resources essential to the establishment, implementation and maintenance of the fall prevention plan are made available so as to achieve its objectives.
- 3.2.2 Competent person(s) shall be appointed to develop, implement, maintain and evaluate the fall prevention plan. The fall prevention plan must be developed specific to the conditions of the premises, that is, on a site-by-site basis.
- 3.2.3 The appointed competent person(s) shall define, document and communicate the roles, responsibilities and accountabilities of all levels of staff that may be affected by the fall prevention plan. It shall include the following:
 - To evaluate the need to work at heights;
 - To ensure that all reasonably practicable measures and methods are taken to eliminate potential falling from heights hazards;
 - To ensure that all workers (inclusive of subcontractors' workers) are properly trained in the use, maintenance and care of personal fall prevention and arrest equipment and the recognition of hazards related to their use;
 - To ensure that all devices /equipment/ materials used for fall prevention and arrest by workers (inclusive of subcontractors' workers) are maintained at design specifications and are inspected/ certified as per manufacturer and/or local regulatory/ approved standards;
 - To implement emergency response procedures and to investigate all falls from height incidents; and
 - To ensure compliance with all applicable regulatory requirements and reporting of performance to top management for review.

3.3 Risk Management

3.3.1 Hazard Identification and Risk Assessment

- 3.3.1.1 Hazard identification and risk assessment are fundamental tools to identify hazards associated with workplace activities, assess their risk levels and determine the suitable control measures to be taken.
- 3.3.1.2 Employers, principals (including contractor and subcontractor) and self-employed persons are required to discharge their duties in identifying the hazards and conducting risk assessment in relation to the safety and health risks posed in the workplace, and to take all reasonably practicable measures to ensure that any person who may be affected by his undertaking is safe in the workplace.
- 3.3.1.3 Risk assessments should be conducted by a multi-disciplinary team who has a thorough knowledge of the work to be undertaken. The team members should include management staff, process or facility engineers, technical personnel, supervisors, safety personnel and workers whenever appropriate.
- 3.3.1.4 Hazard identification and risk assessments should be reviewed periodically to ensure its effectiveness and validity, particularly when there is any significant change to the workplace activities; or when there is an occurrence of any fall from height incident.
- 3.3.1.5 Risk management involves identifying hazards, assessing risks, implementing appropriate control measures, and monitoring and reviewing those measures.

3.3.2 Hazard Identification

- 3.3.2.1 Identifying hazards involves recognising any work process, activity or situation with potential to cause injury or harm to a person such as when a person works at the edge of a building without proper barricades.
- 3.3.2.2 It is important to plan the process for hazard identification and risk assessment. While the focus of this Code of Practice is on the hazards of falling when working at heights, it is also important to address and extend to other workplace safety and health hazards such as manual handling, noise, hazardous substances, falling objects, and slips and trips.
- 3.3.2.3 All hazards to which a person (including members of the public) could be exposed to as a result of work must be identified. The hazards must always be identified prior to work commencement and when changes to systems of work are planned or occur. Examples of workplace conditions that could have potential falls from height hazards are given in the list.

Work Environments that Pose a Fall from Height Risk

- Raised work surfaces such as slopes;
- Slippery work surfaces (wet, oily, dusty or glazed);
- Uneven work surfaces (e.g., broken ground or profiled roof sheeting);
- Cramped work surfaces;
- Work surfaces cluttered with tools, work materials and debris;
- Workers working in adverse weather conditions – for example, in rain, strong or gusty winds, extreme heat or high humidity, or very cold conditions;
- Unprotected edges;
- Work on temporary structures such as scaffolding and formwork;
- Building materials, large tools, or equipment that need to be manually carried;
- Overloading of working platform, which may lead to collapse; or
- Struck by moving object or equipment, for example, load from lifting operation.

- 3.3.2.4** There are various ways to identify potential hazards or situations that may result in a fall. Typically, consideration should be given to the following areas:
- Previous injuries, “near miss” incidents or accidents involving the fall of persons that had occurred at the workplace or other similar workplaces;
 - Relevant codes of practice and guidance notes;
 - Consultation with stakeholders to find out what risks they may be exposed to when working at height. These stakeholders should include safety and health personnel, supervisors, engineers and technical personnel and workers;
 - Walk-through inspections of the workplace; and
 - Any other records or statistics which indicate potentially unsafe work practices.
- 3.3.2.5** A hazard identification process or procedure may range from a simple checklist for specific equipment, such as a ladder or fall arrest system, to a more open-ended appraisal of a group of related work processes. Generally a combination of methods will provide the most effective results.
- 3.3.3 Risk Assessment**
- 3.3.3.1** Assessing risks of working at heights involves consideration of the likelihood of a fall occurring and the extent of any potential harm or injury (i.e., the consequences) and consequently, determine a level of risk. In this manner, hazards that have higher risks need to be given priority.
- 3.3.3.2** Risk assessments should provide information on:
- Where and how many employees are likely to be at risk of incurring injuries;
 - The likelihood – or the probability that - this is likely to occur, taking into consideration the existing control measures; and
 - The potential severity of any injury. As severity refers to the intrinsic or inherent nature of the adverse effect(s) that may result from the hazard, the existing control measures must not be taken into consideration when assessing severity.
- 3.3.3.3** When the risks have been assessed, reasonably practicable measures must be taken to reduce or maintain the risk level at an acceptable level. It is important that no work must be allowed to commence if the risks are assessed to be high or unacceptable.
- 3.3.3.4** The results of the risk assessment must be approved and endorsed by top management. The control measures should be, as far as reasonably practicable, implemented within the shortest timeframe. In determining the implementation of the control measures, priority must be given to those in higher risk levels.
- 3.3.3.5** An action plan should be prepared to implement the control measures. The plan should include a timeline of implementation and responsibility of persons implementing the safety and health control measures. The plan should be monitored regularly until all the measures are implemented.
- 3.3.3.6** Organisations may opt to undertake a generic assessment to be used for similar work activities in different workplaces. If such a model is used, it is necessary to ensure that the risk assessment must be validated to be relevant and applicable for the particular workplace and the work processes.
- 3.3.4 Ensuring Control Measures are Safe and Do Not Introduce New Risks**
- 3.3.4.1** It is important that the control measures selected do not introduce new hazards or expose workers who are installing, erecting or removing these control measures (such as scaffolding) to a greater risk than the one it is designed to control.
- 3.3.5 Maintaining and Re-evaluation of Controls**
- 3.3.5.1** The control measures implemented must be regularly monitored and reviewed to ensure that they are effective and are in good working condition.

3.4 Risk Control Measures

3.4.1 Hierarchy of Control

- 3.4.1.1** If workplace safety and health risks exist, the employer, self-employed person or principal shall, as far as reasonably practicable, put measures in place to control those risks.
- 3.4.1.2** The appropriate control measures/ methods selected to reduce or maintain the risk of falling from heights shall be carefully assessed and implemented to ensure its effectiveness.
- 3.4.1.3** The approaches below are listed according to a hierarchy of control as shown in Fig 3.1. The approach to control measures should be attempted from the top of the hierarchy onwards. These controls are usually not mutually exclusive, for example, engineering controls can be implemented concurrently with administrative controls.

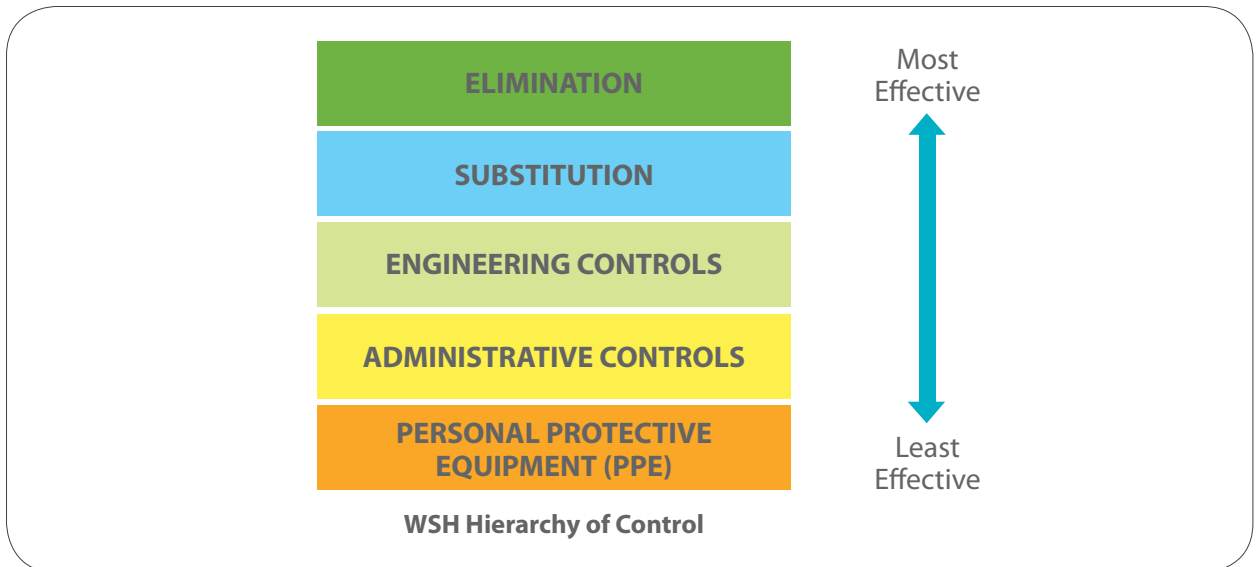


Figure 3.1: Hierarchy of Control.

3.4.2 Elimination

- 3.4.2.1** Elimination of hazards refers to the total removal of the hazards and hence effectively making all the identified possible accidents and ill health impossible.
- 3.4.2.2** This is a permanent solution and shall be attempted in the first instance. If the hazard is removed, all the other controls, such as the use of fall prevention and protection system, workplace monitoring and surveillance would no longer be required. In effect, the item is removed from the table of hazards.
- 3.4.2.3** Examples of elimination include:
- Prefabricating wall frames horizontally before standing them up;
 - Using precast tilt-up concrete construction instead of concrete walls constructed in situ; and
 - Using paint rollers with extendable handles rather than working on a ladder.

Design for Safety

- The purpose of designing for safety is to eliminate or reduce risk at source by taking into consideration foreseeable risks at the planning and design stage so that these risks can be removed, or mitigated by designing around the risk.
- In identifying the foreseeable risks, the work activities of persons involved in the following stages should be taken into consideration:
 - Construction and/ or installation;
 - Usage;
 - Maintenance and/ or cleaning; and
 - Demolition and/or decommission.
- It is also important to consider risks that are posed to persons not directly involved but affected by the work such as visitors, customers or members of the public.
- Refer to the *Guidelines on Design for Safety in Buildings and Structures*, Workplace Safety and Health Council for more details.

3.4.3 Substitution

3.4.3.1 This involves replacing the hazard by one that presents a lower risk. For example, by using mobile elevated work platform (MEWP) instead of ladders for reaching high places, the risk level is lowered as MEWP generally provides a higher level of safety for working at heights than ladders.

3.4.4 Engineering Control

3.4.4.1 Engineering controls are physical means that limit the hazard. These include structural changes to the work environment or work processes or erecting barriers to prevent the worker from being exposed to the hazard.

3.4.4.2 An example of an engineering control includes edge protection such as using guard-rails at open sides to prevent persons from falling over.

3.4.5 Administrative Controls

3.4.5.1 Administrative controls mainly cover systems of work or work procedures that help to reduce the exposure of persons to the risks of falling. It is thus a useful means to limit the frequency and duration of exposure of persons to hazards and the number of persons involved in the task.

3.4.5.2 Administrative controls may also be used to support or be used in conjunction with other control measures that are put in place. For example, safe work procedures may be needed to guide workers on the safe use of temporary work platforms, which in itself is a form of engineering control measure.

3.4.5.3 The development of administrative controls should also involve people who perform work at heights tasks regularly, such as contractors and workers as they often have a good understanding of the risks involved.

3.4.5.4 For effective use of administrative controls, it is necessary to ensure that information is adequately and effectively communicated to the workers. For example, daily toolbox meetings may be used for such purposes.

Supervision

- A competent person should be appointed to provide proper and adequate supervision for workers to ensure that they are not exposed to hazards and all reasonable precautions have been taken where there is a risk of falling.
- Supervision is especially important if the workers are undergoing training, or are new or inexperienced and unfamiliar with the working environment.
- It is essential that persons performing supervisory roles must be competent and have the skills and knowledge of the work processes that they are to supervise.
- Persons performing supervision roles must ensure that:
 - Required safety measures are in place before the commencement of the work;
 - Workers are adequately supervised, particularly when working in an elevated position; and
 - Only workers who have received appropriate training and instruction in relation to the tasks they are to perform are to carry out the work.

3.5 Safe Work Procedures

- 3.5.1** Safe Work Procedures (SWPs) are the most common form of administrative controls in workplaces. It is a set of systematic instructions on how work can be carried out safely. Using information obtained from risk assessment, a set of SWPs should be developed for various work activities that have a risk of falls from heights.
- 3.5.2** A SWP generally provides instructions on how jobs are to be performed, persons involved in these jobs, what safety precautions must be taken and what kind of training and/or certification is necessary to be able to competently carry out these jobs.
- 3.5.3** The SWP must be communicated to everyone involved in the job so that each person is aware of his roles and responsibilities. The SWP must also be communicated to those who will be affected by the job.
- 3.5.4** It is necessary to provide adequate levels of supervision to ensure that SWPs are being followed. Regular review of the effectiveness of the procedures must be undertaken.
- 3.5.5** Make sure that the work is well organised so that workers do not increase the risk of a fall for themselves or others. For example, sequence jobs so that different trades are not working above or below each other at the same time.

Prohibition of Access

- Marking out an area can be effective in making sure that people are not exposed to fall hazards. There should be adequate signage to warn all persons against access to the hazardous area. If possible, a physical barrier should be erected to prevent unauthorised access.
- Employers should provide relevant information to employees on site and adequate supervision to ensure that no worker enters a "No Entry" area.

3.6 Use of Personal Protective Equipment

3.6.1 Personal protective equipment (PPE) should be used only as a last resort, after all other control measures have been considered, or as a short term contingency during maintenance or repair, or as an additional protective measure.

3.6.2 The effectiveness of PPE as a control measure is dependent on the correct equipment being chosen, fitted and worn properly at all times when required by users.

3.6.3 PPE should be selected taking into consideration the following factors:

- The type of hazard;
- Areas of the body that require protection;
- The degree of protection required;
- Ease of use, comfort and convenience;
- Compatible with other PPE;
- Reliability; and
- Ease of maintenance.

3.6.4 PPE that can be used for work at heights include:

- Travel restraint equipment;
- Personal fall arrest equipment; and
- Work positioning equipment.

Refer to the WSH Council's *Guidelines on Personal Protective Equipment for Work at Heights* for more information.

3.6.5 Before personal fall protective equipment is chosen as a control measure for work at height activities, the following conditions shall be fulfilled:

- The PPE is assessed to be suitable and adequate for the persons to conduct the assigned work at heights tasks safely;
- Persons issued with the PPE must be trained and possess the skill and knowledge to use the equipment/ system safely; and
- Suitable and adequate anchor points or lifelines that allow all persons to achieve 100 percent tie-off at all times shall be provided (see paragraph 9.6.5.3 of this Code). All persons involved in work at heights must be made aware of the anchorages.

3.7 Inspection and Maintenance

3.7.1 A thorough visual inspection and checks on equipment usage is important for ensuring that the equipment is free from observable defects. Equipment that have exceeded their serviceable life span or passed their expiry date should not be used.

3.7.2 A maintenance programme should be established and implemented to periodically inspect and maintain both operational and safety equipment to ensure that they are in good working condition.

3.7.3 The maintenance programme shall include the following components:

- An inventory of equipment that require regular inspection and maintenance;
- Frequency of inspection and maintenance;
- Procedures of inspection and maintenance;
- Preventive maintenance, such as servicing;
- Repair for damaged items;
- Replacement for irreparable items; and
- Record keeping (such as for damages, flaws detected, any preventive maintenance, repairs or replacements done).

3.7.4 Maintenance of equipment should only be performed by trained and competent persons.

3.8 Instruction and Training

3.8.1 Persons working at heights who are exposed to the risk of falling should be provided with sufficient and adequate information, instruction and training so that they have the skill and knowledge to perform the work safely. It should help them understand:

- The nature of fall hazards to which they are exposed;
- The risk of injury associated with the task;
- The control measures that are needed, including SWPs and the use of PPE;
- The proper usage and maintenance of equipment, such as performing inspection to ensure that equipment are in good condition before use; and
- Procedures to follow in the event of an emergency such as rescue, accident, or injury.

3.8.2 The amount of information and type of training depend on several factors such as the risks involved, the level of operator skill required and the complexity of the tasks and work procedures. Some common forms of training include:

- General induction course for new workers;
- “In-house” training programmes; and
- Formal training courses offered by accredited training providers.

Information can be disseminated during:

- “Toolbox” briefings; and
- “On-the-job” training.

3.8.3 Information should be provided in a form that can be understood by all workers. This may include providing information in pictorial form or in languages other than English.

3.8.4 If classroom teaching is conducted, it should be complemented by hands-on training to provide practical experience.

3.8.5 Induction programmes are essential and should be provided for workers taking up new jobs or where work situations have changed. Records of training should be kept to enable on-going programme evaluation and review.

Key Elements of an Effective Training Programme

In developing and implementing an effective programme, employers should consider the following:

- An analysis of training needs, including the identification of the tasks to be performed and any associated hazards and risks;
- Identification of any pre-requisites or entry standards;
- Definition of learning objectives and clear identification of the extent or level of competencies to be achieved;
- Selection of appropriate training methods and aids depending on the topic, environment and targeted trainees;
- Adequate assessment to ascertain that the trainees understand and have acquired the knowledge and skills and demonstrated the necessary level of competency;
- Recognition of skills attained where applicable (e.g., accreditation or certification);
- Delivery of training by a competent person; and
- Evaluation of effectiveness of training.

Training on Personal Fall Arrest Systems

A personal fall arrest system is complex and requires an adequate level of competency to be used properly. Employees who use these systems should be trained in the correct fitting, anchorage, use and maintenance of the personal fall arrest systems. It is also important for the users to understand fall hazards and the risks of injury associated with the tasks that they are undertaking. The training should also include awareness of the use of anchorage and rescue systems, and how to respond in an emergency.

3.9 Accident/ Incident Investigation

- 3.9.1** All accidents or incidents relating to falls from heights should be reported, investigated and analysed for the following objectives:
- Determine any underlying deficiencies in the existing fall prevention and protection system and plan, which might have contributed to the occurrence of the incident;
 - Identify the need for corrective action to be taken to address any such deficiencies as identified; and
 - Identify the opportunities for preventive actions to be taken to prevent any such incident from recurring.
- 3.9.2** The results from any such incident investigated (inclusive of lesson learnt and the corrective/ preventive actions to be taken) should be promptly communicated to all relevant parties.
- 3.9.3** A record of all accidents and incidents and their investigation findings and outcomes should be properly documented.

3.10 Emergency Response

3.10.1 A written emergency response plan must be established.

3.10.2 As rescue operations are often carried out under extreme stress, consideration should be given to all aspects of the rescue process. Elements to consider should include:

- Rescue method or equipment required;
- Procedures to gain access into less accessible areas;
- Training required for rescuers and first aiders;
- Details of additional support facilities, including the location, contact information and availability of emergency services, such as Singapore Civil Defence Force (SCDF), ambulance and hospitals; and
- An effective and readily available means of communication.

3.10.3 Workers must be provided with information on the emergency plan including:

- Who to approach or call in the event of an emergency; and
- The procedures to follow for emergencies, including those for persons suspended in safety harnesses during fall arrest. It is recommended that training in self-rescue techniques be provided for workers using safety harnesses.

3.10.4 Ensure that first aid treatment and first aid facilities meet the requirements in the WSH (First Aid) Regulations. Persons assigned to first aid duties must be competently trained.

3.10.5 The immediate rescue of a person after an arrested fall can prevent the onset of injuries such as suspension trauma which can occur when a person is suspended in a harness over a period of time.

3.10.6 A conscious suspended person should be encouraged to exercise his legs gently to stimulate blood circulation or use suspension trauma relief equipment. It is critical to note that suspension trauma relief equipment can only work when the casualty is conscious and they are not an alternative to rescue.

4. Permit-to-work System

4.1 Principles

4.1.1 The permit-to-work system is a formal documented process used to manage work identified as potentially hazardous.

4.1.2 The permit-to-work system aims to:

- Ensure a systematic and tiered authorisation for hazardous work;
- Enable responsible persons to be aware of all hazardous work conducted, their locations in the workplace and when the work ceases;
- Establish a standardised approach with clear individual responsibilities to take all reasonably practicable measures to ensure the task can be carried out safely;
- Enhance supervision of hazardous work with routine monitoring of the work; and
- Provide a visual display (of permit) to clearly identify locations of approved tasks and task durations.

4.1.3 To ensure adequate evaluation and review, a permit-to-work system requires various levels as shown in Fig 4.1.

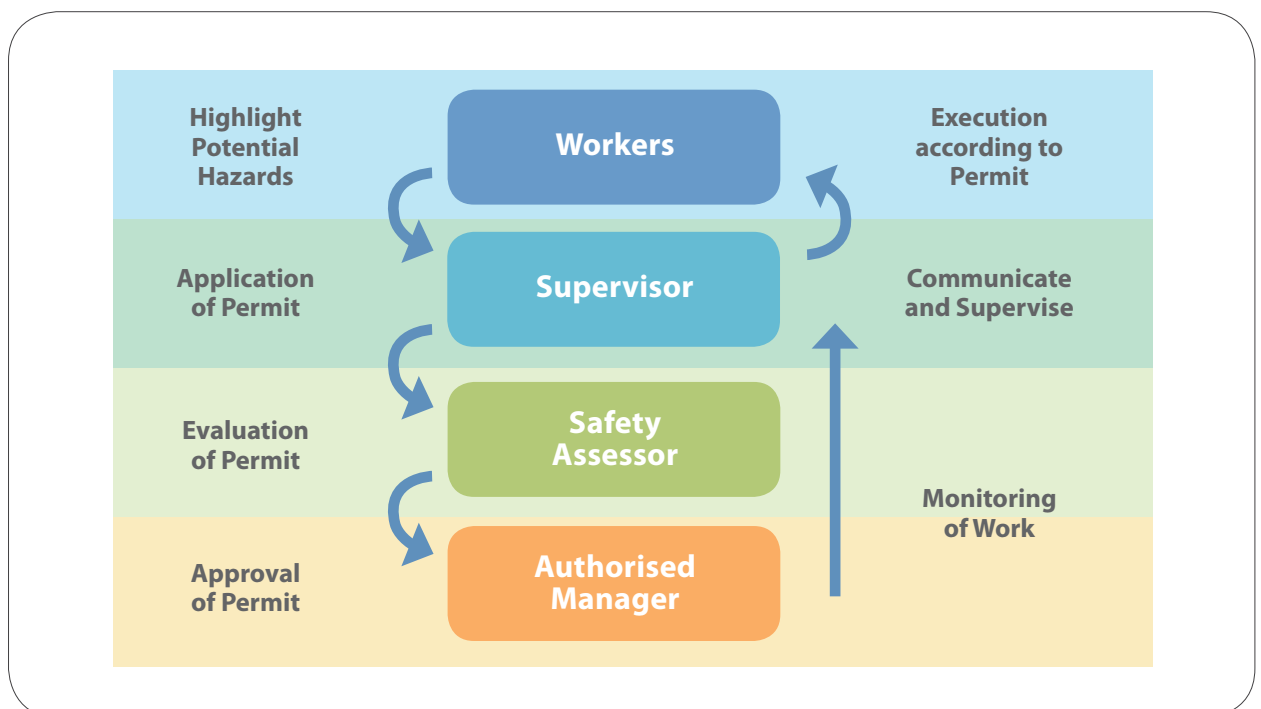


Figure 4.1: Levels within a Permit-to-work System.

4.2 Requirements and Scope

4.2.1 A permit-to-work is required for work at heights where a person could fall from a height of more than 3 metres, including falling into depth (referred to as hazardous work at heights).

4.2.2 For work at heights where the risks of falling more than 3 metres have been mitigated through adequate and effective edge protection, a permit-to-work may not be required, unless the responsible person deemed it should not be exempted.

Such work at heights includes:

- Working on a flat roof with a perimeter parapet wall of at least 1 metre in height, and no openings or open sides where a person may fall;
- Working on a mezzanine with safe and proper stair access and effective barricade around the mezzanine perimeter to prevent falls; and
- Working on a mobile elevated work platform with the appropriate PPE anchored to designated anchor points at all times.

4.2.3 Work at heights that do not require a permit-to-work is exempted only from chapter 4 of this Code. All other relevant sections in this Code will apply and all reasonable practicable measures shall be taken to ensure the safety and health of all persons working at heights.

4.2.4 For hazardous work at heights where the falling risk will only be present after the commencement of work (e.g., scaffold erection), the safety assessor and authorised manager should approve the permit only after ensuring that:

- The control measures and resources to implement them effectively are made available; and
- Review and monitoring of permit is conducted when the task commences.

4.2.5 Relevant documents should be attached to the permit-to-work to support its application (e.g., SWP for scaffold erection).

4.2.6 The permit-to-work at heights can be issued as a joint permit-to-work if necessary, provided all the requirements of the individual permits are fulfilled.

4.2.7 The permit can be used for multiple work areas only if it has been assessed that the work areas share similar fall from height hazards, and that the control measures taken are applicable and effective in all the work areas covered by the permit.

4.2.8 The permit can be used for extended duration only if it has been assessed to be deemed necessary, and that the control measures taken are effective throughout the entire duration of the permit. The maximum duration of such permit is seven days; a daily review is required for such permits.

4.2.9 A sample permit-to-work for hazardous work at heights is provided in Appendix B-2; the sample permit-to-work can be customised to better suit the needs of the workplaces' hazardous work at heights.

4.3 Implementation

4.3.1 Prior to the conduct of any work at heights, a thorough risk assessment shall be conducted (refer to the *Code of Practice on Workplace Safety and Health Risk Management*).

4.3.2 The risk assessment team should give due consideration to eliminate the hazardous work at heights if possible. Elimination measures include working from the ground instead of at heights (e.g., lowering light fixtures to ground level to change light bulbs, working with extension tools instead of working on ladders).

4.3.3 Safe and proper means of access and egress shall be identified and provided as part of the planning process.

4.3.4 Workers assigned to work at heights need to be trained and are competent to work at heights (e.g., attended relevant Work at Heights courses for workers accredited by the Ministry of Manpower). All workers covered under the permit needs to be identified and briefed on the hazards and control measures for the task and work area prior to commencing work.

4.3.5 The appointed work at heights supervisor must be suitably trained and is competent to supervise work at heights (e.g., attended relevant Work at Heights courses for supervisors accredited by the Ministry of Manpower). The supervisor could be a foreman, shift supervisor or other similar capacity to supervise work at heights.

- 4.3.6** The appointed work at heights safety assessor must be suitably trained and competent to assess and advise on work at heights safety (e.g., attended relevant Work at Heights courses for safety assessors accredited by the Ministry of Manpower). The assessor could be a WSH professional or any persons responsible to assess work at heights safety.
- 4.3.7** The appointed authorised manager must be suitably trained and competent to manage the safety processes with regards to work at heights (e.g., attended relevant Work at Heights courses for authorised managers accredited by the Ministry of Manpower). The manager could be a project manager, operations/ engineering/ maintenance manager or any other manager in a similar capacity to oversee and manage activities in a workplace.
- 4.3.8** Upon completion/ suspension/ termination of the hazardous work at heights, the supervisor shall ensure that all persons have egressed from the work area and the work area has been restored with no new hazards introduced.
- 4.3.9** A flow chart of the permit-to-work application is provided in Appendix B-1 of this Code.

Implementing a Permit-to-work System

- A permit-to-work is not simply permission to perform a hazardous task. The permit, by itself, does not make a task safe.
- The safety enhancements can only be achieved through the persons preparing for the job (e.g., control measures implemented), persons supervising the job (e.g., ensuring that SWPs are prepared) and persons performing the job (e.g., using PPE as intended).
- Providing adequate training for all levels of persons involved in a permit-to-work system is essential to achieve consistent and effective implementation.
- The different levels of evaluation and approval ensure authorised and competent persons have thought about foreseeable risks and that such risks are effectively mitigated.
- It is critical to ensure that the permit is effectively communicated to all persons involved in the task for them to understand the hazards and risk control measures, and how to conduct the work safely.

Section B: Fall Control Measures

5. Access to and Egress from Work Areas

5.1 Access and Egress Risk and Assessment

5.1.1 Employers are to provide a safe means for people to get to and move around the work area. The planning for the provision of suitable access and egress should take into account the tools and equipment that people will be required to carry.

5.1.2 Where an area accessed poses a risk of falling, occupiers should control access to it. Only persons who need to carry out work in the area and are competent to do so are to be allowed access.

5.2 Access and Egress Safety Considerations

5.2.1 In providing safe and proper access to and egress from a work area, the following should be considered:

- Installation of fixed work platforms, walkways and stairways;
- Use of temporary work platforms such as scaffolds and crawl boards;
- Installation of fall arrest systems;
- Frequency and number of people who may need access to or egress from the work area. Supervision and regular inspection should also be considered;
- Provision of safe work surfaces;
- Method of getting equipment and materials to the work area;
- Exposure of access ways to the weather (e.g., rain can make surfaces slippery and strong winds can cause loss of hand grip);
- 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; and
- Location and space required for any equipment or materials used or being temporarily stored.

Housekeeping and Material Storage

The risk of falls due to tripping and slipping can be reduced by proper planning for material storage and good housekeeping. Such good practices not only result in a cleaner and safer workplace, it can also improve productivity.

5.3 Roof Access

5.3.1 Employers and occupiers should provide their workers with a safe means of getting to and from the roof. The access ways need to be in place before commencing work. Access should be located where the work on the roof is to begin. (Refer to *WSH Guidelines on Working Safely on Roofs*, Workplace Safety and Health Council, and Chapter 12 of this Code for more information).

5.3.2 For new roof installations or where extensive repair or replacement of existing roofs is planned, it is recommended that an access tower or a personnel and materials hoist be provided.

5.3.3 After a roof membrane has been installed, special provisions may need to be made if the roof is to be used as a platform for access, egress, work or storage. If access and egress are required regularly, a permanent system such as stairs may need to be installed. Stairs should serve each floor of a building or structure that is being constructed or demolished.

5.4 Access to Top of Vehicles/ Containers

5.4.1 Where possible, employers and occupiers should provide systems and equipment to allow workers to work on ground level. Some examples include:

- Installation of access gangway for inspection purposes to eliminate the need to climb on top of containers/ tanks ; and/ or
- Bundling or securing load unto purpose design racks or intermediate bulk containers before loading on to vehicles, instead of stacking them manually while working at heights.

5.4.2 Employers and occupiers should provide their workers with a safe means of access and egress should there be a need for workers to work on top of the vehicle/ container. Some examples include:

- Truck loading gangways and gantries; and/ or
- Use of portable access platform (see Fig 5.1).

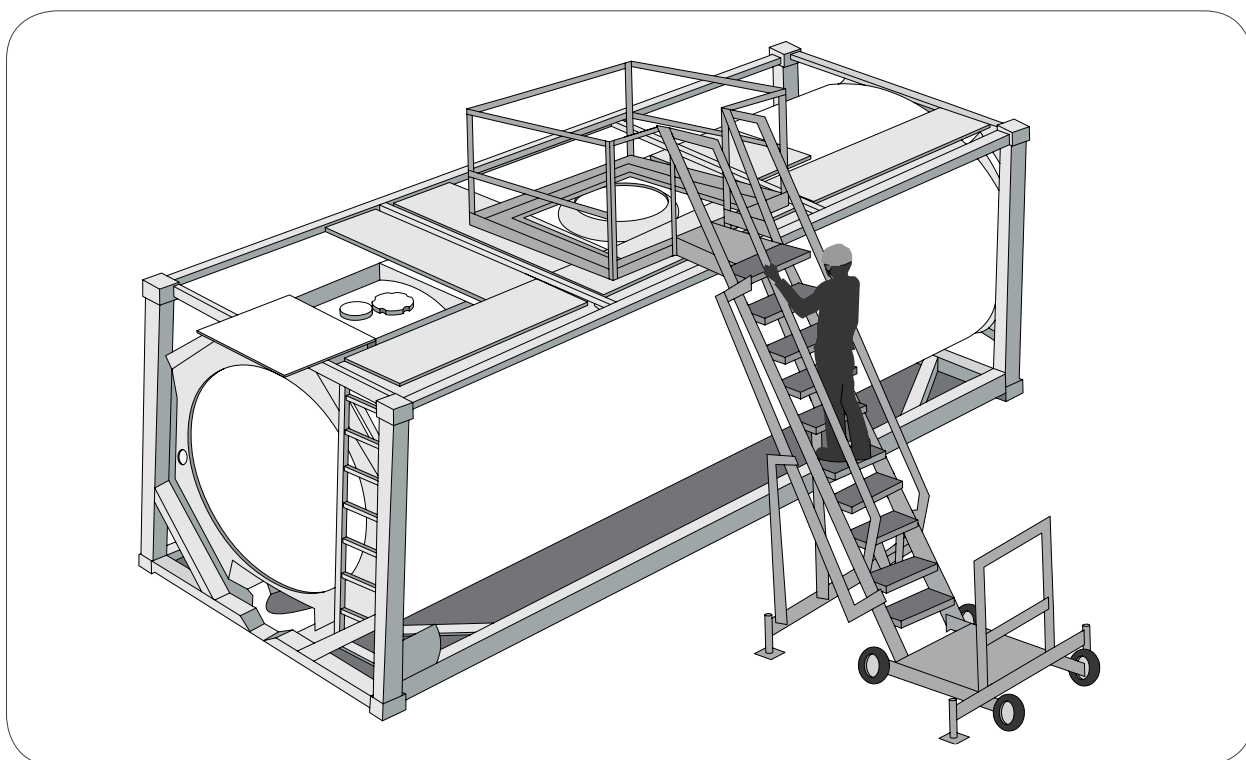


Figure 5.1: Portable access platform for safe access to top of ISO tank.

6. Fall Prevention Systems

6.1 Edge Protection, Perimeter Guard-Railing

6.1.1 Edge protection (often referred to as a “guard-rail”) is used to reduce the risk of a person falling from open sides (see Fig 6.1) and through openings.

6.1.2 Edge protection must be provided to the edge of a scaffold, walkway, ramp (see Fig 6.2 and 6.3), and landing or wherever a person is at risk of falling from open sides. The protection must also be able to withstand the impact of a person falling against it.

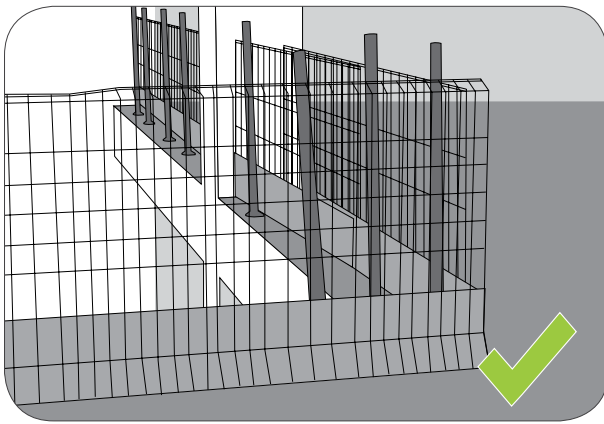


Figure 6.1: Perimeter guard-railing.



Figure 6.2: Unprotected stairways pose a falling hazard.

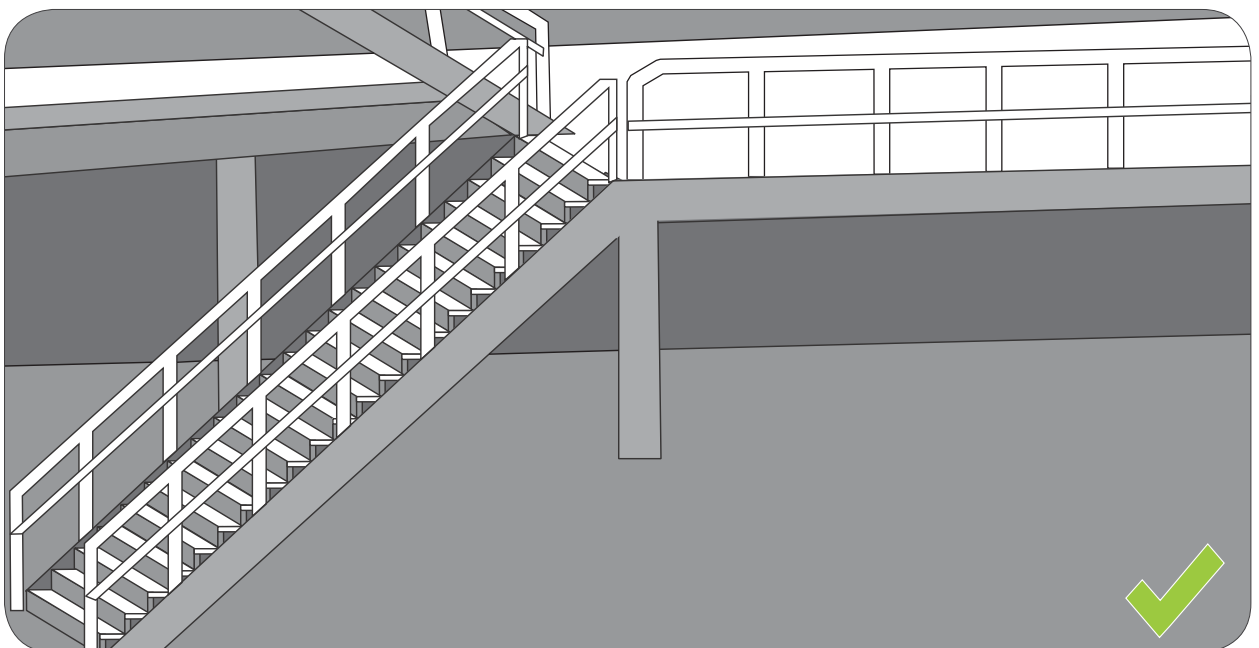


Figure 6.3: Stairways fitted with handrails.

6.1.3 Edge protection must also be provided at any other edge at the workplace where a person could fall. Such protection must adhere to dimensions (see Fig 6.4) and other requirements listed below. (Refer to the *WSH Guidelines on Anchorages, Lifelines and Temporary Edge Protection Systems*, Workplace Safety and Health Council).

- Temporary or advance guards must be provided to reduce the risk of a scaffold erector falling from the uppermost, unsecured or exposed scaffolding level during the process of erecting or dismantling scaffold;
- The guard-rail system must be of good construction, in good condition and be able to withstand the weight of a person (at least 100kg, Singapore Standards SS 567: 2011–Code of practice for factory layout–Safety, health and welfare considerations) applied in any direction at any point;
- If access points are required for equipment (e.g., a hoist), they should be protected adequately with gates, safety chains or any other effective means to prevent a person from falling. The access points must always be covered and secured when not in use (see Fig 6.5 and 6.6);
- Where guard-rail systems are intended to be used in conjunction with steel structures or tilt-up construction, designers and builders should plan for the guard-rails and fixings to be attached to the panels prior to the structures being raised from the edge protection that is being used. This will reduce the risk of a person falling from one level to another.

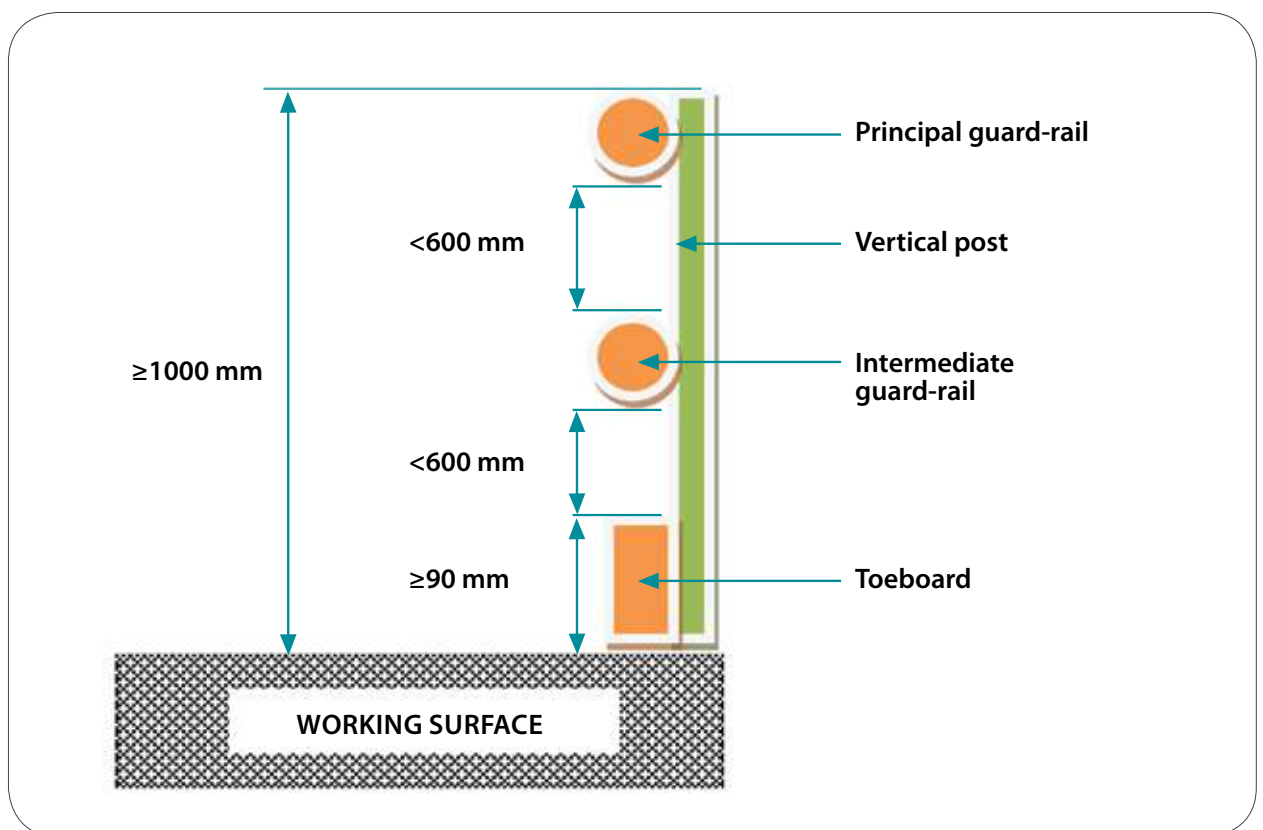


Figure 6.4: Dimension requirements for a temporary edge protection.

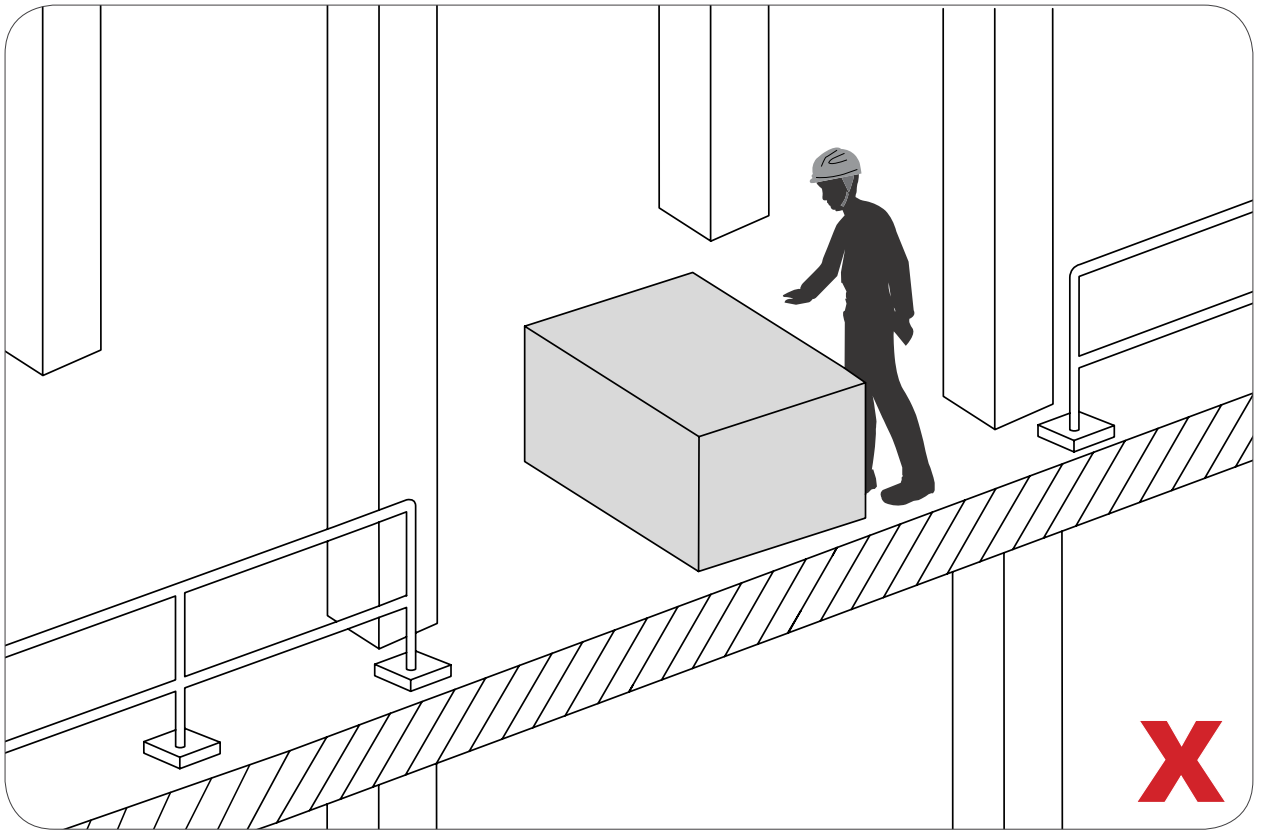


Figure 6.5: Inadequate demarcation and worker protection during temporary removal of edge protection.

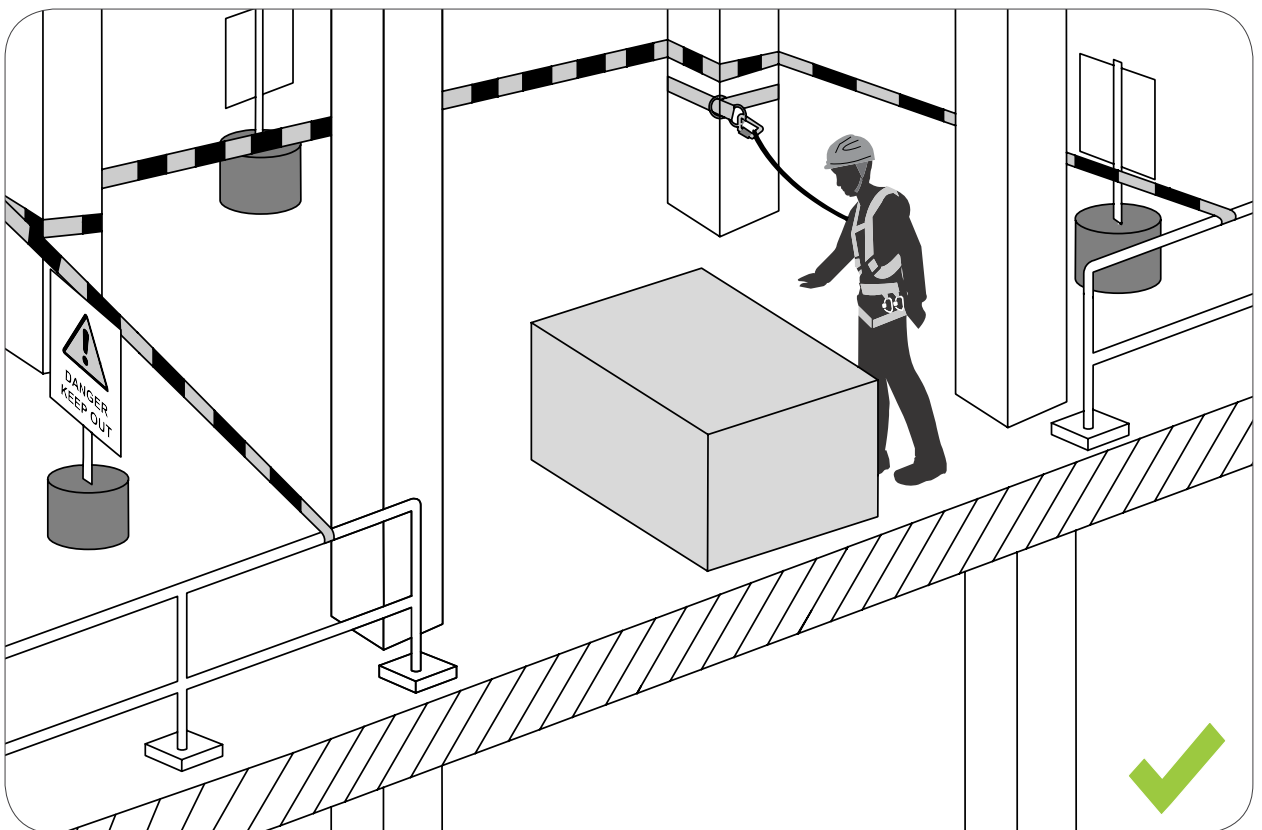


Figure 6.6: Example of proper demarcation and travel restraint for worker during temporary removal of edge protection.

6.2 Guarding of Openings

- 6.2.1** Openings on floors or platforms present significant hazards. A person may fall through an opening, which may result in serious injury or death. If the opening that is stepped upon is small, cuts and bruises may result on the legs or feet. (see Fig 6.7).
- 6.2.2** A person may fall through or step into openings such as lift openings and stairwells. A barrier should be erected around the opening to prevent persons from falling. In addition, the opening should be guarded with embedded wire mesh and covered with material of adequate strength to prevent entry by objects or persons. The cover should be secured to prevent it from dislodging.
- 6.2.3** When an opening is protected by a cover, a suitable signage such as that shown in Fig 6.8 (right) should be placed nearby or onto the cover itself to warn people of the hazard.

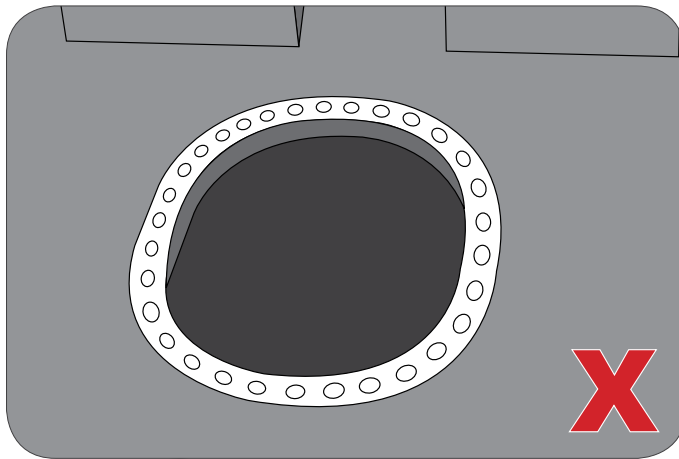


Figure 6.7: Unprotected openings are severe hazards and must be covered.



Figure 6.8: A warning sign can be affixed to the opening cover or placed near a barricaded opening.

6.3 Scaffolds

- 6.3.1** Scaffolds are any temporary structures:
- On and from which a person performs work in any workplace;
 - Which enable a person to access the location to perform work; or
 - Which enable materials to be taken to any place at which work is being performed.
- 6.3.2** All scaffolds and their components must meet the requirements of the regulations stipulated in the *Workplace Safety and Health (Scaffolds) Regulations*. See Fig 6.9 for the basic components of a scaffold.
- 6.3.3** Generally, scaffolds must be erected by an approved scaffold contractor unless it is a tower scaffold, a trestle scaffold, or a scaffold that is under 4m in height. For more details, refer to the *Workplace Safety and Health (Scaffolds) Regulations*.
- 6.3.4** All scaffolds must be inspected by a scaffold supervisor:
- Before its first use;
 - After substantial alteration;
 - After any event likely to have affected its stability; or
 - Once it has been in place for 7 days.
- At intervals not exceeding 7 days, scaffolds must be inspected and a written report made.
- 6.3.5** The design of a professional engineer is necessary for scaffolds with the following conditions:
- For construction sites and general factories, construction of any metal scaffolds exceeding 30m in height and/or with cantilever or jib support;
 - For shipyards, construction of metal scaffolds exceeding 15m in height.
- 6.3.6** In addition, all hanging scaffolds, from which a person may fall more than 2m must also be constructed and installed in accordance with the design and drawings of a professional engineer.

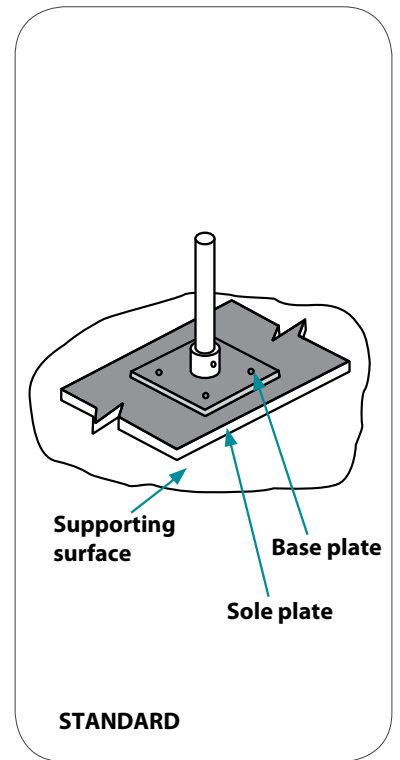
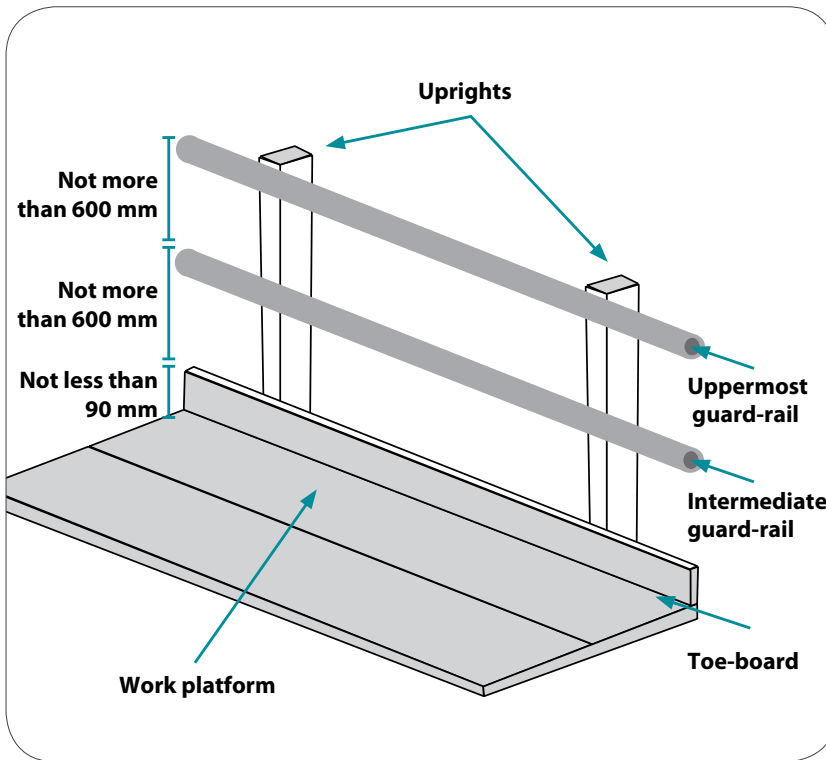


Figure 6.9: Scaffold with components labelled.

6.4 Tower Scaffolds

6.4.1 Tower scaffolds are particular forms of scaffolding that usually consist of fabricated frame units constructed as single-bay towers. Most available tower systems are aluminium, but steel systems are also available. A tower scaffold that is fitted with castor wheels equipped with effective locking devices is deemed to be a mobile tower scaffold (see Fig. 6.10).

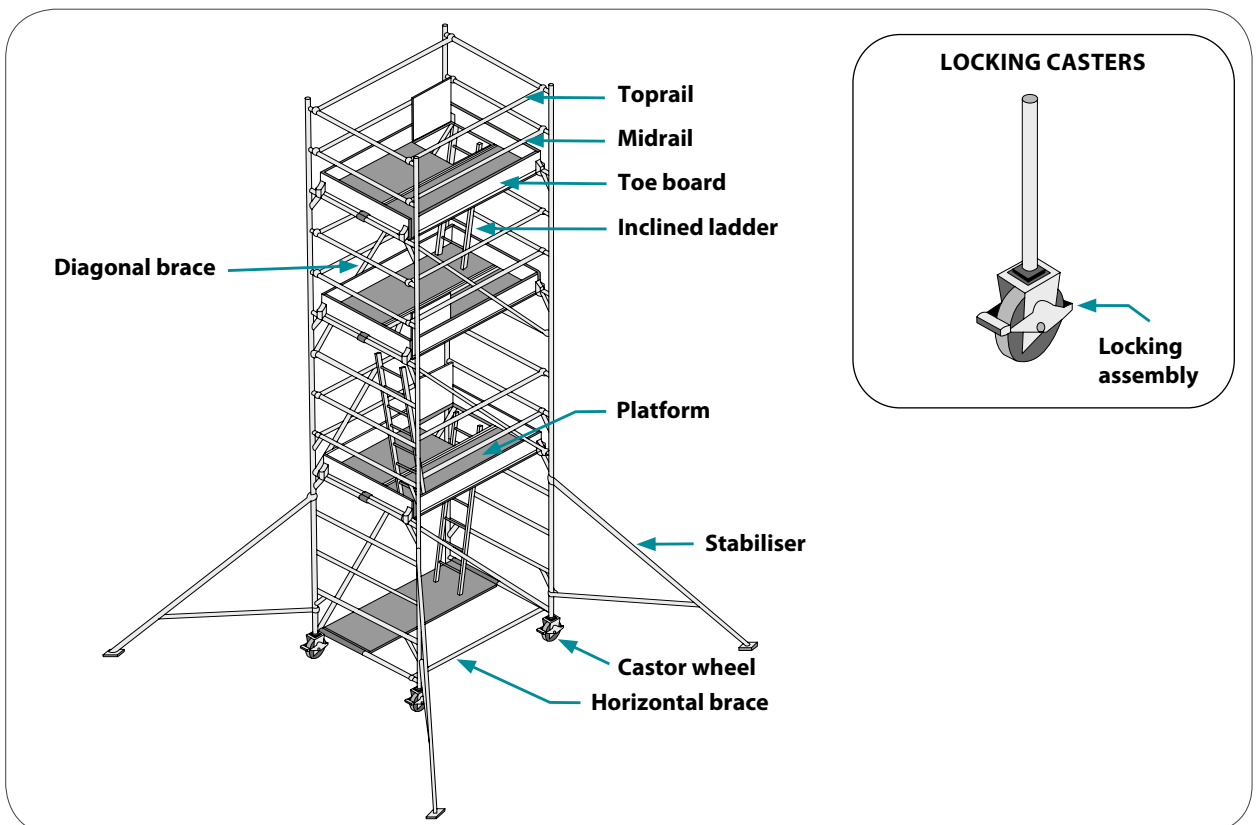


Figure 6.10: A mobile scaffold with access ladder, opening and other features to provide a hazard-free working platform.

6.4.2 A tower scaffold should be erected by a scaffold erector. It must be inspected by a scaffold supervisor as described in paragraph 6.3.4.

6.4.3 Edge protection such as guard-rails must be provided at the highest landing.

6.4.4 When a tower scaffold is mounted on castors for use as a mobile scaffold, the following rules should be strictly observed:

- Prior to moving, the route must be checked for power lines, overhead obstructions and for holes and uneven surfaces on the ground;
- When it is necessary to deploy tower scaffolds on an inclined surface, measures must be taken to ensure stability, such as the use of outriggers. Otherwise, tower scaffolds should not be deployed on an inclined surface;
- Never access the scaffold until all its castors are locked to prevent movement;
- Never shift or move the scaffold while anyone is on it; and
- Do not cover the scaffold with containment sheeting such as shade cloth, unless it has been specifically designed for the purpose and it is only used in an enclosed, wind-protected environment.

6.5 Mobile Elevated Work Platforms

6.5.1 A mobile elevated work platform (MEWP) is a mobile machine consisting of a work platform surrounded by an edge protection system with controls and an extending structure that is intended to position persons, tools and materials at heights. Examples of MEWPs include scissor lifts, boom lifts and vertical personnel platforms (see Fig 6.11).

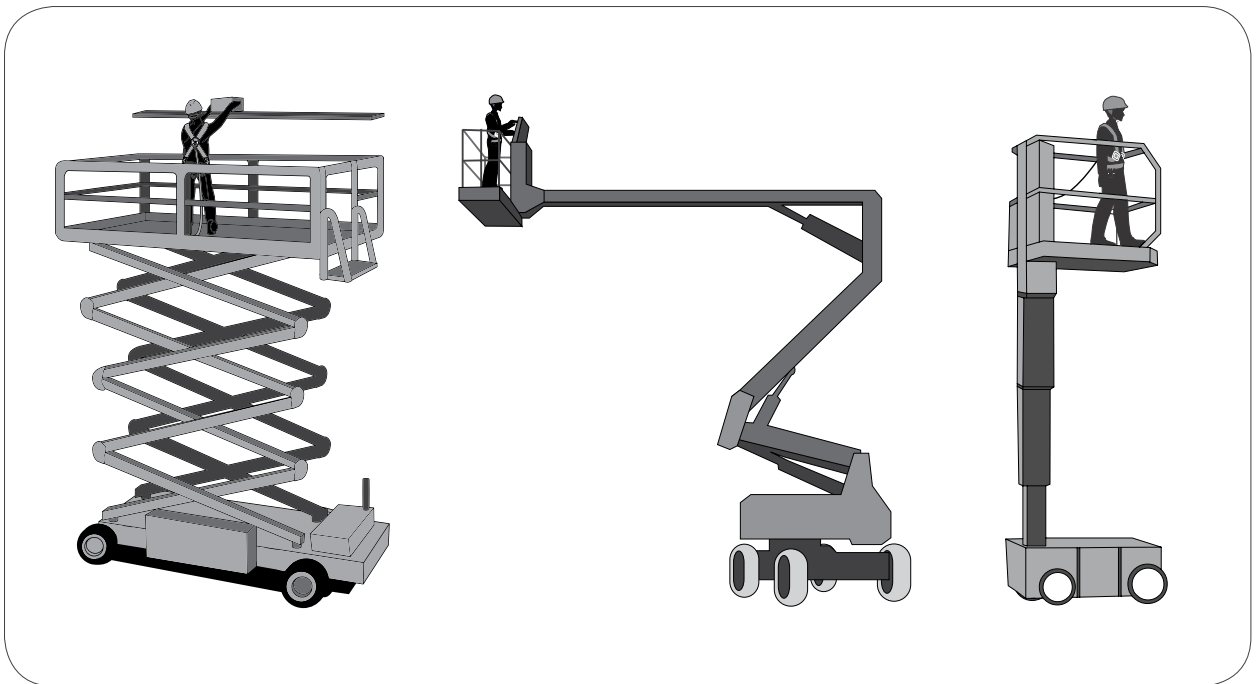


Figure 6.11: Examples of MEWPs; scissor lift (left) boom lift (middle) and vertical personnel platform (right).

- 6.5.2** Prior to deploying MEWPs, thorough planning is needed; a site assessment of the area and ground on which the MEWP is required to operate should be conducted. This is to identify hazards associated with the task and the need for any additional corresponding risk control measures.
- 6.5.3** MEWPs are available in various rated capacities, working heights and reach; some are intended for indoor use only, while others are designed for rough terrain. A suitable and adequate MEWP should be selected for the task to be undertaken.
- 6.5.4** The selected MEWP shall be:
- Inspected and certified by an authorised examiner to be in good condition;
 - Operated according to the manufacturers' specifications and design intent (e.g., safe working load limit, terrain type, outriggers deployment); and
 - Equipped with all safety devices as per manufacturers' specifications. There must be no unauthorised modification, bypass or removal of any such devices.
- 6.5.5** Employers shall ensure that only competent operators are tasked to operate MEWPs. MEWP operator competency includes:
- MEWP operator course conducted by a Ministry of Manpower Accredited Training Provider; and
 - A familiarisation for the model/s of MEWP they are required to operate.
- 6.5.6** While working at heights in a MEWP, the operator shall ensure that:
- All persons on the MEWP use appropriate PPE (for work at heights), including a travel restraint system anchored to the manufacturers' designated anchor point inside the MEWP (see Fig 6.11, left);
 - All persons maintain a firm footing on the MEWP floor – climbing on guard-rails (Fig 6.12, right) or the use of other devices to achieve additional height or reach is prohibited; and
 - When other moving equipment or vehicles are present, additional precautions (e.g., barricade, traffic management measures) are in place.

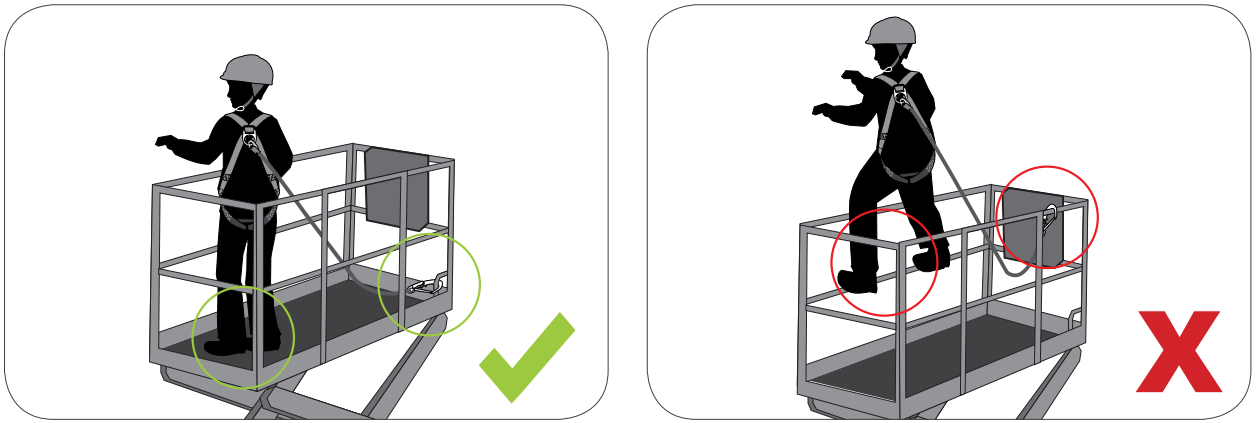


Figure 6.12: Correct method of working in an MEWP (left) and unsafe practices (right).

- 6.5.7** MEWPs are not specifically designed to transfer personnel from one level to another, or for persons to enter/ exit the work platform at height; it should only be considered as an option after ensuring that:
- Access/ egress at heights is not prohibited by the manufacturer;
 - There are no other reasonably practicable means to provide the access to the level or the work area;
 - A thorough risk assessment is conducted to assess all additional risks (e.g., falling of persons, falling of objects or sudden movement of the MEWP); and
 - All persons are able to utilise 100 percent tie-off (Refer to paragraph 9.6.5.3).

6.6 Suspended Scaffold

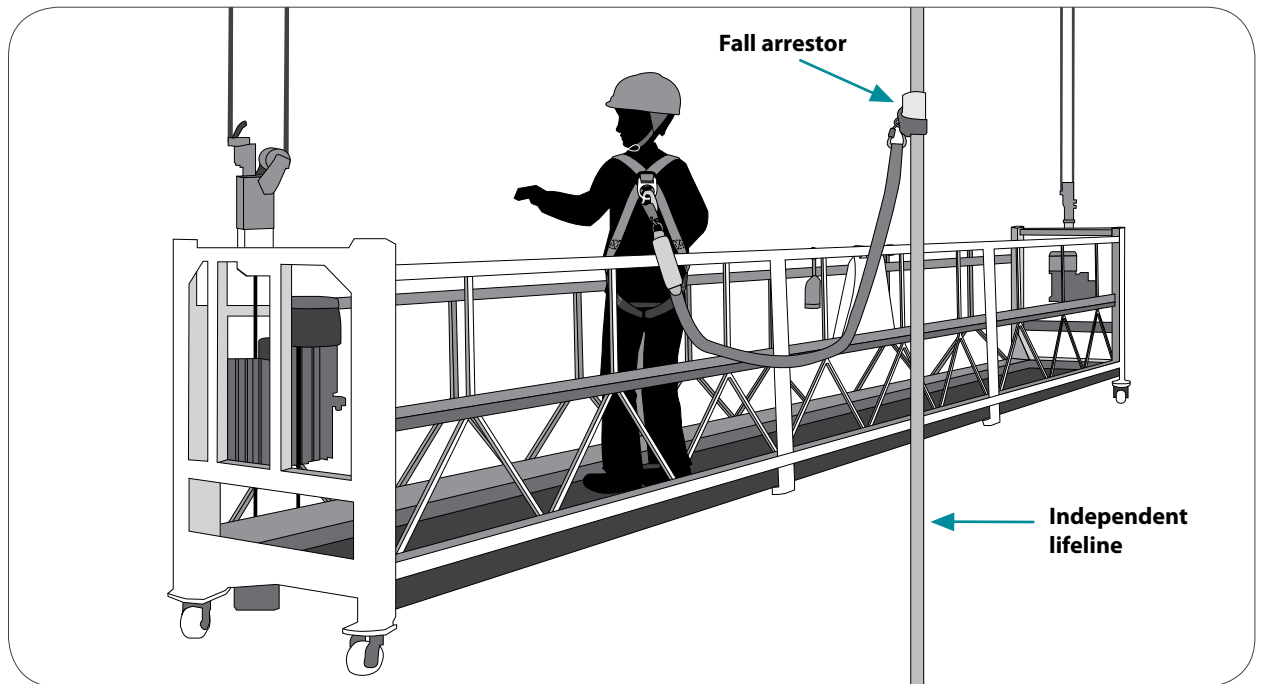


Figure 6.13: A suspended scaffold is mainly used for performing work on the sides of buildings. Workers should be protected by a personal fall arrest system with an independent vertical lifeline anchored from the top of the building.

- 6.6.1** A suspended scaffold (see Fig 6.13) is a power-operated suspended working platform that is fixed to a building structure. It is used for access during building maintenance or window cleaning.
- 6.6.2** During the planning stage, consideration should be given to the methods by which maintenance, repairs or cleaning will be undertaken on buildings or structures.
- 6.6.3** Consideration of future maintenance requirements in the early design stage will avoid the possibility of unsafe work practices occurring during routine maintenance. Sloping building exteriors and recline windows require priority consideration to ensure that maintenance can be carried out in a safe manner.
- 6.6.4** Considerations for safe operation of suspended scaffolds include, but are not limited to:
- Never exceed the rated safe working – load the safe working load must be clearly communicated to intending persons, this includes the equivalent number of persons and amount of material allowed;
 - Anchorage must be adequate to support the weight of the scaffold, occupants and other load, and provides stability against overturning;
 - The suspended scaffold must be inspected to be in good condition (e.g., decking, guard-rails, hooks and shackles) and tested periodically;
 - Adequate primary and secondary (emergency) brakes must be provided and tested periodically;
 - Suspended scaffolds must be inspected at least once every seven days by a scaffold supervisor (suspended scaffold) and examined once every six months by an authorised examiner;
 - Lifting and climbing of the suspended scaffold should be at a speed to avoid undue swinging and controlled using a “dead man’s switch” such that when application is released, the power will be cut;
 - Persons on the suspended scaffold must be provided with the suitable PPE (for work at heights), anchored to a lifeline or anchorage that is independent of the suspended scaffold; and
 - Persons working on suspended scaffold must be competent and are adequately supervised.

6.7 Mast Climbing Work Platforms

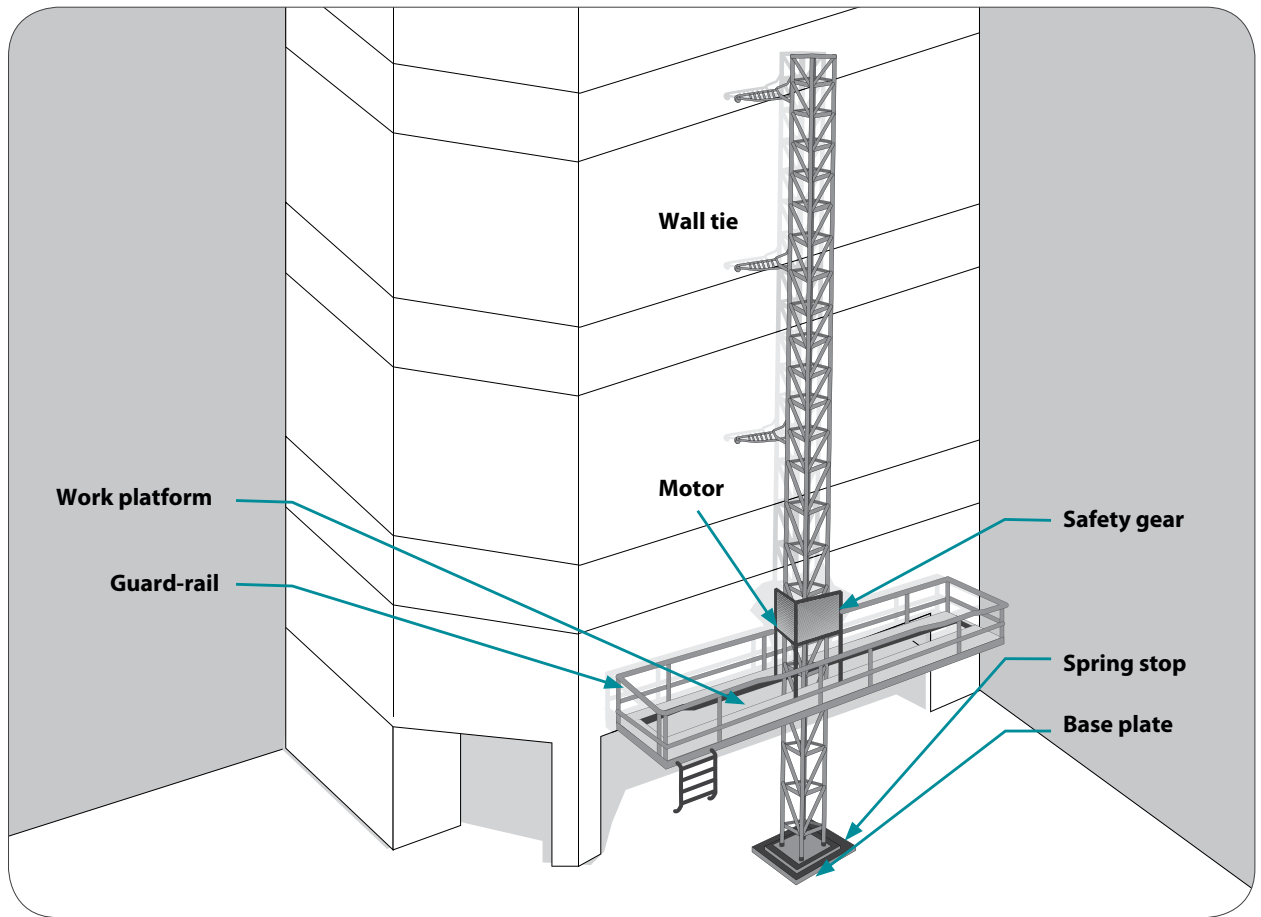


Figure 6.14: A mast climbing work platform is used to raise personnel and materials to the working position.

- 6.7.1** Mast climbing work platforms (see Fig 6.14) are hoists that have a working platform used for temporary purposes to raise personnel and materials to the working position.
- 6.7.2** Mast climbing platforms are generally not suitable for use where the profile of a structure changes at different elevations, for example, where upper floors of a building “step” back or balconies protrude from the building.
- 6.7.3** The erection and rigging of mast climbing work platforms should be carried out or directly supervised by a competent person.
- 6.7.4** Items transported inside the mast climbing work platform must not protrude out from the machine, they may fall out if caught on external objects.
- 6.7.5** Operators working in mast climbing work platforms should be competent and protected by a suitably anchored full body harness.

7. Anchorage and Lifelines

7.1 Application

7.1.1 Anchorage and lifelines should be used if it has been assessed that falls cannot be prevented using fall prevention systems outlined in chapter 6 of this Code.

7.1.2 Anchorage and lifelines are part of personal fall prevention/ arrest systems that include:

- Travel restraint system to exclude persons from falling risks;
- Personal fall arrest system to arrest a fall in an inadvertent accident; and
- Work positioning system (methods of which may require higher competency levels).

7.1.3 Anchorage and lifelines shall be of good construction and come with the relevant certificate of conformance to recognised international standards. Anchorages and lifelines shall be selected, installed, inspected and certified to be suitable and adequate by a competent person (refer to manufacturers' specifications and the *WSH Guidelines on Anchorages, Lifelines and Temporary Edge Protection Systems*, WSH Council).

7.2 Anchorage

7.2.1 Anchorage, also known as "anchor points" is a part of an anchor for PPE (for work at heights) to be attached to. Anchors can be installed as a permanent or temporary fixture to a building or placed around a suitable structure (see Fig 7.1).

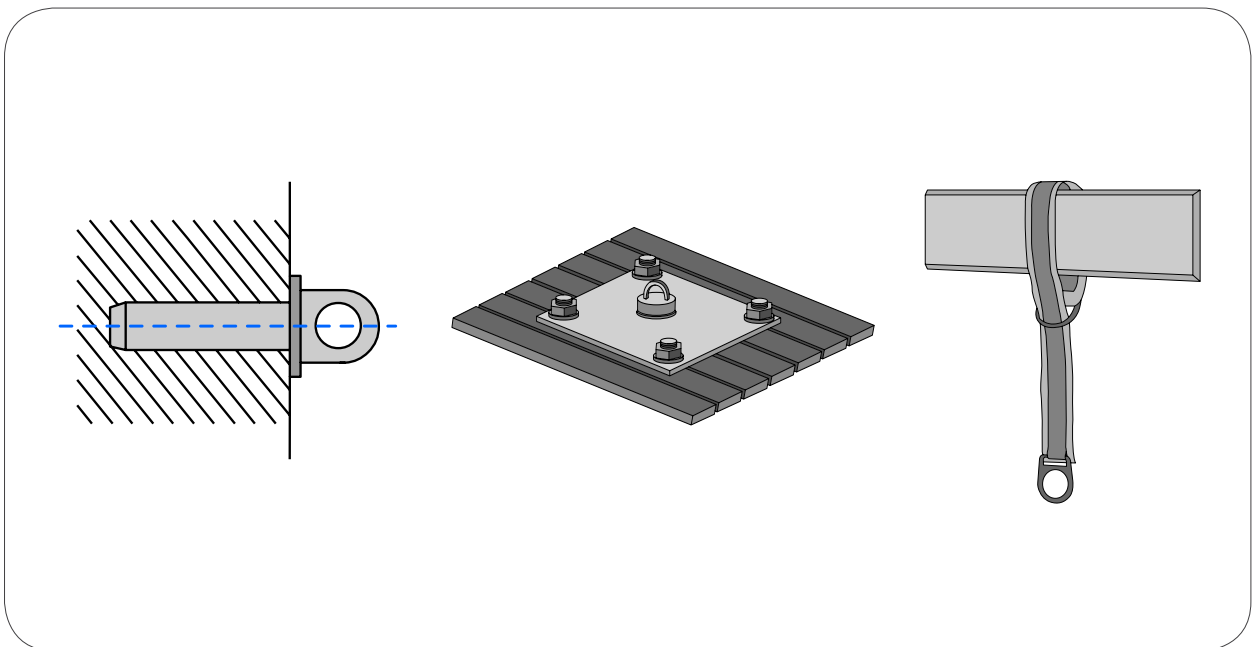


Figure 7.1: Examples of anchor devices – eyebolt (left), roof anchorage (centre) and anchor sling.

7.2.2 In general, anchorage should be positioned above the user where possible. This will help to ensure that there is as little slack in the users' lanyard as possible.

7.3 Lifelines

7.3.1 Lifelines are flexible or rigid lines connected at least to one end to a reliable anchor to provide a link between the anchor and the user of a personal fall prevention/ arrest system.

7.3.2 Lifelines should meet the following characteristics:

- Safe rating high enough to withstand forces generated in the event of a fall; and
- Installed in a proper manner such that they do not interfere with any other items of equipment or clothing, or create any tripping hazards.

7.3.3 The three main categories of lifelines are horizontal (see Fig 7.2), vertical and self-retracting lifelines.

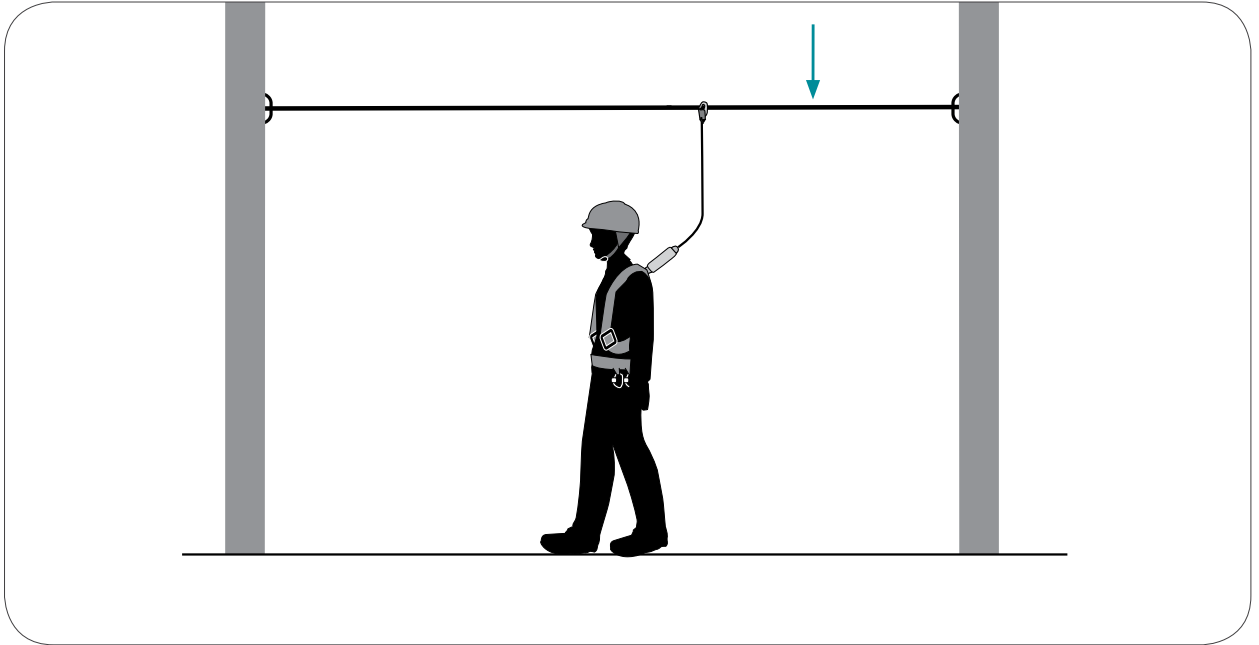


Figure 7.2: An example of a horizontal lifeline.

7.3.4 A self-retracting lifeline (SRL) (see Fig 7.3) involves a spring-loaded reel to ensure the shortest possible length of lifeline between the user and the reel. Where SRLs are used, it is important to note that unless tested and permitted by manufacturer:

- SRLs must not be used in the horizontal plane;
- SRLs must not be attached to a horizontal lifeline;
- A lanyard (with or without energy absorber) must not be attached between the SRL and the full body harness as this may increase the fall distance; and
- Attachment of more than one user to each SRL must not be allowed as overloading may occur.

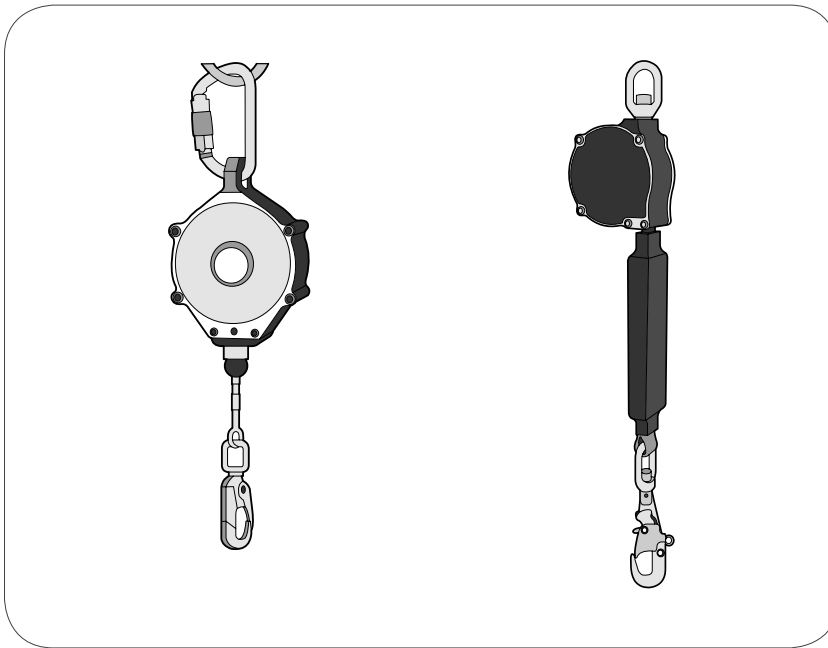


Figure 7.3: Examples of self-retracting lifelines.

- 7.3.5** Lifelines are to be certified as a system by a competent person. Components should not be used independently; components from different manufacturers should not be used together unless it is specified or advised by the manufacturer.
- 7.3.6** It is critical to install and use lifelines according to the manufacturers' specifications. Any misuse may cause the fall prevention/ arrest systems to fail to provide the intended protection from falls. Always consult or refer to manufacturers' specifications.
- 7.3.7** If the lifeline is left at the site of the usage, it must be inspected by a competent person on a daily basis or before each use.
- 7.3.8** Portable anchorage and lifeline structural system (see Fig 7.4) should be provided to protect workers if a fixed lifeline is not available (e.g., working on top of a tank container).



Figure 7.4: Examples of portable anchorage and lifeline structural system.

7.4 Lifeline Devices

7.4.1 Lifeline devices are components that link users to lifelines. They allow users to travel alongside lifelines during upwards, downwards and horizontal movements.

7.4.2 Lifeline devices employed in fall prevention/ arrest systems include:

- Rope grabs for work positioning systems;
- Travellers for horizontal lifelines systems;
- Guided type fall arrestors for vertical lifeline systems (see Fig 7.5); and
- Ascender and descender for rope access systems.

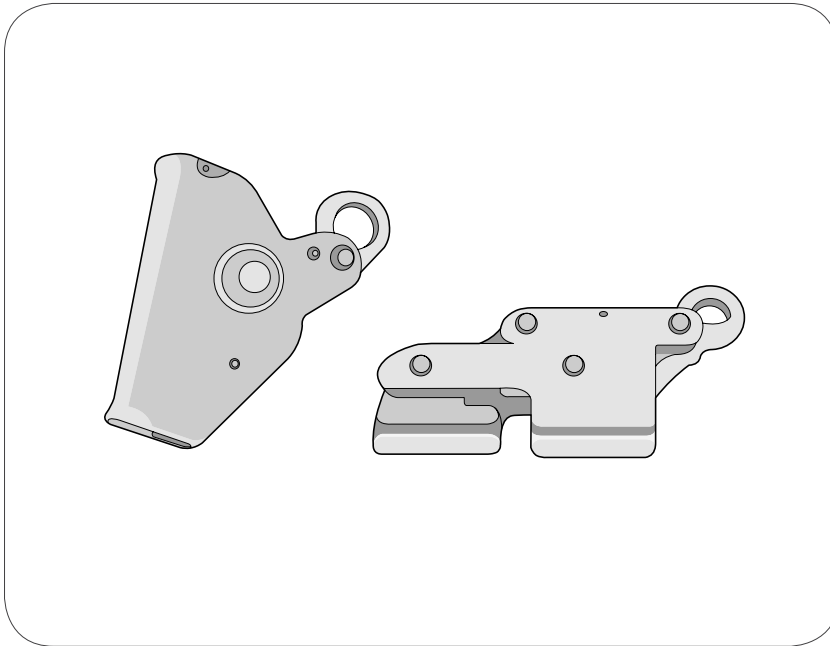


Figure 7.5: Examples of guided type fall arrestors.

7.4.3 Lifeline devices may have direct and significant impact on the fall protection system it is being attached to. It is vital to ensure that the lifeline devices are compatible, suitable (e.g., users' ease of travelling along the lifeline), and should be certified as a system by a competent person.

8. Travel Restraint Systems

8.1 A travel restraint system is a system that:

- Consists of a full body harness or restraint belt, attached to one or more lanyards, each of which is attached to a static line or anchorage point; and
- Is designed to restrict the travelling range of a person wearing the safety harness or belt so that the person cannot get into a position where the person could fall off an edge of a surface or through a surface.

It is critical to note that travel restraint belts are not designed for fall arrest purposes.

8.2 A roof anchor may be used as a travel restraint on steel sheeting or tiled roofs during construction of the roof. It is lightweight, portable and can be installed and removed with minimal time and effort.

8.3 Travel restraint systems can be used in conjunction with other fall prevention methods such as guard-rails.

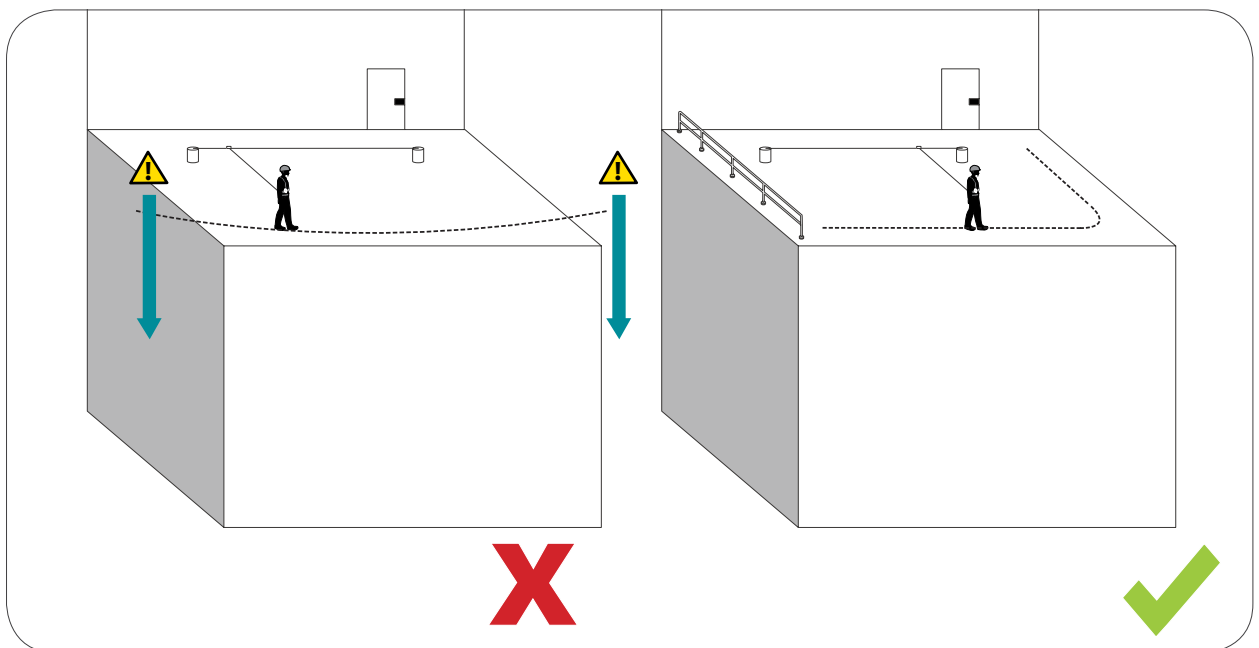


Figure 8.1: Example of incorrect use (left) and correct application (right) of a travel restraint system.

8.4 Where it has been planned to use a travel restraint system, the following conditions should be complied before the system is used:

- The travel restraint system should prevent a person falling from the edge of a roof (see Fig 8.2). The system should not be used on fragile roofs; and
- Persons setting up and/ or using the system should be able to demonstrate that they have a clear and thorough understanding of the system and how the work area can be accessed without the possibility of a fall occurring.

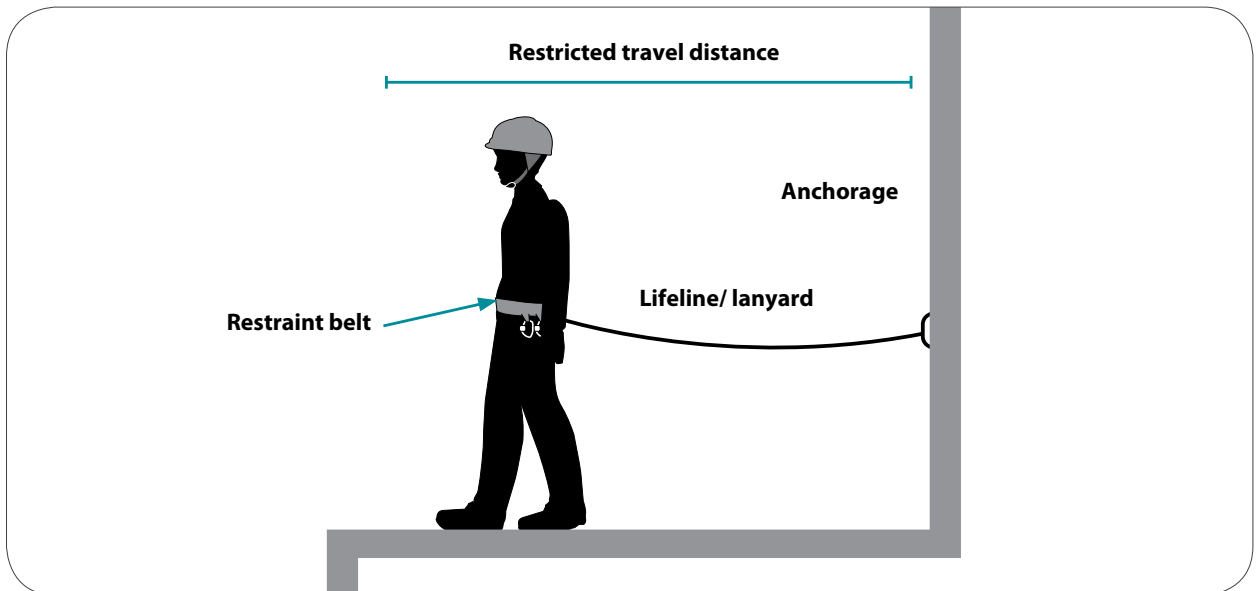


Figure 8.2: The travel restraint system prevents the user from reaching the open side.

- 8.5** Where access to the corner of the roof is required, workers should be attached to two or more sets of ropes and anchorages to prevent a fall from either edge of the roof. While accessing the anchorage points, the users should be restrained so that a fall cannot occur.
- 8.6** The anchorage points must be capable of withstanding at least two times the maximum total load (total weight of person and tools/ equipment) likely to be applied to it without failure, and should conform to Singapore Standard SS541: 2008 - Specification for Restraint belts (Incorporating Amendment No. 1, April 2012).
- Anchorage points should be designed for additional loading should more than one person be using the system.
- 8.7** If the system consists of ropes that require their effective length to be adjusted to prevent a fall occurring, the method of adjusting the rope length should be by means of a lockable cam device or similar; if there is a possibility of the rope grab (or similar device) coming off the end of the rope, the rope should be suitably terminated.
- 8.8** Restraint belts are used only for travel restraint and not for fall arrest purposes. A personal fall arrest system (see Chapter 9 of this Code) should be used if the intention is to provide fall arrest instead of travel restraint.
- 8.9** Travel restraint systems are generally only suitable for work such as the following:
- Roof inspection (not on fragile roofs);
 - Installation and removal of perimeter guard-rail systems;
 - Routine work during temporary removal of guard-rails;
 - Minor repair work, including replacement of some isolated parts of the roof;
 - Painting and cleaning;
 - Installations of skylights and ventilation fixtures;
 - Pointing up tiles or fitting ridge capping on metal roofs; and
 - Installation and removal of television aerials and other similar communication equipment.

9. Personal Fall Arrest Systems

9.1 Fundamentals of Personal Fall Arrest Systems

9.1.1 A personal fall arrest system is a collection of components that work in conjunction to:

- Safely stop a person from falling an uncontrolled distance; and
- Reduce the impact of the fall.

In general, a complete personal fall arrest system consists of three vital components:

- Anchorages;
- Body support; and
- Connections.

It is critical to note that individually, these components will not provide protection from a fall. It is only when they are used correctly and in conjunction with each other that they will be able to arrest or sustain a fall.

(Refer to manufacturers' specifications and the WSH Council's *Guidelines on Personal Protective Equipment for Work at Heights*).

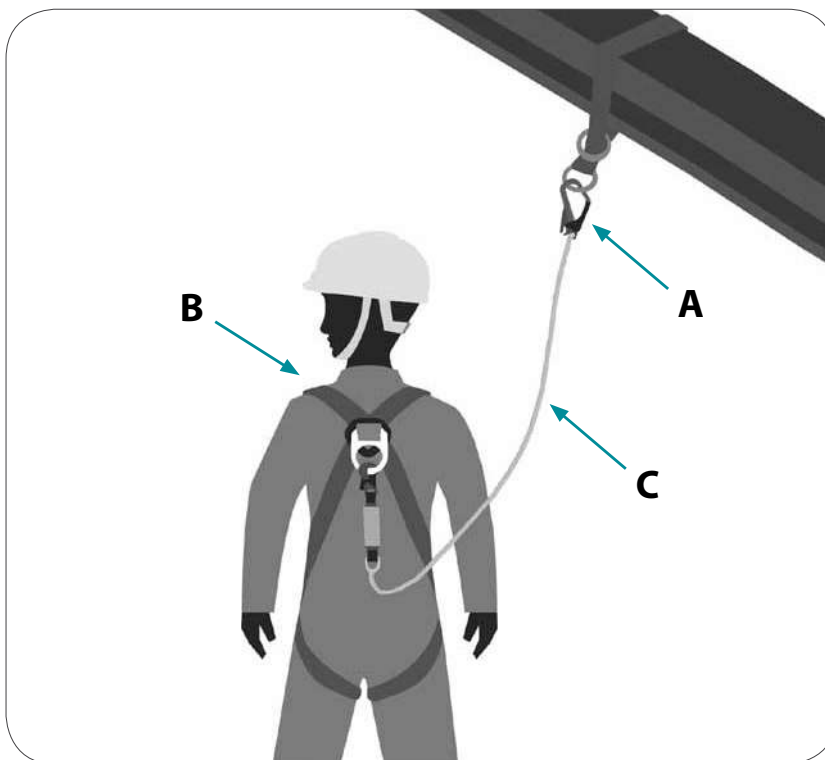


Figure 9.1: “ABC” of a personal fall arrest system – “A”: Anchorage, “B”: Body Support, “C”: Connection.

They can be used where workers are required to carry out their work near an unprotected edge such as rigging and dismantling. They may also be used where the working platform is not stable, for example, in suspended scaffolds.

- 9.1.2** When used to arrest falls the following guidelines are to be observed:
- The system should be rigged such that if a fall occurs, the distance fallen will be the shortest. This is to minimise the impact and swing of the arrest;
 - All fall protection equipment should be visually checked prior to usage (refer to paragraph 9.6);
 - Once a fall arrest system has been used to arrest a fall, it must be removed from service and not used again; and
 - Anchoring of lanyards to guard-rails of scaffolding should be avoided where possible.
- 9.1.3** The personal fall arrest system is designed to arrest only one fall. In the event of a fall, even if the shock absorber has not been extended, all the components of the fall arrest system should be inspected and approved by a competent person or the manufacturer before it is put to use again. Otherwise, they are to be removed from service.

9.2 Limitations of Fall Arrest Systems

- 9.2.1** Personal fall arrest systems should only be used if it is not reasonably practicable to use other risk control measures to prevent falls. Personal fall arrest systems require a moderate level of skill to use safely, and in the event of an arrested fall, it may cause some physical injury to the user.
- 9.2.2** Height clearance is another limitation of personal fall arrest systems. For a person falling from height, the combined length of the lanyard, sag in life line and the shock absorber fully extended may be more than 5m in total. This 5m might be more than the actual height of the fall; and
- 9.2.3** Therefore, when working in areas where falls over short distances are possible, a short lanyard or retractable fall arrest block should be considered.

Calculation of the Free Fall Distance

Free Fall Distance

The allowable free fall distance for personal fall arrest systems should be limited to not more than 6 feet (1.8m).

Fall Clearance Distance

This is also known as 'free space', it is the total distance below a worker who is using a personal fall arrest system to safely arrest his fall without striking an obstruction or the ground. Below are the formulae for two commonly used configurations.

For a harness, lanyard with energy absorber assembly (Fig 9.2):

- Clearance Height = Length of Lanyard + Length of Energy Absorber Extension + Height of Worker + Safety Distance (usually taken as 3ft or 1m)

For a Self Retracting Lifeline (SRL)/Retractable Fall Arresters:

- Clearance Height = Deceleration Distance + Height of Worker + Safety Distance (usually taken as 3ft or 1m)

If the personal fall arrest system (fall arrest lanyard or SRL) is attached to a horizontal life line (HLL), the deflection of the HLL needs to be included.

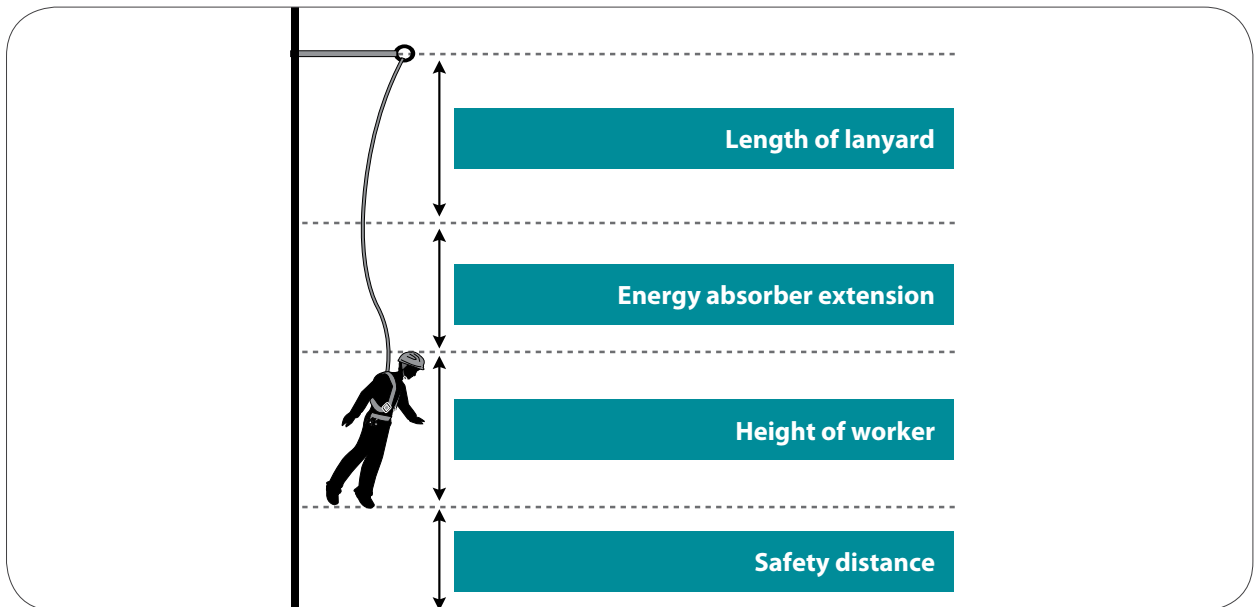


Figure 9.2: A graphical representation of the formula for calculating clearance height.

9.3 Instruction and Training for Workers Using Personal Fall Arrest Systems

9.3.1 Any person required to use a personal fall arrest system should be trained and instructed in:

- The correct fitting and attachment of safety harnesses;
- The dangers of using incompatible hardware;
- The inspection, maintenance and storage of equipment;
- The correct anchorage, installation and use of the system; and
- Emergency rescue procedures.

9.3.2 Upon completion of the training programme, workers should be assessed for their competency in the safe use of the equipment.

9.4 Hazards of Fall Arrest Systems

9.4.1 There are some hazards when using personal fall arrest systems. One such hazard is “swing back” and “swing down”. It is caused by the pendulum effect of a person falling off the edge.

9.4.2 “Swing back” – In a fall, particularly from a perpendicular edge, the worker will swing back into the building structure and collide with any obstructions in the path of the swing (see Fig 9.3, left). If there is a risk of a swing back occurring, the use of a personal fall arrest system should be reassessed.

9.4.3 “Swing down” – In a swing down, the arrest line extends diagonally from the anchor point, following the perimeter edge of the roof. If the worker falls, the fall arrest line will slide back along the perimeter until it is at a right angle with the edge of the roof. If the arrest line is too long, the worker will drop and hit the ground (see Fig 9.3, right) or the arrest line may break when it comes into contact with the edge of the roof and result in the worker hitting the ground.

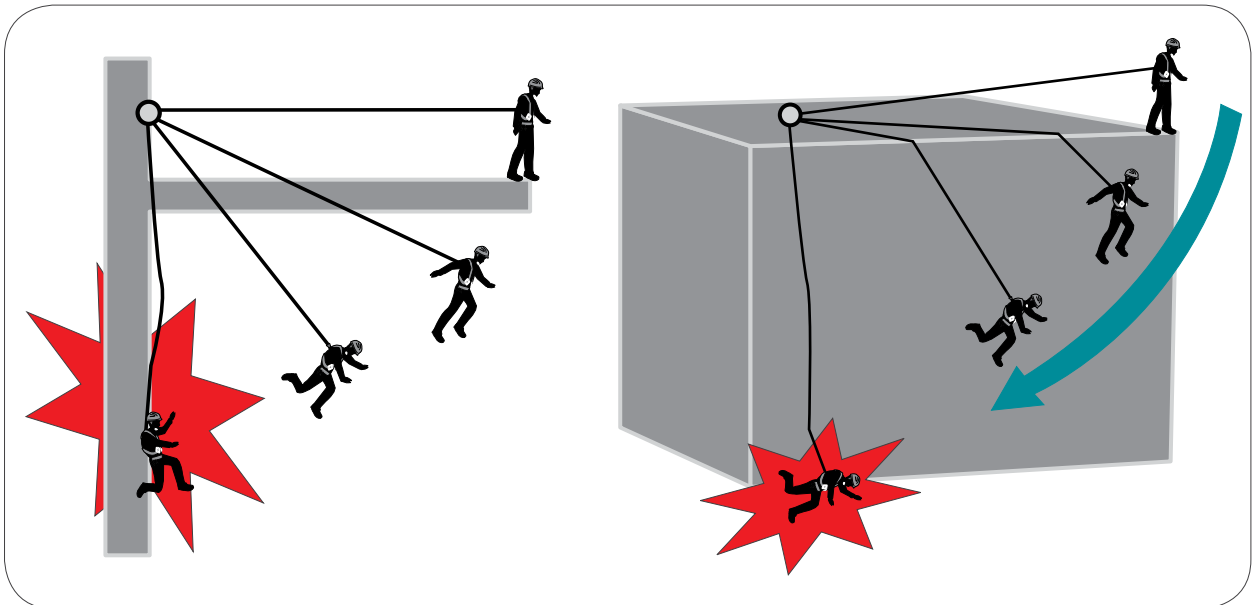


Figure 9.3: **Swing back (left) and swing down (right) hazards.**

9.5 Rescue of Persons Using Personal Fall Arrest Systems

- 9.5.1** Personal fall arrest systems should be used only if a written rescue plan is in place to ensure that persons who fall can be rescued as soon as reasonably practicable.
- 9.5.2** The rescue procedure must not put the rescuers at risk. If a mobile elevated work platform is to be used for a rescue, it should be readily available at all times.

9.6 Components of a Personal Fall Arrest System

9.6.1 In general, a personal fall arrest system consists of the following components:

- Full-body harness;
- Connectors;
- Energy absorbers; and
- Lanyards.

They will require connection to a suitable anchor in order to function effectively. The inspection of the components of a personal fall arrest system should be conducted periodically to ensure that they have not exceeded the manufacturer's recommended usage life. Additionally, users should conduct a visual inspection before each use.

9.6.2 Full body harness

9.6.2.1 A full body harness (Fig 9.4) is an assembly of interconnected shoulder and leg straps with or without a body belt or saddle designed to spread the load over the body and to prevent the wearer from falling out of the assembly.

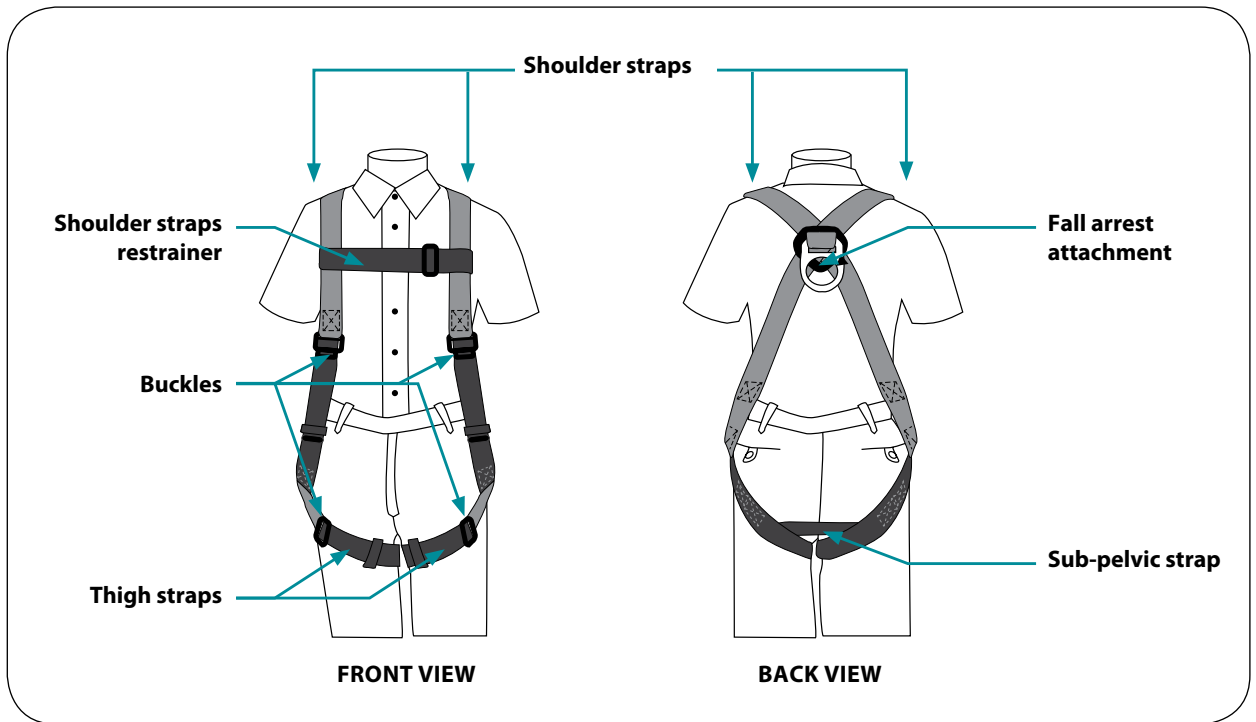


Figure 9.4: Components of a full body harness.

9.6.2.2 When doing pre-use checks for harnesses, the competent person should pay attention to the following:

- The mounting ring or the body for damage;
- Check that the activation of the fall arrest indicator and that the labels are present;
- Inside and outside of any textile attachment point loops, the competent person performing the inspection should pay particular attention to the following:
 - Cuts and frays, excessive wear and age;
 - Abrasion (furriness), particularly to load bearing parts;
 - Stitching (unauthorised repair);
 - Discoloration (sign of chemical or UV damage);
 - Powdery surface (damage by chemicals);
 - Hardening or stiffness;
 - Heat glazing or burns (damage by heat);
 - Dirt, oil, grease;
 - Flattening or thinning; and
 - Lumps.

Marking or Labelling of Textile Components of the Personal Fall Arrest System

Solvents present in markers may damage or weaken textiles and may result in the protection provided to be compromised. As a general rule, textile products must not be marked unless it has been ascertained that the marking agent will not cause damage to the textile.

- Fastening and adjustment buckles as well as any other safety critical metal and plastic parts for:
 - Correct assembly;
 - Correct functioning;
 - Excessive wear;
 - Corrosion; and
 - Cracks.

9.6.3 Connectors

9.6.3.1 Connectors are components that link other components of a personal fall protection system together (e.g., connecting a full body harness to a lanyard, connecting a lanyard to an anchorage). Connectors have a closure function to protect against inadvertent opening (see Fig 9.5).

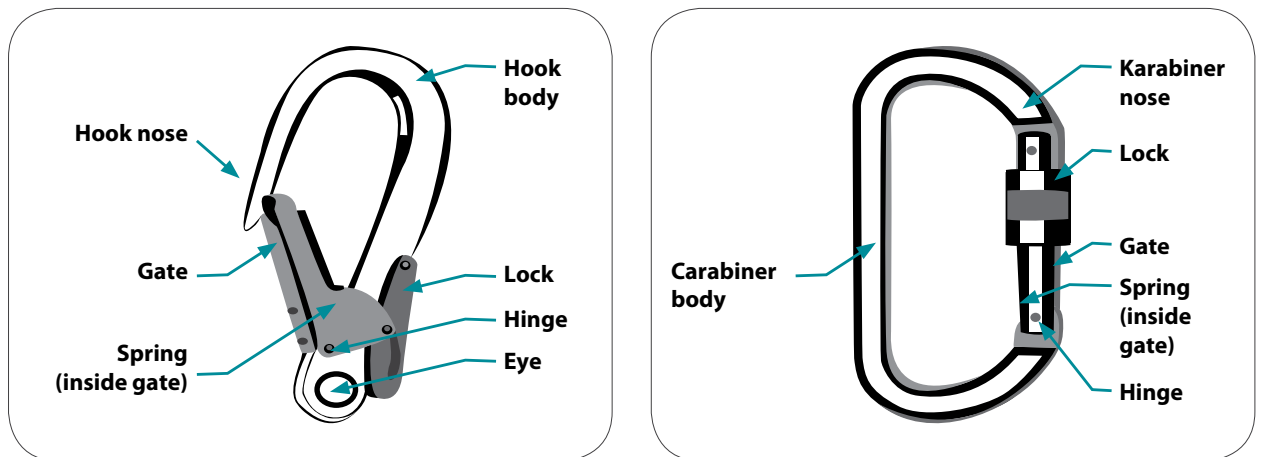


Figure 9.5: A diagram of a self-locking connector or snaphook (left) and a karabiner (right).

9.6.3.2 It is critical to ensure that connectors selected are compatible with other components of a fall protection system. It is critical to note that connectors, when applied in an improper manner, may fail to perform its intended purpose in the event of a fall (see Fig 9.6).

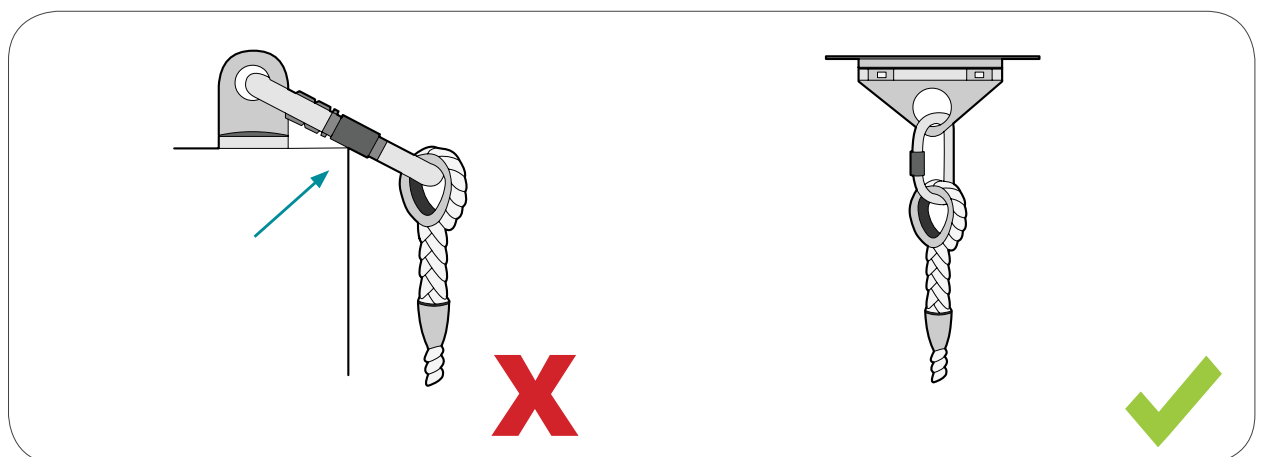


Figure 9.6: Example of incorrect application (left) and proper application (right) of a connector to an anchor point.

9.6.3.3 When doing pre-use checks for connectors, such as snaphooks, the competent person performing the inspection should take note of:

- Obvious damage or deformations (bent, twisted, corroded, worn, cracks, etc.), especially at contact points;
- Rust or corrosion;
- Contamination by chemicals (pitting or flaking);
- Build up of foreign matter (grit, grease or paint);
- Cuts, serrations, burring, heavy marking or scoring;
- Hinge pin (ensure that it is in good condition);
- Catch pin (ensure that it is not bent); and
- Functionality of moving parts such as locking mechanisms, they should open and close as intended.

9.6.4 Energy Absorber

9.6.4.1 An energy absorber is a component designed to limit the arresting forces applied to the user in the event of a fall (see Fig 9.7). Energy absorbers shall be fitted correctly as per manufacturers' specifications. Failure to do so may result in the energy absorber not deploying correctly in the event of a fall. The energy absorber may be a separate item or manufactured into the lanyard.

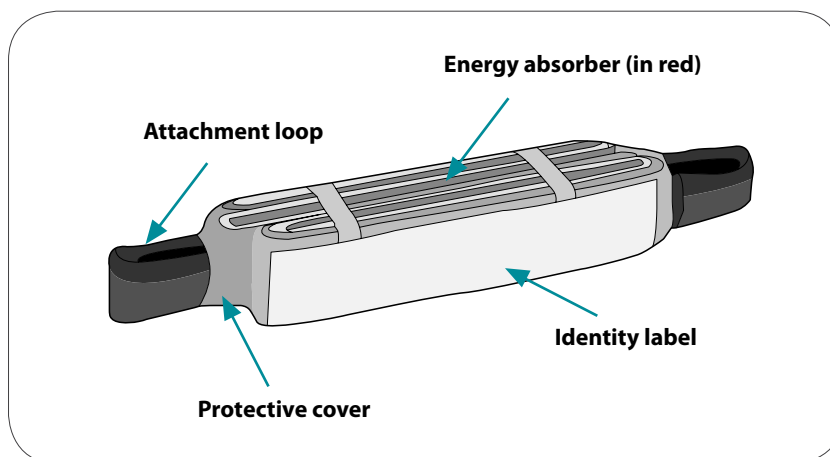


Figure 9.7: Main components of an energy absorber.

9.6.4.2 An energy absorber shall have protective coverings to shield it against damage (e.g., exposure to chemicals, sharp objects and so on, that may impair its designed purpose).

9.6.4.2 Energy absorbers can only be used for a period of time from the date the equipment is put to use as per the manufacturers' specifications. After the recommended period, the energy absorber must be withdrawn from use and destroyed to prevent misuse.

9.6.4.2 When doing pre-use checks for shock absorbers, the competent person should take note of:

- Signs of activation; and
- Wear and tear of point of attachment.

9.6.5 Lanyard

9.6.5.1 A lanyard is a finished length of flexible material which is often used in conjunction with an energy absorber (see Fig 9.8). There also exist lanyards with built-in energy absorption capabilities. A lanyard is used to connect a fall arrest harness to an anchorage point or static line. A lanyard assembly should be as short as reasonably practicable.

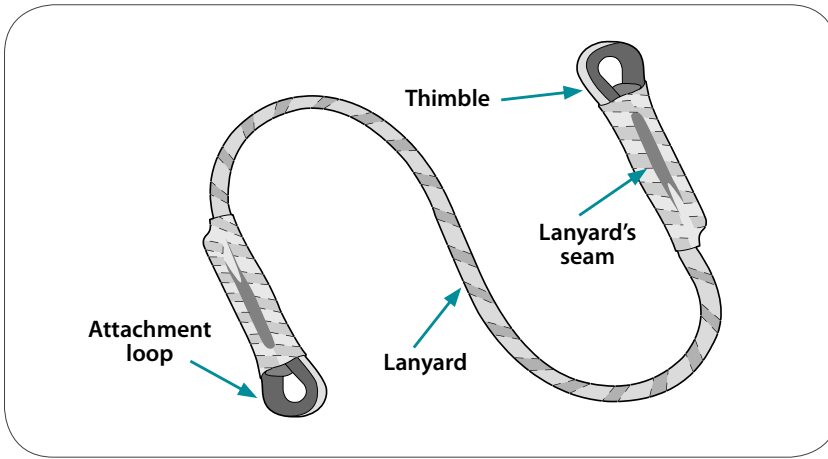


Figure 9.8: Main components of a lanyard.

9.6.5.2 An adjustable lanyard is a lanyard that incorporates a designed mechanism that allows its length to be shortened or lengthened (see Fig 9.9). This mechanism is useful in situations where work restraint and anchor points at varying heights are needed.

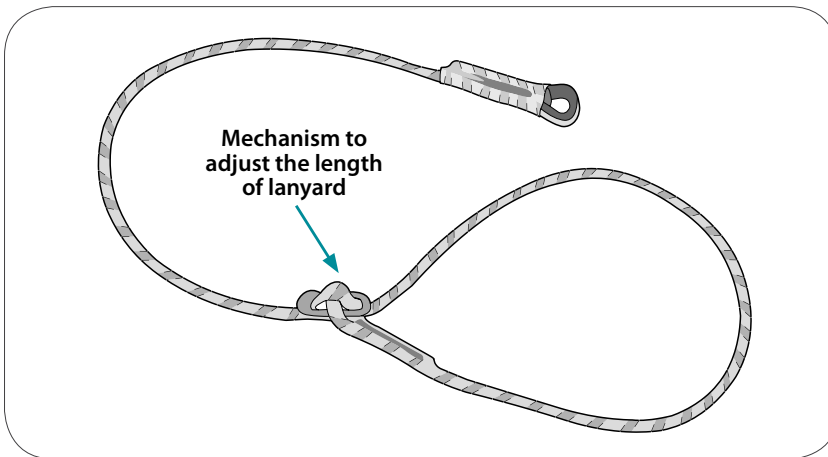


Figure 9.9: An adjustable lanyard.

9.6.5.3 Twin lanyards systems or twin-tailed lanyards allow users to remain protected while transferring from anchorage point to another (see Fig 9.10). This is also known as 100 percent tie off.

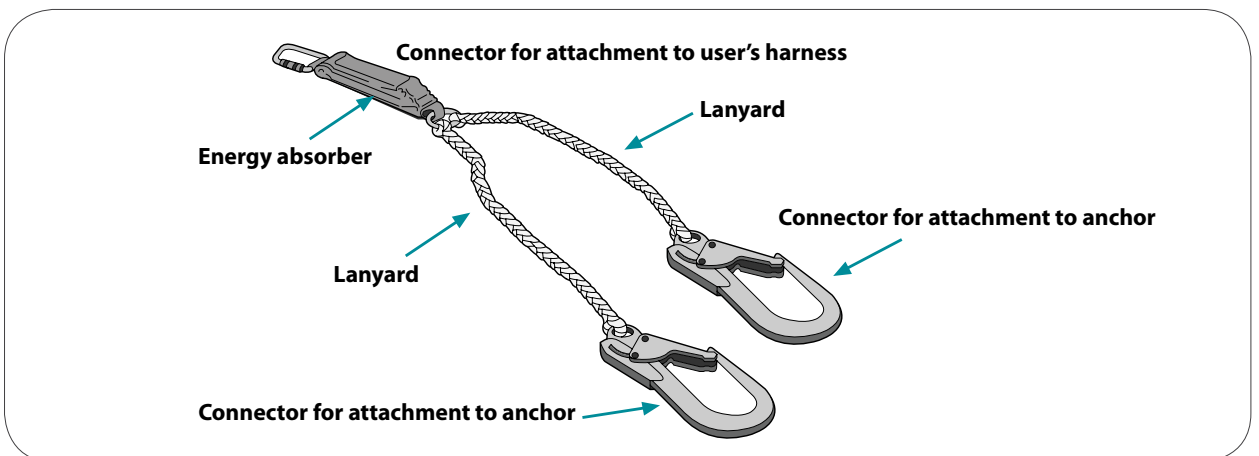


Figure 9.10: Components of a twin lanyard system.

Anchorage, 100 Percent Tie Off

A safety harness is able to provide protection from falls only if the harness is attached to a lanyard that is anchored.

Ensuring 100 Percent Tie Off

The term '100 percent tie-off' means that anchorage is maintained at all times. This is done to allow for fall protection even when transferring between two separate anchorage points. A 100 percent tie-off will require twin-tailed lanyards that allow users to remain anchored to one point of anchorage with one lanyard, while transferring to another point of anchorage with the second one.

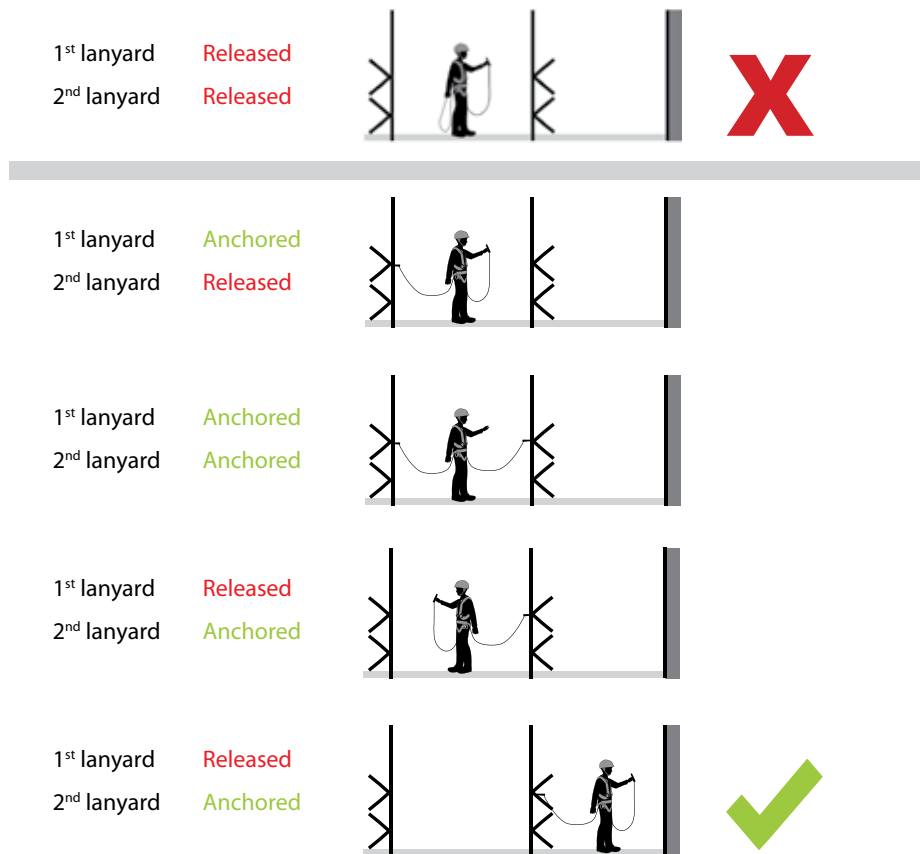


Figure 9.11: 100 percent tie off allows the person fall protection throughout the transfer of anchorage.

9.6.5.4 When doing pre-use checks for lanyards and flexible anchorage lines (textile based equipment), the competent person performing the inspection should pay particular attention to the following:

- Cuts and frays;
- Excessive wear;
- Abrasion (furriness), particularly to load bearing parts;
- Stitching (unauthorised repair);
- Discoloration (sign of chemical or UV damage);
- Powdery surface (damage by chemicals);
- Hardening or stiffness;
- Heat glazing or burns (damage by heat);
- Dirt, oil, grease;
- Age;
- Flattening or thinning; and
- Lumps.

Standards for Personal Fall Arrest Systems

Further information for standards of fall arrest systems can be obtained from the following standards issued by SPRING Singapore:

- Singapore Standard SS 528-1 : 2006 Personal Fall Arrest Systems. Full-body harnesses
- Singapore Standard SS 528-2 : 2006 Personal Fall Arrest Systems. Lanyards and energy absorbers
- Singapore Standard SS 528-3 : 2006 Personal Fall Arrest Systems. Self-retracting lifelines
- Singapore Standard SS 528-4 : 2006 Personal Fall Arrest Systems. Vertical rails and vertical lifelines incorporating a sliding-type fall arrester
- Singapore Standard SS 528-5 : 2006 Personal Fall Arrest Systems. Connectors with self-closing and self-locking gates
- Singapore Standard SS 528-6 : 2006 Personal Fall Arrest Systems. System performance tests

10. Work Positioning Systems

10.1 Work Positioning Belts

10.1.1 A work positioning belt is a form of body support that works in tension or suspension to keep a person at an elevation with both hands free to perform a job (see Fig 10.1). It is critical to note that work positioning belts are not designed to arrest a fall.

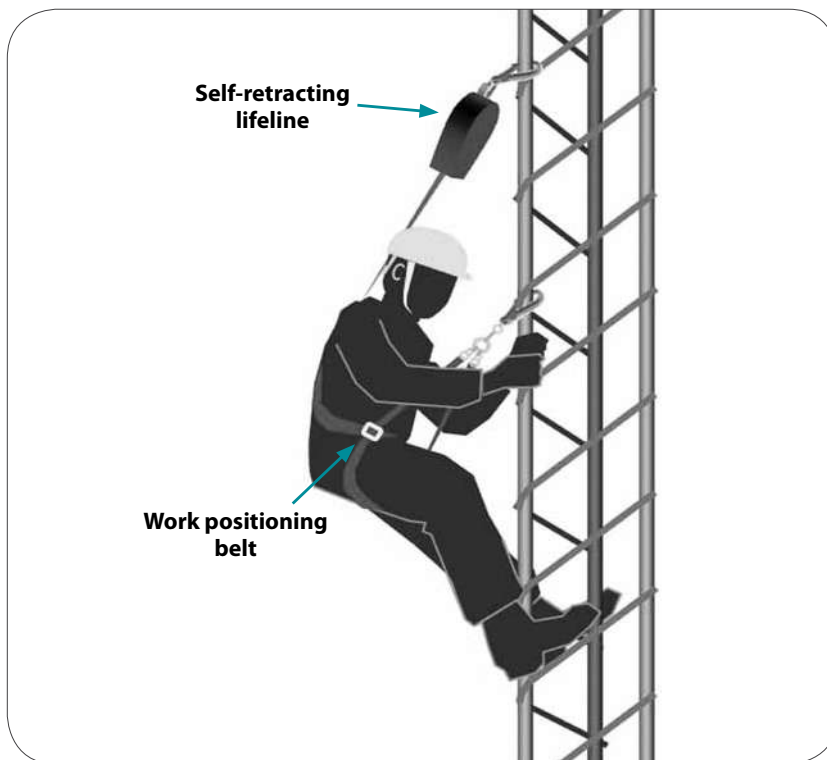


Figure 10.1: An example of a worker using work positioning belt.

- 10.1.2** Work positioning should be considered only if it is not possible to employ other safer means to access the work at heights. All persons assigned to use work positioning systems must be competent and use the system only as intended by manufacturers' specifications. Examples of tasks where work positioning may be considered include access and working on monopoles, towers and antennas.
- 10.1.3** A work positioning belt is linked to an anchorage using a work positioning lanyard. An independent lifeline should be attached to protect the person at work in an inadvertent fall.
- 10.1.4** It is critical to ensure that all components selected are compatible as a work positioning system. Always consult the manufacturer and have the work positioning system inspected as a system, and not as individual components, by a competent person.

10.2 Industrial Rope Access Systems

10.2.1 Industrial rope access systems are used for gaining access to work areas that are hard to reach by other means, usually through the use of vertically suspended ropes (see Fig 10.2). Rope access systems require a high level of competency from the users and therefore, other means such as MEWPs and suspended scaffolds, which require less skill to operate, should be used if it is reasonably practicable to do so.

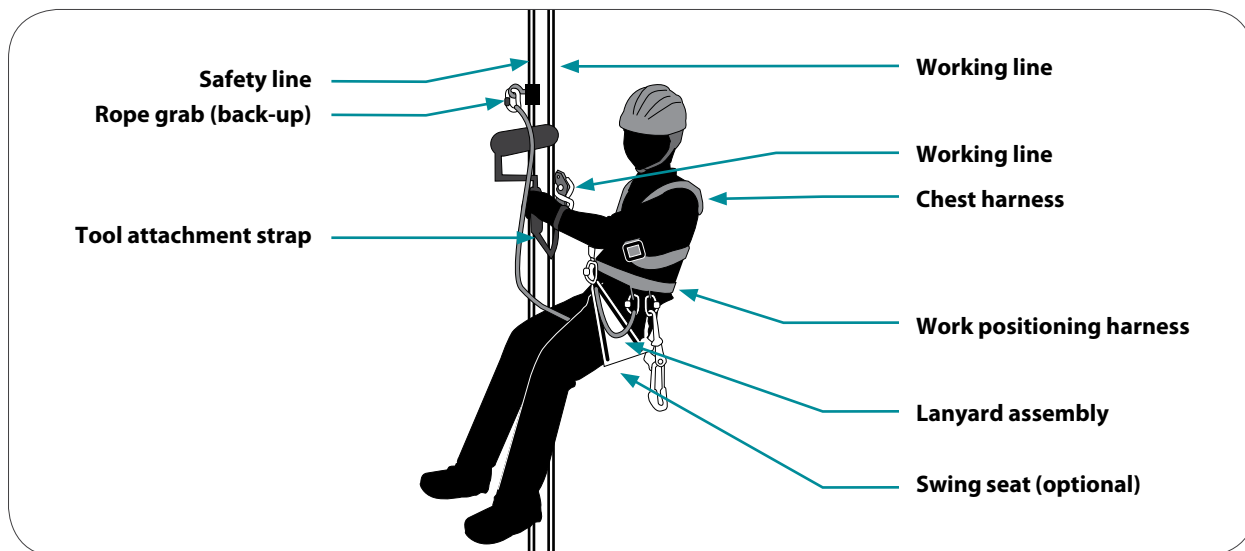


Figure 10.2: Operator using an industrial rope access system, the backup device has to be maintained at a higher elevation in relation to the operator.

10.2.2 Industrial rope access systems are a specialised and job specific form of abseiling. The system is designed to access areas for work such as window-cleaning, sign maintenance on high rise buildings and other forms of maintenance where it is not reasonably practicable to use other forms of access. Such systems are usually suited for light or medium work but may be adapted for heavier work, such as derrick erection in shipyards through the use of lightweight suspended scaffolds for firmer footing.

10.2.3 An industrial rope access system can be extremely dangerous if used by an inexperienced or untrained user or if used in an improper manner. To ensure safety during industrial rope access system operations, it is critical to address at least the following key elements:

- Hazards Identification and Risk Assessment;
- Competency;
- Rope access equipment; and
- SWPs.

10.2.4 Hazard Identification and Risk Assessment

10.2.4.1 Rope access should only be employed after due consideration has been given to assess that it is a suitable method and that all control measures are in place to allow the work to be carried out safely.

10.2.4.2 A comprehensive hazard identification and risk assessment ensure that risks are minimised, by addressing (but not limited to) the following:

- Team structure – levels of rope access, supervision, and so on;
- Competency;
- Selection of tool and equipment;
- Inspection and maintenance; and
- SWPs communication, permit-to-work system, and so on.

10.2.5 Competency

10.2.5.1 All persons assigned to perform rope access works must be competent in working at heights, in addition to having undergone structured and documented rope access training. Rope access personnel should be competent in the level of responsibility assigned to them (e.g., workers being able to conduct self-rescue, supervisors being able to supervise and ensure a rope access team works safely).

10.2.5.2 Rope access team size must be assessed and established for each work situation. Each team should consist of at least two members, one of them must be a trained and competent rope access supervisor. Rope access personnel must not work alone in case assistance is required in an emergency.

10.2.6 Rope Access Equipment

10.2.6.1 The equipment used can be determined through the risk assessment process, which must be carried out before each task. Equipment selected must be suitable and adequate for industrial rope access, and be compatible as a system. Always consult the equipment manufacturers and use the equipment in accordance to the manufacturers' user instructions.

10.2.6.2 All load-bearing rope access equipment or components should be marked with a unique identifier to ensure equipment traceability. Equipment that is withdrawn from service must not be used without the inspection and approval by a competent person. Defective equipment should be destroyed and disposed of to prevent misuse.

10.2.6.3 Records of equipment usage, inspection and maintenance should be kept. Equipment should be routinely and thoroughly inspected by a competent person. Equipment should also be inspected by user prior to each use; user inspections can be structured using a checklist.

10.2.6.4 After usage, equipment should be cleaned and dried or otherwise prepared for storage. Equipment should be stored in a cool, dark and dry location that is chemically neutral and not in close proximity to any objects or substances that may damage them.

10.2.7 Safe Work Procedures

10.2.7.1 An industrial rope access system should be configured and used in a manner to protect persons from falls. One of the key elements includes having two independently anchored ropes for each person. It is critical to note that an industrial rope access system is not designed to stop or sustain falls, unless designed so by a competent person.

10.2.7.2 Work should start from areas safe from falling risks, or made safe with fall prevention control measures (e.g., edge protection). The rope access system should only be installed in locations where it is possible to provide prompt assistance and rescue if necessary.

10.2.7.3 SWPs or methods should be clearly understood by all persons. The supervisor should ensure that there is adequate and effective means of communication between all team members.

10.2.7.4 The risks of falling objects must also be mitigated. Small tools should be secured to the person using lanyards. It is important to note that the combined weight of all items carried must be within the safety factor of the rope access system.

10.2.7.5 Persons using rope access should be provided adequate rest periods, taking into consideration the adverse effects of weather, working at altitude (e.g., high wind speeds) and their difficult work positions.

11. Ladders and Step Platforms

11.1 Safety Guidelines for Ladders

11.1.1 Ladders can be broadly categorised as fixed ladders and portable ladders:

- A fixed ladder is an integral part of a building or structure, and cannot be readily moved or carried.
- Portable ladders are ladders that are designed to be mobile and can be carried and deployed at various locations. The two main categories of portable ladders are step ladders and vertical access ladders.

11.1.2 Observe the following safety guidelines when using ladders:

- Do not use ladders that are of poor construction, unsound material or are of inadequate strength;
- Do not use ladders where a person or ladder may make contact with power lines. Do not use ladders that contain metal near live electrical equipment;
- Do not set up ladders in passageways, doorways, driveways or other places where a person, vehicle or crane lifted load can hit it;
- Do not use ladders near the edge of an open floor or on scaffolding to gain extra height; if a ladder topples in such a situation, the worker could fall over the edge;
- Do not work on ladders continuously for extended periods of time (maximum recommended time: 10-15 mins);
- Do not overreach – ensure that body stays within the stiles and keep both feet on the same rung throughout the task;
- Do not use the ladder unless slip resistant footwear is being worn; and/ or
- Do not carry materials and tools by hand when ascending or descending the ladder. Persons on ladders should maintain three points of contact at all times (see Fig. 11.1).

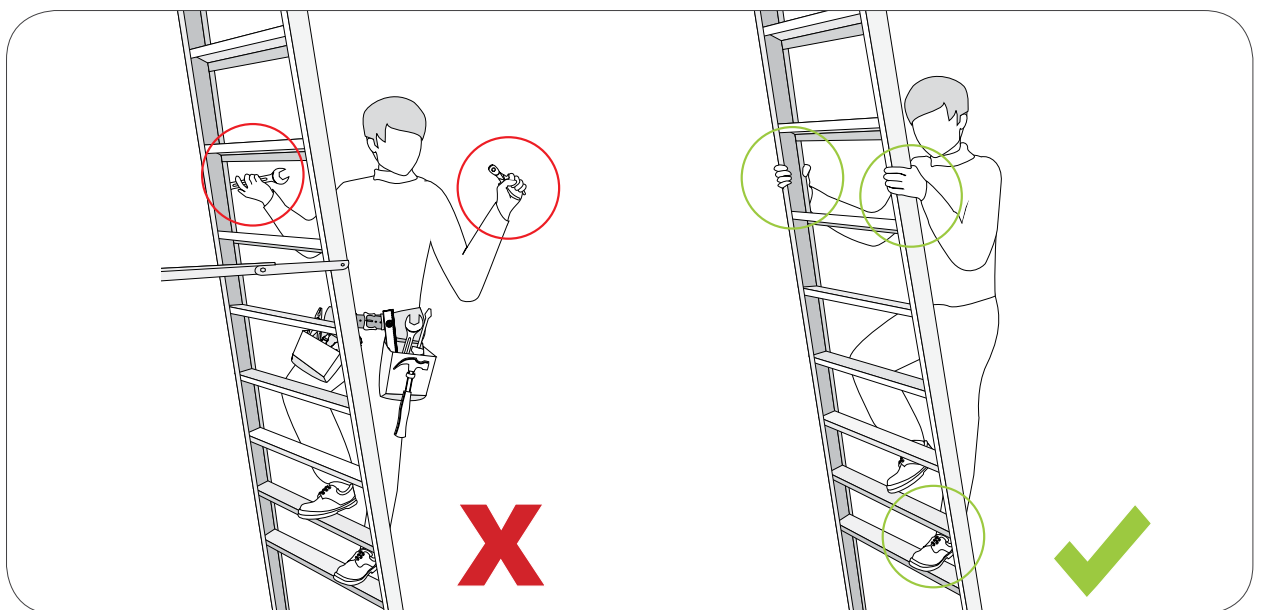


Figure 11.1: Tools and materials should not be carried by hand and should be in a tool belt or side pouch (left). Three points of contact with the ladder should be maintained at all times (right).

11.1.3 Do not use ladders with any of the following faults:

- Metal stiles which are corroded, twisted, bent, kinked, crushed, or with crack welds or damaged feet;
- Rungs, steps, treads or top plates which are missing, worn or loose;
- Missing, broken or loose tie rods; and
- Missing, broken or worn ropes, braces or brackets.

11.1.4 Ladders can be checked for serviceability by;

- Taking each end of the ladder in turn and trying to push the stiles apart and then together. Any movement indicates insecure rungs or loose tie rods;
- Laying the ladder flat, raising one end and attempting to push one stile while pulling the other. If the stiles move relative to each other, the rungs are loose; and
- Ladders should be inspected routinely to ensure that they are in good condition.

11.1.5 Fall prevention measures in association with the use of ladders should be in place if the risk assessment shows that additional protection is necessary (e.g., ladder lashing).

11.1.6 Alternative safe means of access and work platform (example of a step platform shown in Fig 11.2) should be provided if the risk assessment shows that usage of ladder may be unsafe for the duration or height of the task.



Figure 11.2: A step platform can provide a more stable work surface.

11.2 Portable Ladders

11.2.1 Step Ladders

11.2.1.1 Step ladders, commonly known as A-frame ladders, in general should not be used for access to another level unless they are designed for the purpose as specified by the manufacturer. Ladders used for access to another level must be properly secured.

11.2.1.2 Step and trestle ladders should only be used when they are in the fully open position.

11.2.1.3 Standing on top of a step ladder (see Fig 11.3, left) is highly unsafe and should never be done. If it is necessary to work from a step ladder, work a few steps below the top rung, so that a handhold can be maintained.

11.2.1.4 Ensure that both spreaders are locked firmly in the open position.

11.2.1.5 Avoid work that imposes side loading. If side loading cannot be avoided, ladder must be properly secured using tie backs or other suitable means.

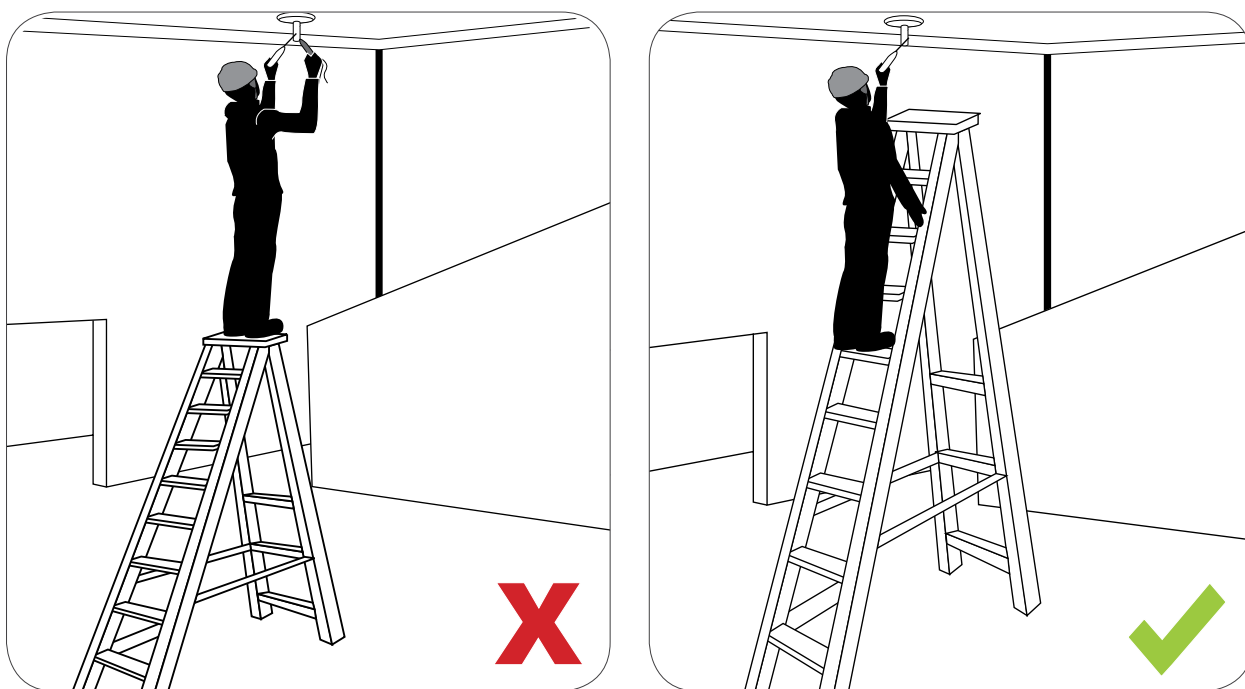


Figure 11.3: If it is necessary to work on a step ladder, work a few steps below the top rung, so that a handhold can be maintained.

11.2.2 Vertical Access Ladders

11.2.2.1 Ladders leaning against a supporting structure should be set up on a level area on firm footing and the base should be located a distance from the wall approximately a quarter of the vertical height of the ladder (see Fig 11.4).

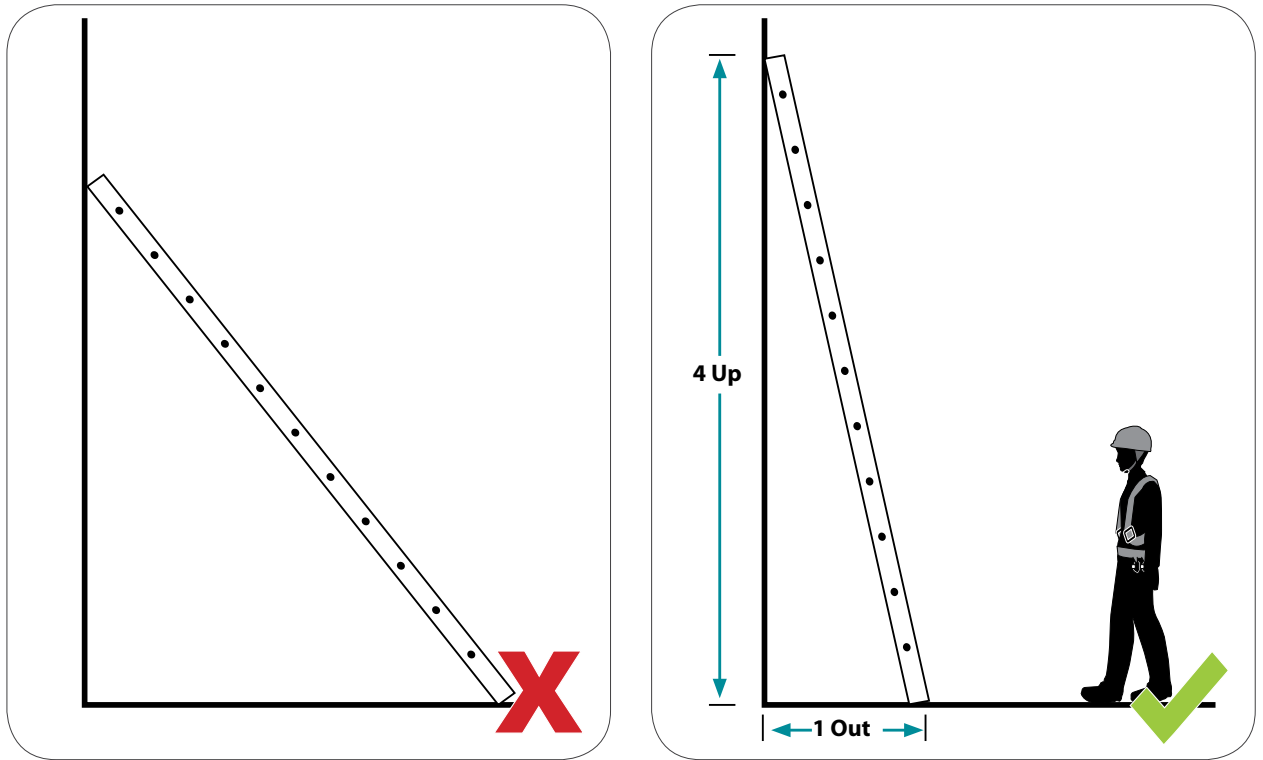


Figure 11.4: The ratio of the height to the base for a correctly positioned ladder is 4:1.

11.2.2.2 Where a ladder is used as a means of access or as a working place, adequate handholds should be provided to a height of at least one meter above the place of landing of the highest rung to be reached by the feet of any person working on the ladder.

11.2.2.3 When securing a ladder:

- Ensure that the ladder is on firm ground or the user can spread the load, for example, by placing a board at the bottom of the ladder;
- Tie the ladder to a suitable point making sure that both stiles are tied (see Fig 11.5).

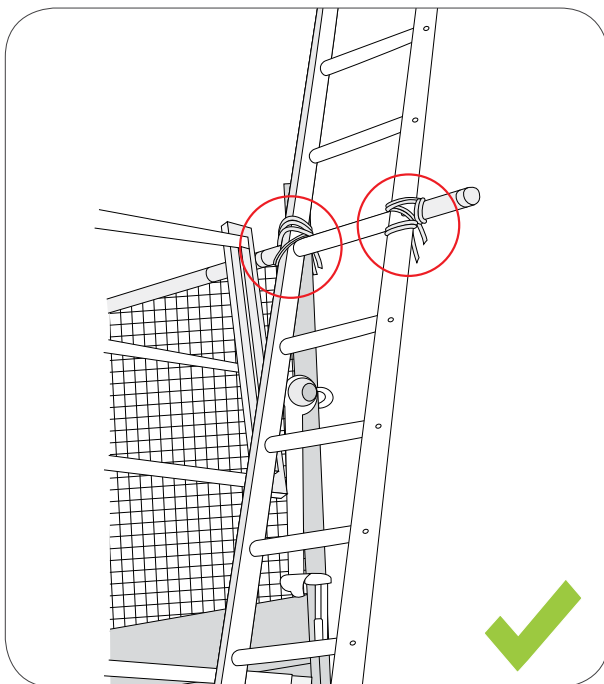


Figure 11.5: An access ladder with secure handhold and both stiles tied.

11.3 Fixed Ladders

- 11.3.1 A fixed ladder used to provide access to another level must provide adequate handhold at the landing (e.g., the ladder rising at least 1 metre above the landing).
- 11.3.2 For fixed ladders that rise a vertical distance of more than 3 metres, additional fall prevention measures shall be considered (e.g., installation of a safety cage shown in Fig 11.6).
- 11.3.3 For fixed ladders that rise a vertical distance of more than 9 metres, an intermediate landing shall be provided to reduce the distance between landings; such landings need to be effectively barricaded to prevent falls.
- 11.3.4 A risk assessment shall be conducted to determine if additional fall prevention measures associated with the use of fixed ladders are required (e.g., installation of a vertical life line).
- 11.3.5 Access to and usage of fixed ladders should be controlled (e.g., locking the base of the safety cage to prevent unauthorised access) such that only persons who are competent and have work duties should access them.

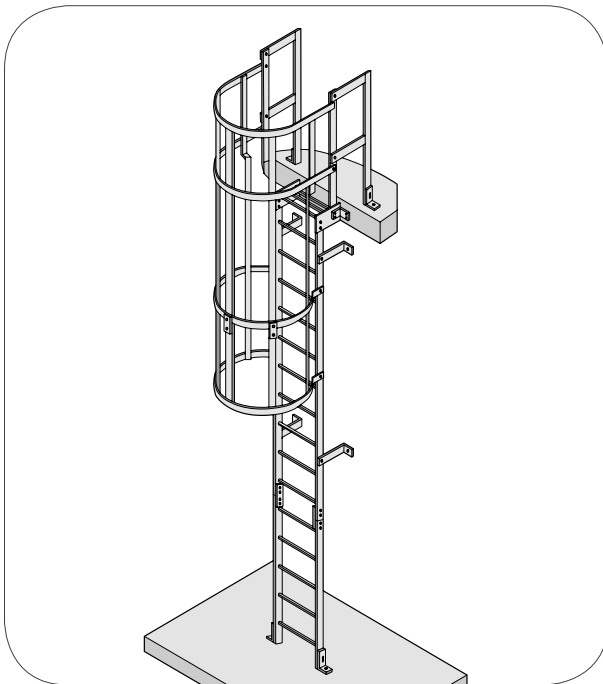


Figure 11.6: A fixed ladder with safety cage installed and a secure handhold at the landing.

12. Hazards of Working on Rooftops

12.1 Working on Rooftops

12.1.1 Works on rooftops are potentially hazardous work at heights; due consideration should be given to eliminate the need for persons to work on rooftops (e.g., working from bottom of roof, providing alternative work platforms like scaffolds or MEWPs).

12.1.2 There are many potential fall hazards when working on rooftops that include:

- Falling over an unprotected edge (e.g., open side at roof access point);
- Falling through a fragile roof surface (e.g., skylight, corroded roof sheets);
- Falling through openings on roofs (e.g., incomplete roofing, roof hatches); and
- Slips and falls off pitched roofs (e.g., wet or smooth pitched tile roofs).

(Refer to *WSH Guidelines on Working Safely on Roofs*, WSH Council, for more information).

12.1.3 It is critical to ensure that all persons assigned to perform works on rooftops are competent. If introducing inexperienced workers, ensure that they have undergone formal training and fully understand the hazards and the fall control measures before they go onto a roof. Inexperienced workers should work in areas where the supervisor can see and communicate with them at all times.

12.2 Working on Pitched Roofs

12.2.1 Any person working on a pitched roof, or is required to access a pitched roof in the course of his work shall be protected at all times against any sliding or falling from the roof.

12.2.2 Persons should not walk or work directly on tiles or slates unless additional fall control measures are in place.

12.2.3 Suitable and adequate fall control measures shall be considered. This includes, and is not limited to:

- Installation of temporary edge protection, for example, guard-rails, scaffold edge fall protection (see Fig 12.1);
- Installation of proper access to work areas, for example, roof ladders, gangway (see Fig 12.2);
- Installation of proper work platform to provide persons with a flat work platform on an inclined roof, for example, roof brackets;
- Personal fall prevention system that allows persons to access their work areas while utilising 100 percent tie off (see Fig 12.3); and
- Other measures that can be effectively deployed to reduce the distance of a potential fall, for example, safety net.

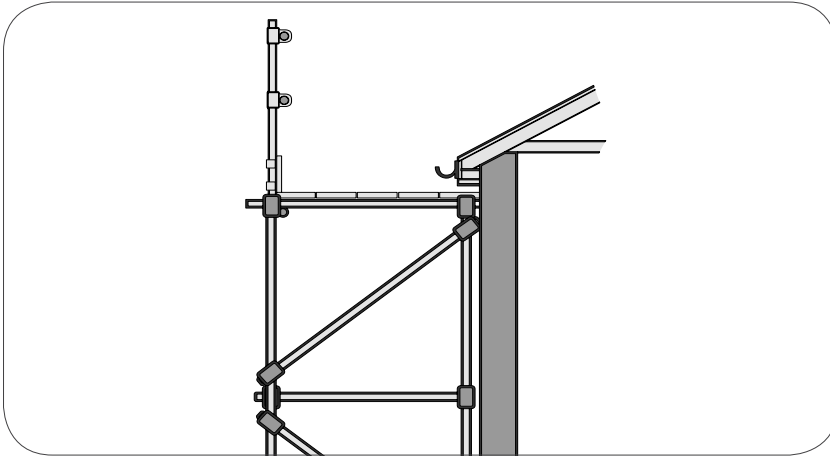


Figure 12.1: Typical pitched roof scaffold edge protection.

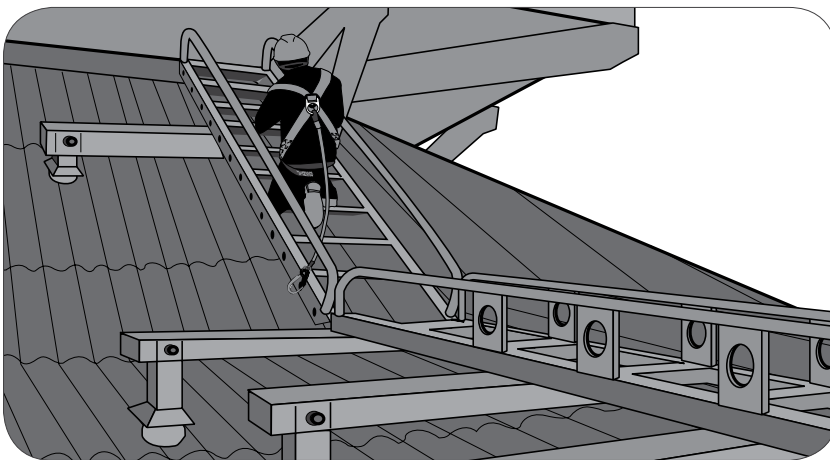


Figure 12.2: Crawler boards, gangways and perimeter guard-rails can enhance safety for work on pitched roofs.

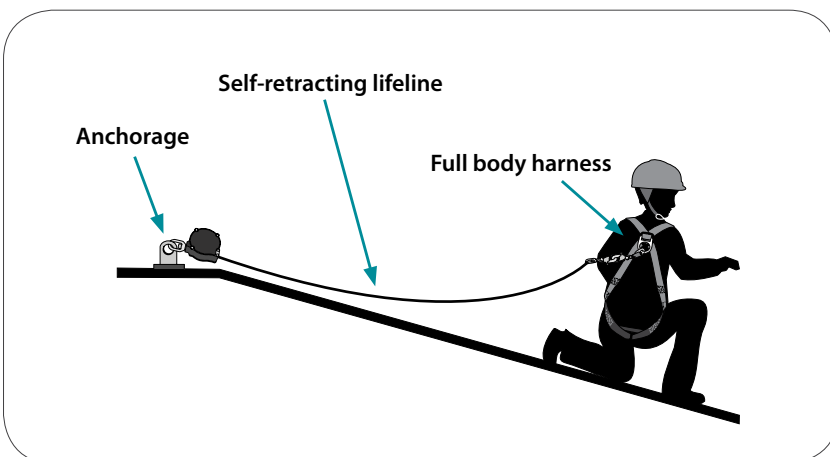


Figure 12.3: An example of personal fall arrest system for roof works.

12.3 Working on Fragile Roofs

- 12.3.1** Fragile roof surfaces refer to parts of the roof that are not designed to bear load; thus, persons standing on fragile and brittle roofs are at risk if the roofs break and give way under the loading of the persons' weight. These roofs typically include those that are constructed from moulded or fabricated materials such as cellulose cement roof sheets, glass, fibreglass, acrylic or other similar synthetic materials.
- 12.3.2** Some materials may become fragile eventually due to wear and damages may lead to early failure or the sheets and fixings have reached the end of their usability period. All roofs should be treated as fragile until a competent person has confirmed they are not.
- 12.3.3** Fragile roofs should be identified and clearly communicated to any persons accessing the roof. In addition, the following information should be made available to any persons, including contractors that may access the fragile roofs:
- The material the existing roof is made of;
 - The age of the existing roof;
 - Any previous modifications to the roof;
 - Any repairs carried out in the past (e.g., partial repair using "patching");
 - Any parts where the material could be of different properties (e.g., skylights);
 - Any existing safe access methods to the roof; and
 - Any areas where access is prohibited.

Never Walk Unprotected on Fragile Roofs

The assumption that it is safe to walk along the line of the roof bolts above the purlins must never be made.

- Some roofing sheets may fail to provide adequate support for a person near the purlin as it provides an edge to tear the sheet;
- Previous modifications may result in overlapping and bolting that do not coincide with any purlin – these appear safe but in fact, there is no support underneath it; and
- Any additional load, for example, an inadvertent stumble, may cause the roof to fail instantly.

Hence, it is critical to ensure that all persons exposed to falling hazards on a fragile roof are able to utilise 100 percent tie off at all times.

- 12.3.4** If a person is required to work on or from a roof that is fragile and can break easily, it is important to ensure that:
- Before the roofing work is carried out, the brittle or fragile areas are identified and the stability of the structure and soundness of the roof is assessed as part of the risk management process;
 - The worker is informed that it is a fragile or brittle roofing;
 - Safe access to the work area is provided to enable workers to step directly onto a safe platform or area (e.g., using crawler boards);
 - Work is carried out from a working platform that is located and constructed to allow work to be performed safely (see Fig 12.4);
 - An adequate fall arrest system is installed and used;
 - There is another person present at all times when work is being performed on a brittle roof in case there is an emergency;
 - Training and instruction have been provided to workers on precautions to be taken;
 - Warning signs are displayed at access points to any work area where fragile material is present (see Fig 12.5); and
 - Other measures that can be effectively deployed to reduce the distance of a potential fall, for example, safety net.

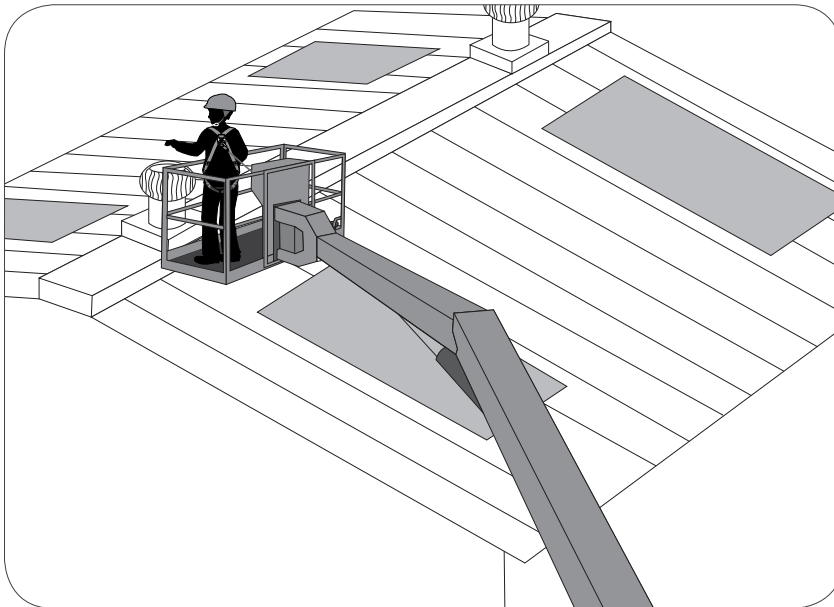


Figure 12.4: Use of MEWP to eliminate the need for workers to stand on fragile roof surfaces.



Figure 12.5: Warning signs to be fixed at points of access to fragile roofs

Hazards Identification and Risk Assessment

Identification of Fall from Heights Hazards and Control Measures Implemented

S/N	Fall Hazards <small>(list specific fall hazards in the work area, e.g., open sides, unprotected openings)</small>	Location <small>(insert sketch/ photo if necessary)</small>	Control Measures <small>(list specific control measures for each hazard; insert sketch/ photo if necessary)</small>	SWP No. <small>(if any)</small>	SWP Title <small>(List relevant SWPs for control measures implemented)</small>

To be attached with: Inventory of WAH activities/ Risk Assessment form (see Code of Practice on WSH Risk Management); relevant SWP documents.

Personal Protective Equipment for Work at Heights

(FPP Components #6 and #7)

Selection of Personal Protective Equipment (for WAH)

S/N	Description of PPE (for WAH) (e.g., travel restraint PPE, Full-body harness)	Quantity Issued	Inspection/ Maintenance Frequency	Inspected/ Maintained by

Personal Fall Prevention/ Arrest Systems

S/N	Description of Personal Fall Prevention/ Arrest Systems (e.g., travel restraint system, fall arrest system)	Quantity Installed	Inspection/ Maintenance Frequency	Inspected/ Maintained by

To be attached with: Relevant certification by competent person; inspection/ maintenance records.

Accident/ Incident Investigation

(FPP Component #9)

Fall from Heights Investigation Reports

Doc No.	Incident Description	Date of Incident	Parties Informed

To be attached with: Relevant incident investigation reports.

Emergency Response

(FPP Component #10)

Emergency Response Team Contact List

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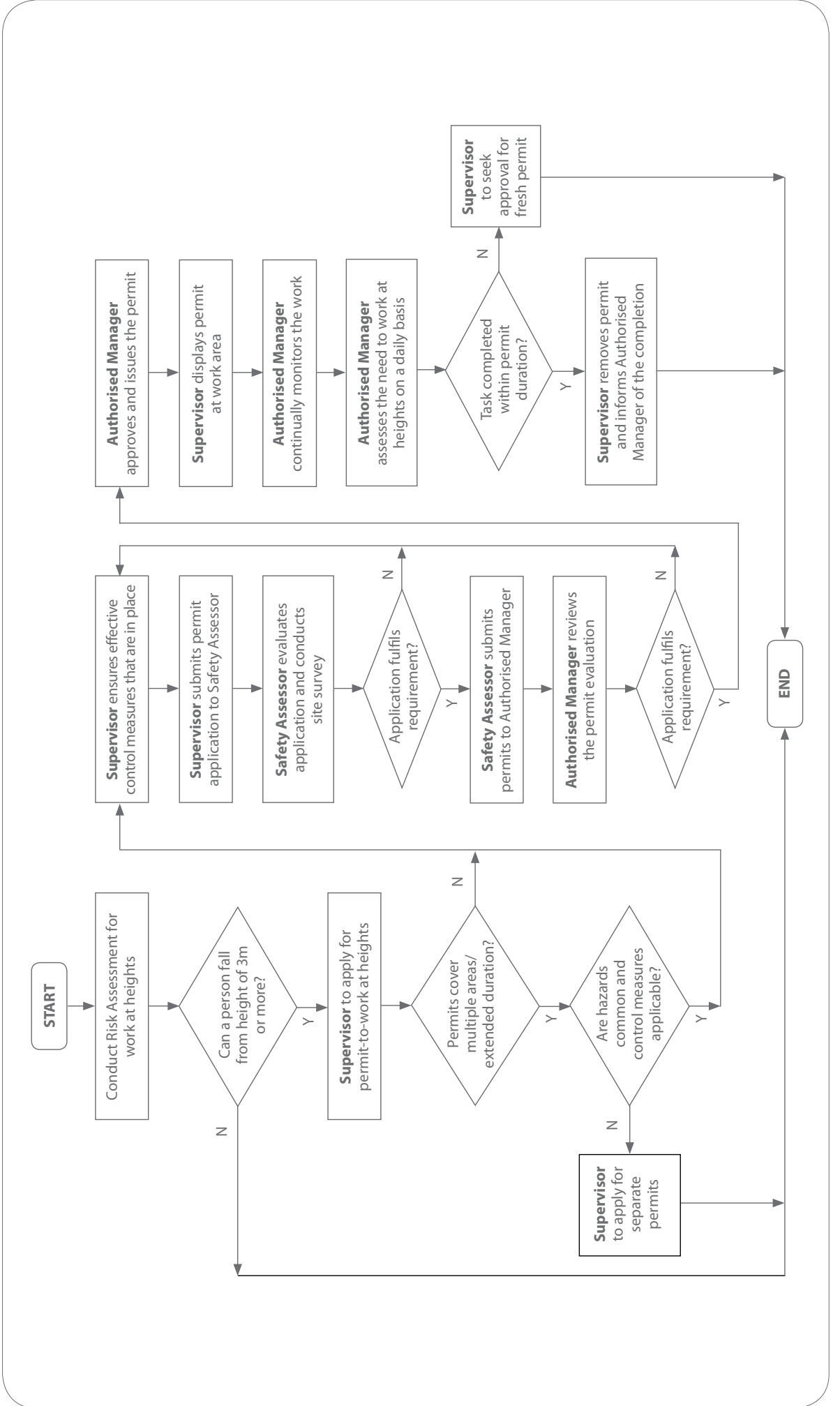
Fall Rescue Equipment/ Procedures

(attach sketch/ photo if necessary)

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To be attached with: Emergency Response Team training records; inspection/ maintenance records of fall rescue equipment.

Appendix B-1: Flow Chart for Permit-to-work



Appendix B-2: Sample Permit-to-work (for WAH)

PERMIT TO WORK AT HEIGHTS

Permit No: _____

This permit shall be displayed for the duration of the approved task and removed only upon task completion or upon its expiry.

SECTION 1: APPLICATION (to be completed by Supervisor)

Task Description: _____

Location of WAH: _____

Task covers multiple locations (attach sketch/ map if necessary)

Start/ End Date: _____

Task exceeds one work shift (daily endorsement required)

No. of Workers: _____

No. of Supervisors _____

WAH Control Measures Implemented:

Y N NA

Remarks

Due consideration given to eliminate work at heights tasks.

Safe means of access or egress provided.

Edge protection provided wherever there is falling risks.

Fall prevention equipment used to provide access or work platform.

Fall prevention equipment are adequate and in good condition.

Anchorage/ lifeline installed and inspected by competent person.

Travel restraint system used to exclude persons from falling risks.

All persons subjected to falling risks are equipped with PFAS*.

All personnel are adequately trained to perform work at heights.

Hazards and risk assessment are conducted and communicated.

Others (please specify).

* Personal Fall Arrest System

I declare that the information provided is accurate and the control measures listed above have been effectively implemented.

Name/ Designation/ Signature: _____ Date: _____

SECTION 2: EVALUATION (to be completed by Safety Assessor)

Assessment of Control Measures:

Y N NA

Remarks

All reasonably practicable measures have been taken.

Verification of documents/ interview workers/ others.

Site Survey with Supervisor:

All persons on site are protected from falling risks.

Surrounding areas do not pose additional hazards.

Multiple Locations/ Extended Duration:

Hazards are common at various locations/ time period.

Control measures are applicable and effective.

I have evaluated the application and am satisfied that all reasonably practicable measures have been taken effectively.

Name/ Designation/ Signature: _____ Date: _____

SECTION 3: APPROVAL (to be completed by Authorised Manager)

Review of Permit:

Y N NA

Remarks

Proper permit-to-work evaluation has been completed.

No incompatible works that may pose additional hazards.

Control measures have been implemented effectively.

Fall from heights risks have been effectively mitigated.

I authorise the work at heights to the conditions and duration stated in this permit.

Name/ Designation/ Signature: _____ Date: _____

SECTION 4: TASK COMPLETION (to be completed by Supervisor)

The WAH task has been:

- Completed.
- Suspended due to permit expiry.
- Terminated due to change in condition.

Date/ Time:

Remarks

I confirm that the work area has been restored to its original condition and no new hazards have been introduced.

Name/ Designation/ Signature: _____ Date: _____

13. Acknowledgements

The Workplace Safety and Health Council would like to thank all who had commented and contributed in any way to the improvement of this Code of Practice.

14. List of References

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2. Government Of Western Australia Commission For Occupational Safety And Health–Code of Practice Prevention Of Falls At Work Places, 2004.
3. HSE Health and Safety in Roof Work–Fourth Edition, 2012.
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5. HSE The Work At Height Regulations 2005–A Brief Guide.
6. OSHA Regulations (Standards–29 Cfr)–Sample Fall Protection Plan–Non Mandatory Guidelines For Complying With 1926.502(K)–1926 Subpart M App E.
7. Royal Gazette Of The Province Of Nova Scotia (Canada)–Fall Protection And Scaffolding Regulations Made Under Section 82 Of The OHS Act S.N.S 1996,C.7 O.I.C. 96-14 (January 3, 1996), N.S. Reg 2/96.
8. Workplace Safety and Health (Scaffold) Regulations, 2011.
9. Workplace Safety and Health (Work At Heights) Regulations, 2013.
10. Workplace Safety and Health Guidelines–Anchorage, Lifelines and Temporary Edge Protection Systems.
11. Workplace Safety and Health Guidelines–Personal Protective Equipment for Work at Heights.
12. Workplace Safety and Health Guidelines–Working Safely on Roofs.
13. Worksafe Victoria Code of Practice No.29–Prevention Of Falls In Housing Construction, 2004.
14. Worksafe BC OHS Regulations–Guidelines Part 11 Fall Protection.

15. Other Useful Contacts

To report unsafe practices at the workplace, call the MOM hotline at 6317 1111.

To report accidents, dangerous occurrences and occupational diseases, visit www.mom.gov.sg/ireport

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