ENERGY SAFETY CANADA

# Fall Protection

## PARTICIPANT MANUAL

VERSION 24.1

ENERGY SAFETY CANADA

# SAFETY DOESN'T CLOCK IN AND IT DOESN'T PUNCH OUT. IT'S 24/7.

The creation of the Petroleum Industry Training Service in 1949 signaled a new day for safety in the industry. Today—recognizing that training is just one path to safety—Energy Safety Canada is advancing the work of its legacy organizations to act as a hub for safety expertise.

As the national voice for oil and gas safety, Energy Safety Canada advocates for those working in the industry and supports companies in their efforts to improve safe work performance.

## AT ENERGY SAFETY CANADA, WE:

- Lead industry collaboration to develop common safety standards, making it easier for workers to move from site to site.
- Ensure workers have the training they need to get home safe at the end of each day.
- Help employers by providing leading-edge data and customized support for their health and safety programs.
- Reinvest training revenues, as a not-for-profit organization, back into safety for the oil and gas industry.

## FOR WORKERS, WE:

- Make it easier to get safety training
- Reduce duplication of safety training
- Make safety standards more alike from site to site
- Make training certifications easy to access

## FOR COMPANIES, WE HELP:

- Reduce injuries and incidents
- Improve safe work performance faster
- Improve access to safety data analysis
- Save time, money and increase efficiency through shared solutions and common safety standards

## WE'RE LOCATED WHERE YOU NEED US:

### Our Network of Authorized Training Providers (ATPs):

Energy Safety Canada works with hundreds of partners across the country to deliver safety training and services. From BC to the Atlantic provinces, you'll find ATPs close to where you work and live.

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Nisku, AB T9E 1A8

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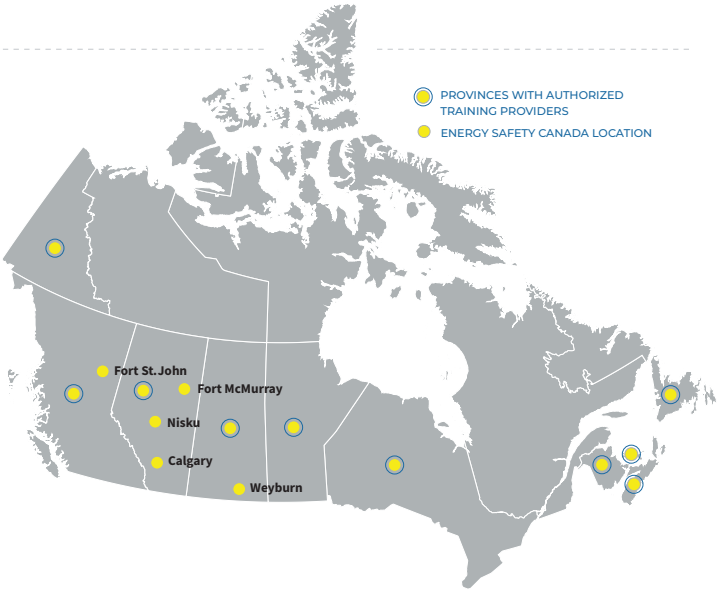

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# CHAPTER 1:

# Fall Protection Basics

## OUTCOME

Summarize the basic principles of fall protection.

## OBJECTIVES

Upon completion of this chapter,
you should be able to:

1. Identify why fall protection is needed.
2. Identify key legislative requirements for worksite fall protection, including a worker's responsibilities.

## INTRODUCTION

Working safely at height is not an easy task. Moving from one area to the next, using ladders for only a short period of time, or trying to work with heavy equipment are only a few of the many potential at height situations you may confront daily.

Governing bodies and legislation regulate fall protection throughout Canada. Both the employer and the worker have responsibilities when it comes to fall protection. Make it a point to know what applies in **your** area!

## FALL ACCIDENT STATISTICS

Industrial work sites have a variety of hazards, including the potential for falling. Fall hazards exist on the same level, on stairs, ladders and anywhere employees work at height. Improved record keeping has allowed for falling accidents to be categorized with the intention that accidents may be accurately tracked. This statistical information has helped system designers, manufacturers and educators direct their efforts to the areas of greatest need. The statistics gathered by government agencies have revealed some interesting trends.

**To gain a better understanding of the prevalence of falling at the work site, please complete the following accident facts.**

1. The ..... industry has the highest number of falls of all industries.
2. ..... is one of the five most frequent types of fatal incidents investigated by safety officers.
3. Over the past few years, the number of claims from falls is approximately ..... % of the total work place injury claims.

Fall accidents account for a significant portion of the total work site injuries that occur each year. The cost associated with these accidents is staggering.

(Source: Government of Alberta Statistics: http://employment.alberta.ca)

| YEAR | NUMBER OF FALLS FROM SAME LEVEL | NUMBER OF FALLS TO LOWER LEVEL | NUMBER OF FATAL FALLS |
|---|---|---|---|
| 2009 | 3670 | 1494 | 8 |
| 2010 | 3127 | 1334 | 8 |
| 2011 | 3726 | 1452 | 5 |
| 2012 | 3890 | 1595 | 6 |
| 2013 | 4333 | 1673 | 8 |
| 2014 | 3667 | 1633 | 6 |
| 2015 | 3545 | 1471 | 6 |
| 2016 | 3131 | 1351 | 5 |

## DYNAMICS OF FALLING

It is not uncommon for individuals who regularly work at height to share the opinion that their work methods and experience are enough and fall protection is not required for them. They believe that agility and attention to the job is sufficient to ensure their safety while exposed to a potential fall. Unfortunately, this is not always the case. Workers need to appreciate that a fall from height can suddenly occur to anyone at anytime. These falls typically cause greater injury than falls on the same level.

**Based on your impressions, approximately how far and how fast do you think you would free fall in two seconds?**

| Distance | Speed |
|---|---|
| a. 5 m (16 ft) | a. 25 km/hr (15 mph) |
| b. 10 m (32 ft) | b. 35 km/hr (22 mph) |
| c. 15 m (48 ft) | c. 50 km/hr (31 mph) |
| d. 20 m (65 ft) | d. 70 km/hr (43 mph) |

## CASE STUDY
## Fall From Low Height

**Industry:**
General Construction

**Work Description:**
To install an overhead door track to the ceiling, the worker set up one level of scaffolding, 5 ft (1.5 metres) high, but it was not enough. The worker did not have enough pins to construct a second level of scaffolding so he decided to use a short stepladder positioned on top of the scaffolding.

**Summary:**
The worker lost his balance and fell backwards 8 ft (2.44 metres) landing on the concrete floor below. Emergency response services were called and the worker was air lifted to the hospital with severe head injuries. He died two days later in hospital.

**Conclusion:**
A fall from any height may be fatal.

## NOTES

## GOVERNING BODIES AND REGULATIONS

### Threshold Heights

Governing bodies throughout North America dictate at what height a worker must start using fall protection. It is your responsibility to know the threshold height for your particular jurisdiction. See Appendix A to identify the rules that apply to you!

**According to the** .....(governing regulation),

**a worker must start using fall protection at** .....

metres (m) or ..... feet (ft) or ..... .

### Who Regulates the 'When', Where' and 'How' of Fall Protection?

Each province develops a standard governing the regulation of working at height. Typically there is a provincial ministry that oversees occupational health and safety standards for that province. Some employees in each province are governed federally. Federally governed employees should refer to the Canada Labour Code.

**NOTE**
Workers must use or wear the fall protection system required by the employer that complies with the applicable Federal/Provincial code.

### Who Approves Fall Protection Equipment?

The Canadian Standards Association (CSA) sets the standards for most fall protection equipment used in industrial settings. The equipment bearing the CSA label has been manufactured and tested to a strict criteria set by the CSA. The use of American National Standards Institute (ANSI) and Conformité Européenne (CE) standards are also acceptable within the province of Alberta. It should be noted that many sites will only reference CSA as the standard to be followed for their equipment.


Federal/Provincial

Canadian Standards Association (CSA)

» ANSI

» CE

## EMPLOYER AND WORKER RESPONSIBILITIES

Occupational Health and Safety (OH&S) law governs specific safety responsibilities for both the employer and employee. Refer to OH&S for detailed responsibilities in your area.

General employer and worker responsibilities that are common in Canada are listed below.

### Employer Responsibilities

**The employer or designate, for example supervisor is responsible to ensure that:**

1. Adequate steps have been taken to eliminate/control all hazards present and workers are briefed on the hazards present and the safety measures in place.
2. All applicable legislative requirements, the code of practice, and any other facility specific standards, rules, procedures, and practices are followed.
3. All workers are competent, have received necessary training, and can safely perform their assigned duties.

### Worker Responsibilities

**Workers are responsible to ensure that they:**

1. Work safely and cooperate with their employer by following the health and safety rules for the job.
2. Have received training to safely perform their assigned duties.
3. Use appropriate Personal Protective Equipment (PPE), equipment, and the training received to safely perform their assigned duties.
4. Follow all applicable legislative requirements, the code of practice, and any other facility specific standards, rules, procedures, and practices.
5. Identify to their supervisor when they feel they are not competent to perform their assigned duties.

## EXERCISE

1. At what height is fall protection required at your worksite? (consult Appendix A)

2. Who sets the rules for when, where and how fall protection is used in this province?

## NOTES

# CHAPTER 2:

# Hierarchy of Hazard Controls

## OUTCOME

Identify and describe the basic concepts and elements of fall protection systems.

## OBJECTIVES

Upon completion of this chapter, you should be able to:

1. Identify the Hierarchy of Hazard Controls.
2. List the six systems of the Fall Protection Hazard Control Hierarchy.
3. Identify the four components of active fall protection systems.
4. Outline the components of a fall protection plan.

## INTRODUCTION

It is important for you to stop and think about the times you work at height and how you can do this safely. Some solutions are simple, such as eliminating the hazard or changing the procedures you use to perform your work. Other solutions are more complex, such as relying on specialized equipment to protect you in the event of a fall.

Fall protection solutions range from passive and active systems to procedural-based controls. The aim should always be to create the **safest** solution.

## HIERARCHY OF HAZARD CONTROLS

In all areas of industrial safety, a hierarchy of controls is traditionally used to determine the implementation of feasible and effective controls.

The OH&S Code identifies the specific hierarchy of controls to be used. The list below identifies the different controls, starting with the most effective and protective systems based on reducing risk.

### Elimination or Substitution

First, try to eliminate the hazard completely or substitute it with a safer alternative.

### Engineering Controls

If it is not possible to eliminate or substitute the hazard with a safer alternative, engineering controls should be considered.

Engineering controls involve installing or modifying facilities and equipment in order to control the hazard at its source. This is typically done during the design of a worksite or process. Although workers may not be directly involved in engineering controls, it is important they understand them.

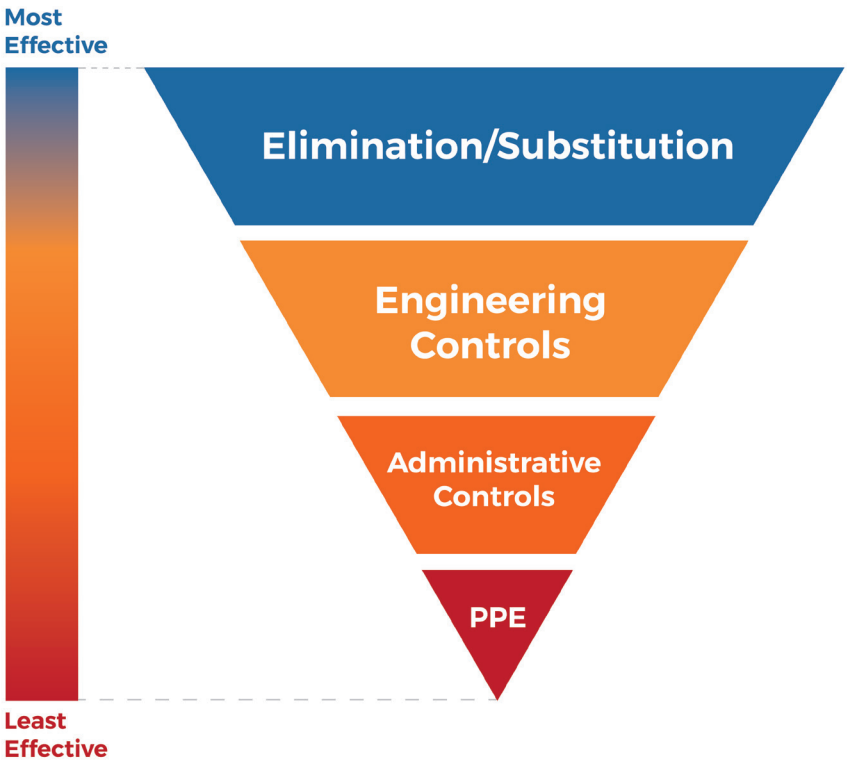
### Administrative Controls

Administrative controls focus on the work process and the worker. They control the hazard by managing how the work is performed and are often used in conjunction with other types of controls.

### Personal Protective Equipment (PPE)

Equipment worn by individuals to reduce exposure to risk or possible contact.

When confronted with a fall hazard there are several fall protection options available to workers to protect themselves. It is the responsibility of the worker and site supervisors to determine the most appropriate system for a given situation. System selection should be based on work environment, task to be completed, level of safety and may also be dictated by regulations and work site policies.



## Fall Protection Hazard Control Hierarchy

Selecting a fall protection system is not decided by a random decision. You must consider all factors before making the final selection. Approach all situations with the intention of eliminating the hazard of having workers at height (see Caution Box). When possible, use this option as it provides the safest work environment. If not possible, select the system presenting the least amount of risk to the workers.


**CAUTION**

### Eliminate the Hazard

The best method of fall protection for any worker is to eliminate the hazard. If workers can remain at ground level, the possibility of a fall is reduced. Preplanning and engineering may hold the key to eliminating a percentage of work-at-height risk. Always explore eliminating the hazard as your first solution for at height safety.

Examples of eliminating the hazard:

- Constructing residential roofs at ground level.
- Designing street light posts to mechanically lower the light to ground level.
- Using telescopic poles to wash second story windows from ground level.

## 1. Guardrails

**Definition:**
A barrier or structure designed to prevent a worker from reaching the fall hazard. Guardrails are considered a passive means of fall protection and may be either permanent or temporary in design.

**Requirements:**
Must meet or exceed all federal and/or provincial requirements for your site.

**Hazards:**
- » Refrain from leaning on guardrails.
- » Avoid climbing over or under guardrails.
- » Refrain from standing on the midrail to extend your reach.
- » Avoid climbing above base level of the platform protected by guardrails without an alternate form of fall protection.
- » Be aware of removable sections of the guard rail.

**MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:**

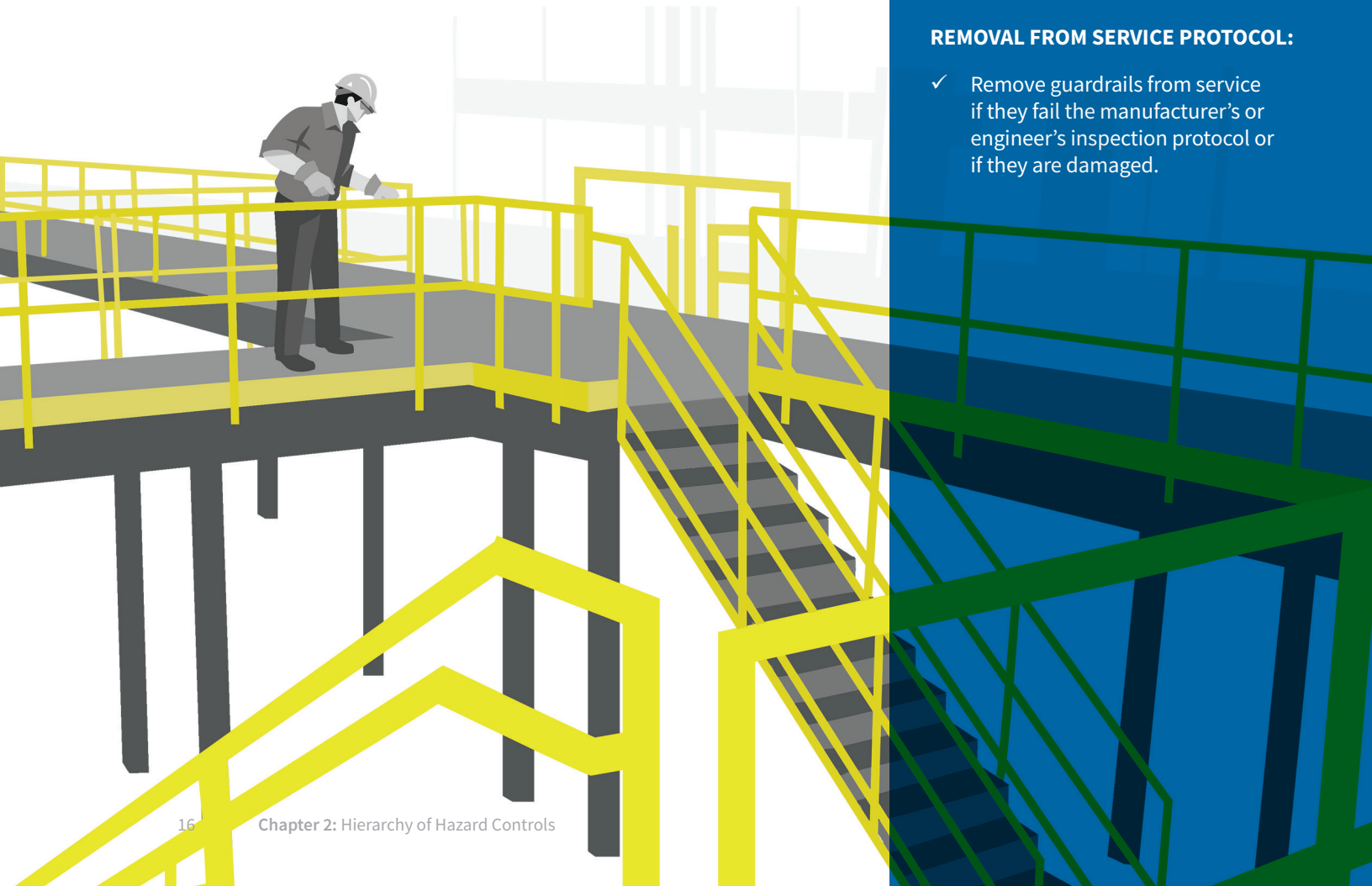
- ✓ Periodic inspections may be required by the engineer or manufacturer of the guardrail system.
- ✓ You must re-certify guardrails if they fail the manufacturer's or engineer's inspection protocol.

**PRE-USE VISUAL INSPECTION REQUIREMENTS:**

- ✓ Inspect all guardrails and materials including midrails and toe boards for any abnormalities, bends, corrosion, deformation and proper functioning.
- ✓ Inspect connecting components such as nuts, bolts, fixings and welds.
- ✓ Inspect integrity of all supporting structures and base plates.

**REMOVAL FROM SERVICE PROTOCOL:**

- ✓ Remove guardrails from service if they fail the manufacturer's or engineer's inspection protocol or if they are damaged.



## 2. Travel Restraint Systems

**Definition:**
A personal fall protection system that prevents a worker from traveling beyond the edge they are working on. A travel restraint system is considered an Active means of fall protection.

**Requirements:**
Travel restraint systems require proper selection and use of fall protection equipment in accordance with your governing regulations. Selection and use of these components are discussed in a later chapter.

**Hazards:**
When erected properly, travel restraint systems are a very safe way to work near a fall hazard. However, there a few hazards to be aware of:

- Slack in a lanyard or lifeline may create a tripping hazard for both you and other workers.
- Failing to disconnect when returning to the safe zone may cause the lanyard or lifeline to engage and pull the worker off his or her feet (fall from same level).
- Selecting a connector which is too long may place the worker in a fall arrest situation.

**MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:**

- ✓ Complete a pre-use inspection prior to use.
- ✓ Formal inspection is to be completed by a competent person (as defined by the manufacturer) on an annual basis. These inspections should be recorded in an equipment logbook.
- ✓ Remove unsafe equipment from service and either destroy or return to the manufacturer for possible repair.

**PRE-USE VISUAL INSPECTION REQUIREMENTS:**

- ✓ Inspect all components, systems and subsystems prior to constructing a travel restraint or personal fall arrest system.
- ✓ Check for manufacturer's labeling.
- ✓ Check webbing for cuts, tears, burns, worn stitching, excessive abrasion, chemical contamination and UV degradation.
- ✓ Check wire rope for broken strands, kinks, bird caging, bent or stretched eyelets, arc strikes and intact swages.
- ✓ Check all metal components (buckles, grommets, D-rings, etc.) for cracks, corrosion, deformation and missing hardware.
- ✓ Check for any modifications such as cut straps or items stitched to webbing.
- ✓ Check to ensure load indicators have not been deployed.
- ✓ Ensure SRL/SRDs have current certification sticker.

**REMOVAL FROM SERVICE PROTOCOL:**

- ✓ Remove equipment from service after failing inspection.
- ✓ Remove from service any equipment that has seen fall arresting service.

## 3. Personal Fall Arrest Systems (PFAS)

### Definition:

A personal fall protection system that allows a worker to fall but arrests the fall in progress before the worker contacts the ground or any obstruction below. A PFAS is considered an active fall protection system.

### Requirements:

Personal fall arrest systems require proper selection and use of fall protection equipment in accordance with your governing regulations. Selection and use of these components are discussed in a later chapter.

### Hazards:

The use of PFAS can involve several hazards if not erected properly including:

- Inadequate anchorage unable to withstand potential impact forces placed on it in a fall.
- Excessive free fall distance beyond limitations of equipment.
- Excessive arrest force causing serious injury and failure of the system.
- Insufficient clearance allowing contact with the next level causing injury.

## TRAVEL RESTRAINT AND FALL ARREST

**Review the illustrations below. Which is a travel restraint system and which is a fall arrest system?**

1

2

## System Components

Travel restraint and fall arrest systems consist of four specific components. All four components must be present to have a complete and functional personal fall protection system.

### Activity: Critical Components

**Using the illustration, name the four components of a complete travel restraint or personal fall arrest system.**

1) _____

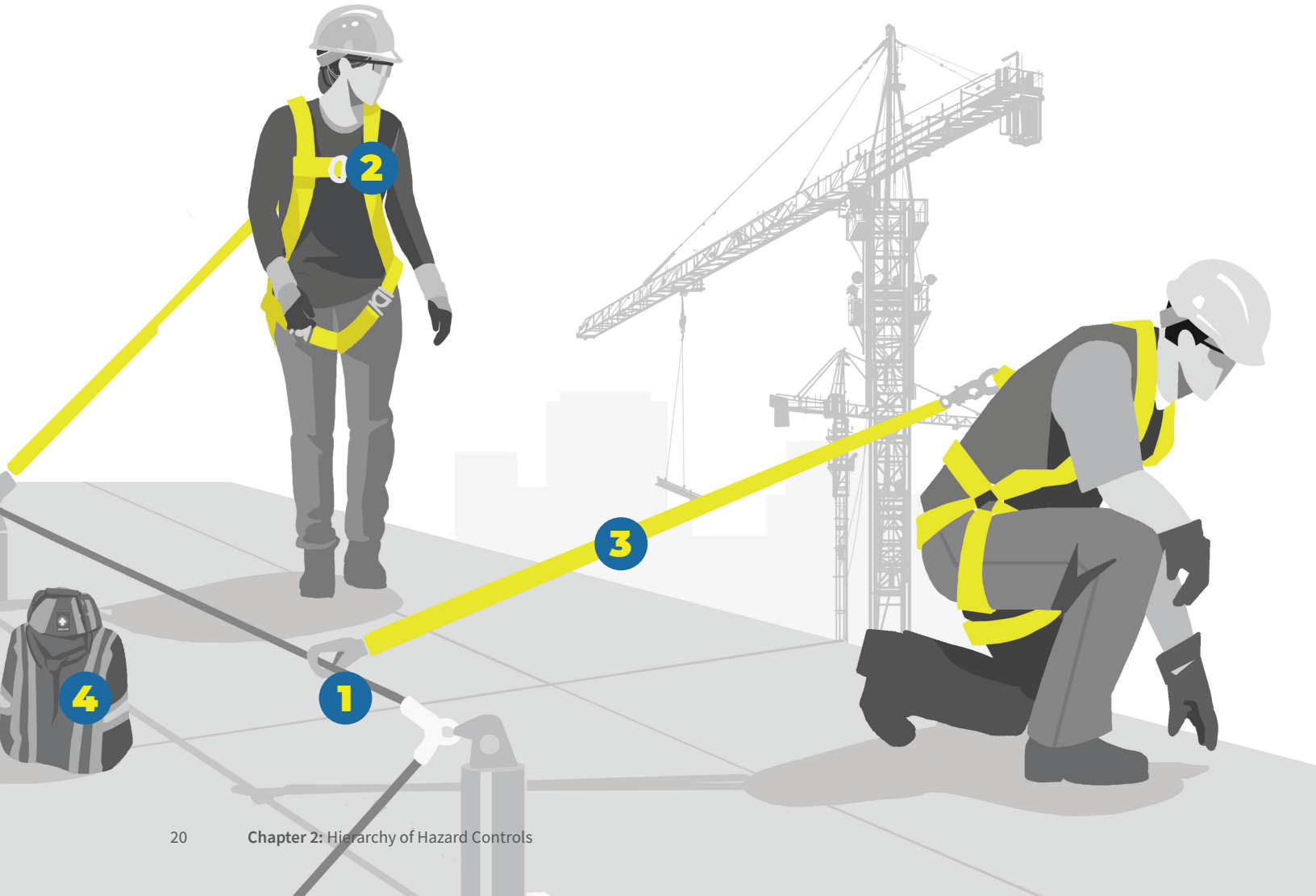
2) _____

3) _____

4) _____

**NOTE**

It is important for you to understand and recognize the difference between travel restraint and personal fall arrest systems. Always attempt to use a travel restraint system before considering a personal fall arrest system.



## 4. Safety Nets

**Definition:**

A passive means of fall protection where large specialized nets are suspended below the work area to catch workers in the event of a fall.

**Requirements:**

Must meet or exceed all federal and/or provincial requirements for your site.

**Critical Components:** Safety nets must:

- Extend at least 2.4 m (8 ft) beyond the work area and no greater than 6 m (20 ft) below the work area.
- Be installed so maximum deflection under maximum impact load does not allow the net to touch any surface below.
- Be attached to a supporting structure certified by a professional engineer as capable of withstanding potential loads.
- Have safety hooks or shackles of drawn, rolled, or forged steel with ultimate tensile strength of at least 22.2kN (5000 lbs).

**Hazards:**

- Keep safety nets clear of debris.
- Refrain from using to access or egress work environments.

**MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:**

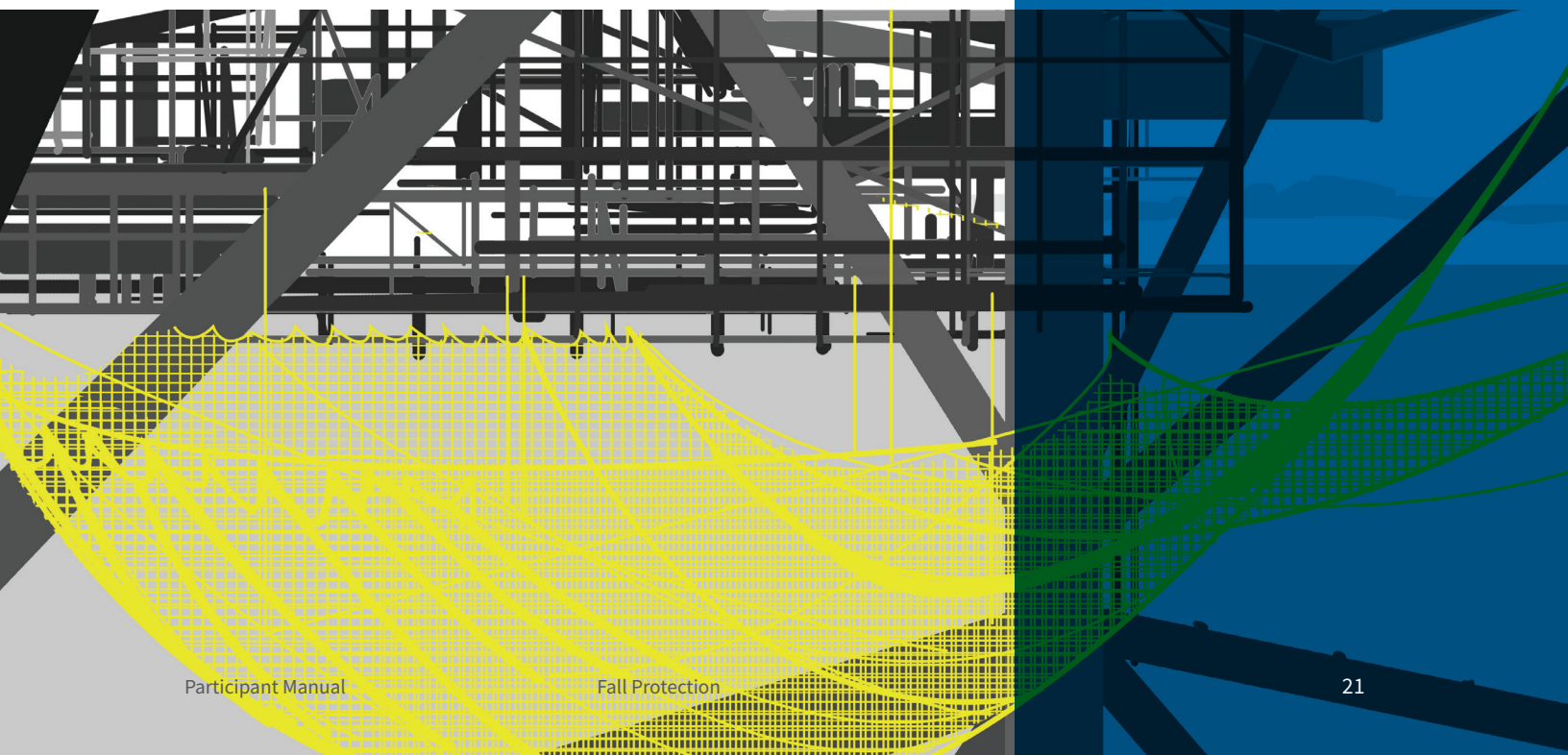
- ✓ Periodic inspections and re-certification as required by the engineer or manufacturer of the safety net system.
- ✓ Re-certify safety nets if they fail the engineer's or manufacturer's inspection protocol.

**PRE-USE VISUAL INSPECTION REQUIREMENTS:**

- ✓ Inspect all safety nets and materials including all netting and connecting components for any abnormalities, bends, corrosion, deformation, cuts, tears, frays, burns and holes.
- ✓ Inspect connecting components such as nuts, bolts, fixings and welds.
- ✓ Inspect integrity of all supporting structures.

**REMOVAL FROM SERVICE PROTOCOL:**

- ✓ Remove safety nets from service after failing the manufacturer's or engineer's inspection or if they are damaged.



## 5. Control Zones

### Definition:

The area within 2 m (6.5 ft) of an unguarded edge of a level or slightly sloped (≤ 4 degrees) elevated work surface. A control zone is a passive means of fall protection.

### Requirements:

Must meet or exceed all federal and/or provincial requirements for your site.

### Critical Components:

» Be a minimum 2 m (6.5 ft) wide.

» Be clearly marked with an effective raised warning line:

- Flagged or marked with highly visible materials at intervals not exceeding 2 m (6.5 ft).
- Raised between 0.9 m and 1.2 m (34 - 45 inches).
- Attached to each stanchion so that each section acts independently.
- Constructed of rope, wire or chain having a minimum tensile strength of 2.2 kN (500 lbs).

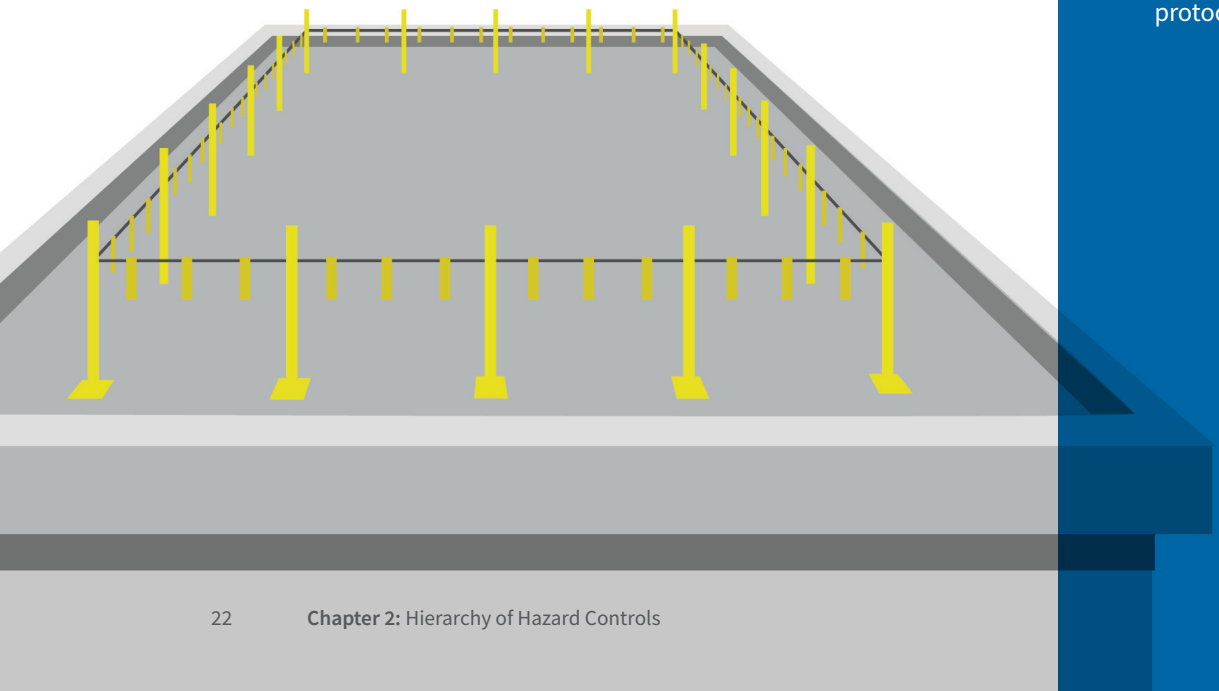
### Hazards:

» Refrain from working in the control zone without the use of a travel restraint system or equally effective means of fall protection.

» Be aware of surroundings, for example slippery surfaces, equipment and other workers.

» Refrain from using on a skeletal structure.

» Exercise caution when crossing through the control zone to enter or leave the work area.



### MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:

✓ Periodic inspections and re-certification as required by the manufacturer of the control zone system.

✓ Re-certify the control zone if it fails the manufacturer's inspection protocol.

### PRE-USE VISUAL INSPECTION REQUIREMENTS:

✓ Inspect all control zone components and materials including all stanchions and tension lines for any abnormalities, bends, corrosion, deformation, cuts, tears, frays and burns.

✓ Inspect connecting components such as nuts, bolts, fixings and welds.

✓ Inspect integrity of all stanchions for proper strength and footing.

✓ Inspect for proper tension in the line and that the line is highly visible.

### REMOVAL FROM SERVICE PROTOCOL:

✓ Remove control zone components from service if they fail the manufacturer's inspection protocol or are damaged.

## 6. Procedure-Based Fall Protection Systems

### Definition:

A procedure-based fall protection system involving the use of administrative controls or work procedures to assist in minimizing the risk of a fall.

### Scope:

A procedure-based fall protection system may only be used for the following:

- Installation or removal of fall protection equipment (first person up/last person down)
- Roof inspection or estimating
- Emergency repairs
- At height transfers between equipment and structures (if allowed by manufacturer)
- Situations where a worker must work on top of a vehicle or load

### Conditions:

When utilizing a procedure-based fall protection system, the following conditions must be in place:

1. Written hazard assessment
2. Documented work procedures
3. Limited number of workers exposed to fall hazard
4. Light duty tasks of limited duration
5. Competent workers
6. Pre- and/or post-work inspection, investigation and assessment activities
7. Limit worker exposure to additional hazards

## Fall Protection Plan and Hazard Assessment

Preplanning is the key to any fall protection solution. Many provinces require a written plan at certain instances while working at height. Please consult the appropriate regulations and/or explanation guide for your province to gain greater insight to the requirements for a written plan.

The fall protection plan may be the result of the general hazard assessment a worker and/or their supervisor conducts prior to the start of the job. An example of a general hazard assessment and inspection form is provided in Appendix B.

Alberta is an example of a province requiring a fall protection plan. In Alberta if work is performed where a fall of 3 metres (approx. 10 ft) or more may occur and guardrails are not used to protect workers, a fall protection plan is required. The Alberta Occupational Health and Safety Code requires that a fall protection plan be developed to meet the requirements on the next page.

See Appendix C for a sample.

## ALBERTA OCCUPATION HEALTH AND SAFETY CODE PART 9 SECTION 140(1) - 140(4)

**140(1) (1)**

An employer must develop procedures in a fall protection plan for a work site if a worker at the work site may fall 3 metres or more and workers are not protected by guardrails.

**140(2)**

A fall protection plan must specify

**(a)** the fall hazards at the work site,

**(b)** the fall protection system to be used at the work site,

**(c)** the anchors to be used during the work,

**(d)** that clearance distances below the work area have been confirmed as sufficient to prevent a worker from striking the ground or object below,

**(e)** the procedures used to assemble, maintain, inspect, use and disassemble the fall protection system, and

**(f)** the rescue procedures to be used if a worker falls, is suspended by a personal fall arrest system or safety net and needs to be rescued.

**140(3)**

The employer must ensure that the fall protection plan is available at the work site and is reviewed with workers before work with a risk of falling begins.

**140(4)**

The employer must ensure that the plan is updated when conditions affecting fall protection change.

**Workers affected by the fall protection plan must be trained in all its elements. A Sample Fall Protection Plan is included in Appendix C. Refer to Appendix E to determine when a fall protection plan is required in your area.**

## EXERCISE

1. What are the six different fall protection systems, from most to least effective?

2. What are the components of a fall protection plan?

3. Give an example of an active and a passive means of fall protection.

## NOTES

# CHAPTER 3:

# Anchor Points

## OUTCOME

Identify and describe the basic concepts and elements of anchor points.

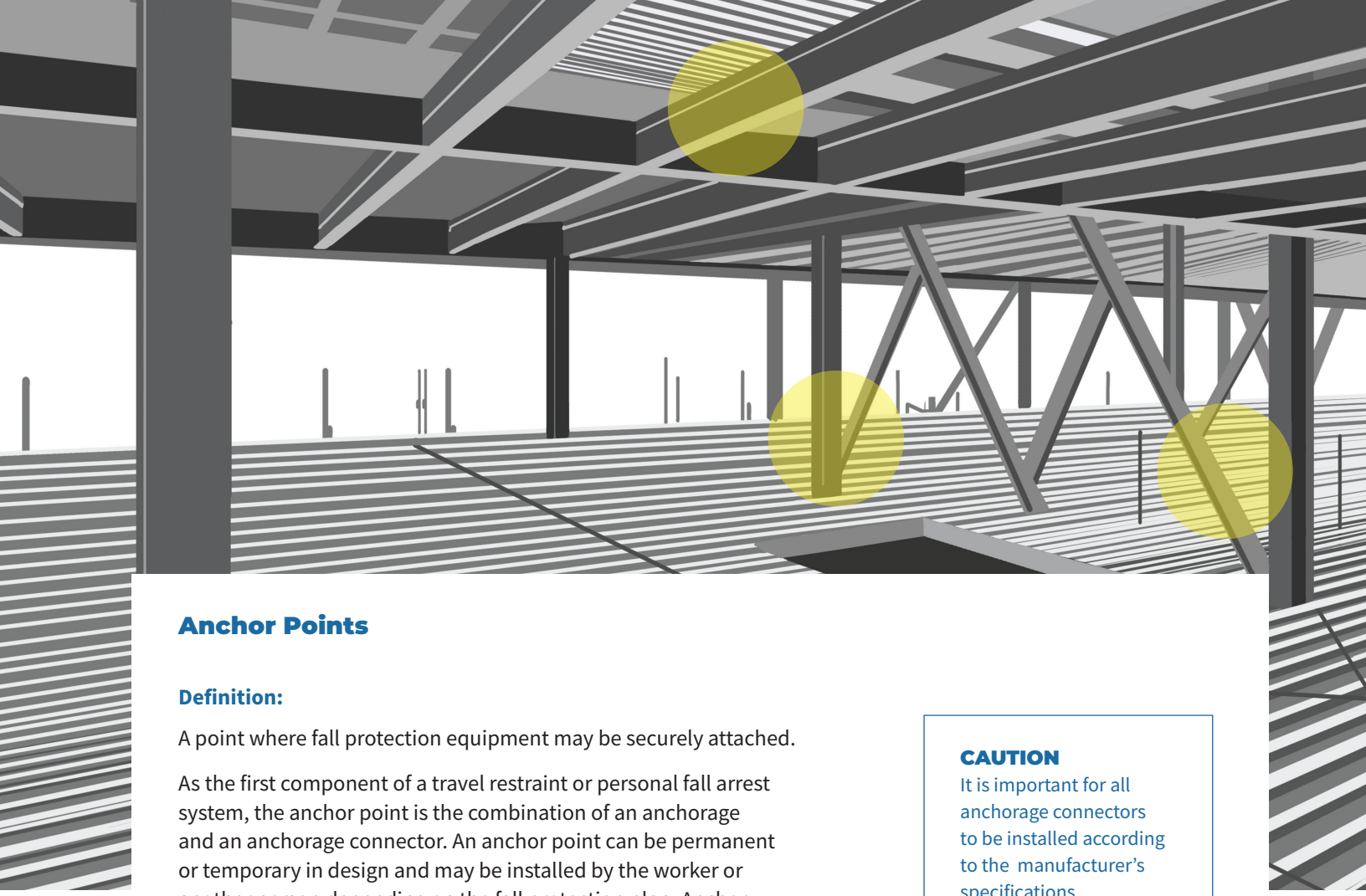
## OBJECTIVES

Upon completion of this chapter, you should be able to:

1. Identify common anchorage connectors.
2. Define force values.
3. Explain the difference between permanent and temporary anchor points.
4. Identify the hazards associated with the improper use of anchor points.

## INTRODUCTION

Any structure that is in the right location possessing adequate strength for the forces generated in the arrest of a fall, is considered the anchorage. Anchorages allow you to secure the remaining components of your fall protection system.



## Anchor Points

### Definition:

A point where fall protection equipment may be securely attached.

As the first component of a travel restraint or personal fall arrest system, the anchor point is the combination of an anchorage and an anchorage connector. An anchor point can be permanent or temporary in design and may be installed by the worker or another person depending on the fall protection plan. Anchor points come in a variety of different forms and are built using specific fall protection equipment called anchorage connectors.

Anchorage connectors can be connected to various anchorages such as:

- Secured I-beam
- Concrete column
- Floor structure

**CAUTION**

It is important for all anchorage connectors to be installed according to the manufacturer's specifications.

If you are ever unsure about an anchor point, do not use it!

### Arrest Force:

A force (lbf or kN) a mass falling over a distance generates on all components of a fall arrest system.

### Maximum Arrest Force (MAF):

The peak force exerted on a worker when a fall arrest system stops a fall.

### Minimum Breaking Strength (MBS):

The minimum amount of force to which a piece of equipment is certified by the manufacturer or professional engineer to be subjected to without failure. Equivalent to ultimate load capacity.

## Activity: Strength Requirements

The key to understanding the strength requirements of an anchorage for travel restraint or fall arrest is to understand how arrest force is created. Many factors determine how much arrest force is generated from a falling worker.

**What are the three major factors influencing the amount of arrest force generated during a fall?**

**1)** _____

**2)** _____

**3)** _____

| **Temporary Anchor Point Strengths:** |
| --- |
| Travel Restraint: ..... lbf<br>or ..... kN |
| Fall Arrest: ..... lbf<br>or ..... kN |

| **Permanent Anchor Point Strengths:** |
| --- |
| Travel Restraint: ..... lbf or ..... kN |
| Fall Arrest: ..... lbf or ..... kN |
| ✓ Although the current anchor point strengths in Alberta for fall arrest are set at 3600 lbs (16kN), many equipment manufacturers still require a 5000 lbs (22.2kN) anchor point for a fall arrest system.<br>✓ All figures based on only one person attached to the anchor point.<br>✓ **Note:** 225 pounds force = 1 kilonewton<br>✓ Fall arrest anchor points incapable of attaining the necessary strength requirements may be engineered, installed and used as part of a system that is capable of withstanding twice the maximum arresting force.<br>✓ Horizontal lifeline anchor points are not represented in these requirements, please refer to the Horizontal Lifelines section. |

## Anchorages: Assessment and Selection

### Permanent Anchor Points

**Definition:**
A point connected to an underlying structure designed to last permanently.

**Design Purpose:**
Designed and installed under the supervision of a qualified individual (engineer). These anchor points should be labeled, “For fall protection use only” or similar. They should only be used for attachment of travel restraint or personal fall arrest systems and designed to withstand at least twice the maximum arrest force.

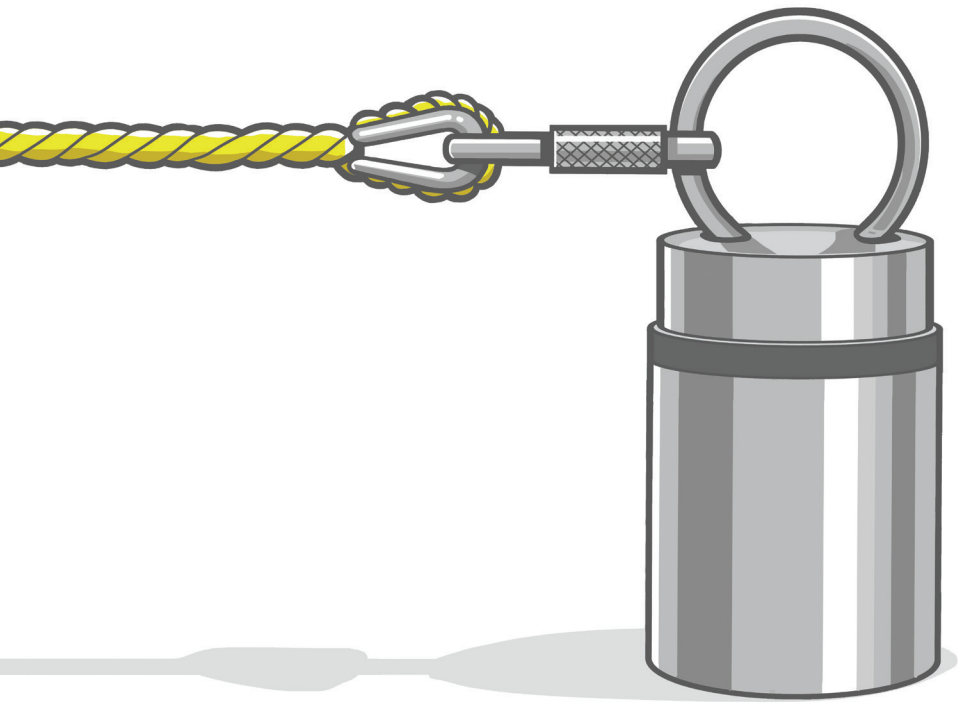
**Component Hazards**

» Protect from damage from moving machinery, excessive heat or harsh chemicals.

» Refrain from exceeding the number of users permitted to attach to the anchor.

» Ensure proper orientation and compatibility of the connector.

» Follow the manufacturer’s or engineer’s requirements for inspection, re-certification and post fall protocols.

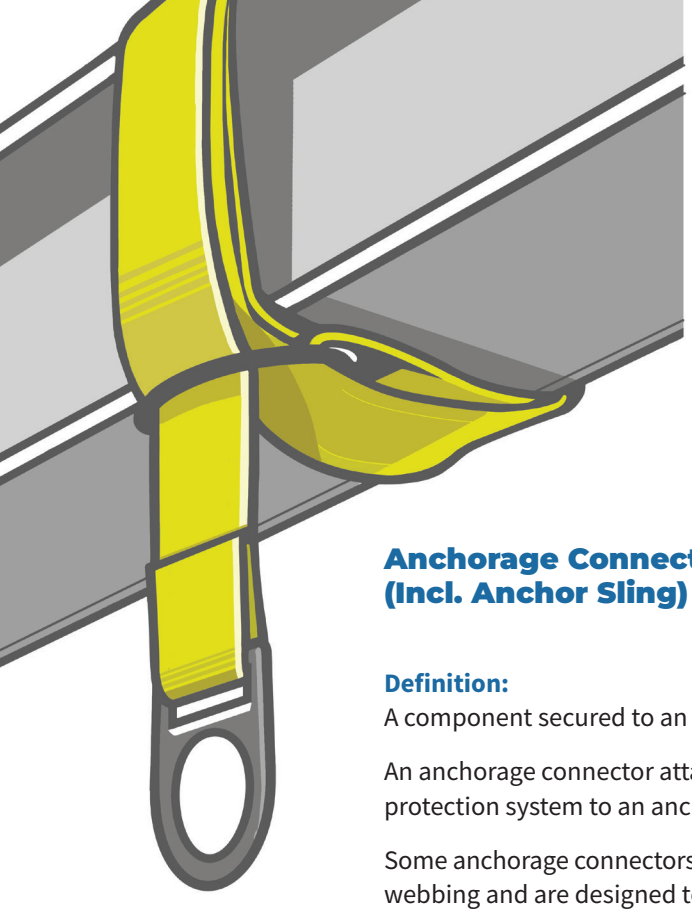


**MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:**

- ✓ Complete a pre-use inspection prior to use.
- ✓ Complete formal inspections on an annual basis by a competent person (manufacturer defined). Record inspection in an equipment logbook.
- ✓ Remove any unsafe equipment from service and either destroy or return to the manufacturer for possible repair.

**PRE-USE VISUAL INSPECTION REQUIREMENTS:**

- ✓ Follow the manufacturer’s or engineer’s requirements for inspection, re-certification and post fall protocols.
- ✓ Check synthetic webbing for cuts, tears, burns, worn stitching, excessive abrasion, chemical contamination and UV degradation.
- ✓ Check all metal components for cracks, corrosion and deformation.
- ✓ Check wire rope for broken strands, kinks, bird caging, bent or stretched eyelets, arc strikes and intact swages.



## Anchorage Connectors (Incl. Anchor Sling)

**Definition:**
A component secured to an anchorage structure.

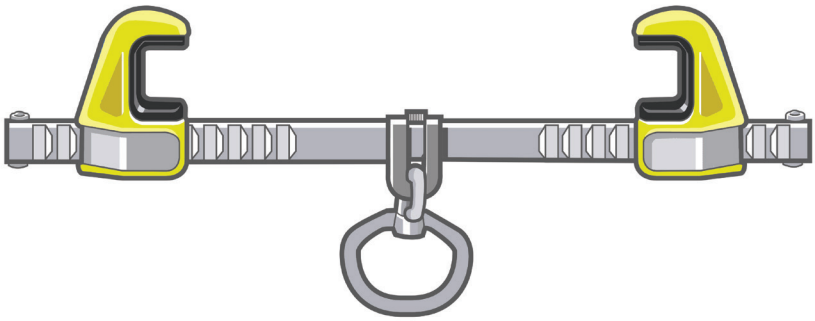
An anchorage connector attaches a personal fall protection system to an anchorage structure.

Some anchorage connectors are wire rope or synthetic webbing and are designed to wrap around a structure to provide a connection point for a PFAS. In practice, these are often referred to as **anchor slings**.

Other anchorage connectors designed by manufacturers, for example beam clamps, roof anchors, trollies and rail sliders allow workers to attach to specific anchorage structures more promptly and safely.

**CAUTION**
For details regarding proper equipment usage, always review the manufacturer's instructions.

Protect from all surrounding hazards such as moving machinery, sharp edges, excessive heat, harsh chemicals, sharp bends and electrical hazards.



**MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:**

- ✓ Complete a pre-use inspection prior to use.
- ✓ Complete formal inspections on an annual basis by a competent person (manufacturer defined). Record inspection in an equipment logbook.
- ✓ Remove any unsafe equipment from service and either destroy or return to the manufacturer for possible repair.

**PRE-USE VISUAL INSPECTION REQUIREMENTS:**

- ✓ Check all anchorage connectors, for example slings, I-beams clamps, removable concrete anchor for manufacturer's labeling.
- ✓ Check synthetic webbing for cuts, tears, burns, worn stitching, excessive abrasion, chemical contamination and UV degradation.
- ✓ Check all metal components for cracks, corrosion and deformation.
- ✓ Check wire rope for broken strands, kinks, bird caging, bent or stretched eyelets, arc strikes and intact swages.

## Temporary Anchor Points

**Definition:**
An appropriate anchorage connector temporarily attached to an underlying structure.

**Design Purpose:**
Allows a worker to anchor their personal fall protection system to a structure where a permanent anchor point does not exist.

While working at height using fall protection equipment, the worker's first choice of securing a fall safety system is to connect it to an permanent anchor point. When there is no permanent anchor point available, a nearby strong structure can be used as a temporary anchor point.

Temporary anchor points may include an I-beam, concrete column, floor structure, cross member of a tower or other similar, robust structures combined with commercially available equipment. This equipment would be in the form of wire rope or synthetic slings or other similar devices. These devices are attached by chokering or wrapping around the selected structure.

**Component Hazards:**

» Ensure sufficient anchor strength and integrity of structure.

» Locate the anchor point directly above the work area to prevent swing fall.

» Ensure proper angle of attachment of anchor sling eyelets. (typically no greater than 45˚).

» Choker only anchor slings intended for this purpose.

» Use fall protection anchor slings only.

» Observe all rules of safe fall protection when creating anchor points.

» Follow the manufacturer's instructions regarding proper equipment usage, inspection, re-certification and post fall protocols.

**MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:**

✓ Complete a pre-use inspection prior to use.

✓ Complete formal inspections on an annual basis by a competent person (manufacturer defined). Record inspection in an equipment logbook.

✓ Remove any unsafe equipment from service and either destroy or return to the manufacturer for possible repair.

**PRE-USE VISUAL INSPECTION REQUIREMENTS:**

✓ Follow the manufacturer's or the engineer's requirements for inspection, re-certification and post fall protocols.

✓ Check synthetic webbing for cuts, tears, burns, worn stitching, excessive abrasion, chemical contamination and UV degradation.

✓ Check all metal components for cracks, corrosion and deformation.

✓ Check wire rope for broken strands, kinks, bird caging, bent or stretched eyelets, arc strikes and intact swages.

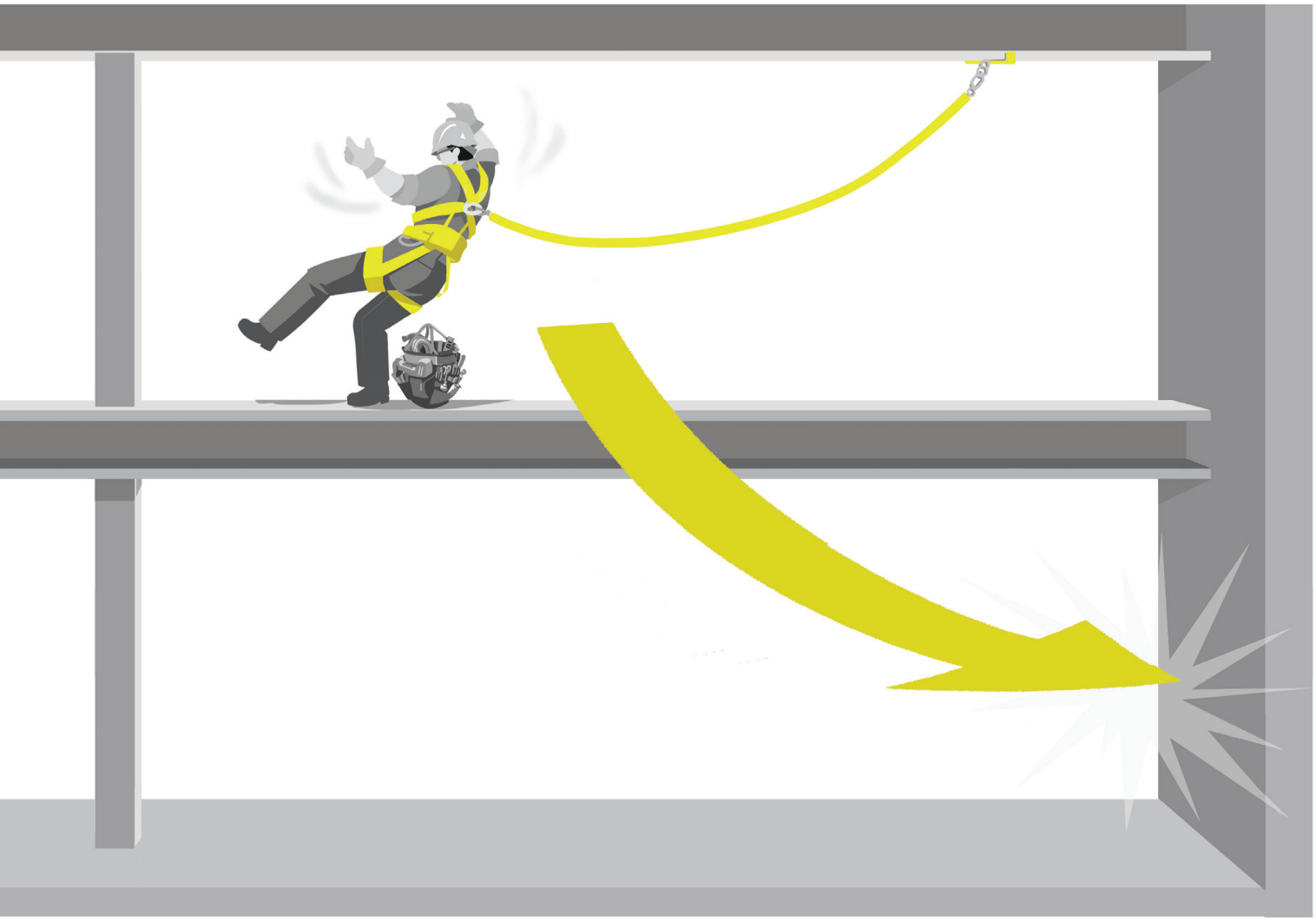
**CLASS DISCUSSION**

Using the illustraion below, discuss the imporance of locating the anchor above the work area.

**CAUTION**

Protect from potential surrounding hazards:

- Moving machinery
- Sharp edges
- Excessive heat
- Harsh chemicals
- Sharp bends
- Electrical hazards



## EXERCISE

1. What is the minimum breaking strength for both temporary and permanent fall arrest anchors?

2. List three surrounding hazards that may impact temporary anchor points.

3. What is the minimum breaking strength for a temporary travel restraint anchor?

4. How do you prevent swing fall from occurring?

## NOTES

# CHAPTER 4:

# Connectors

## OUTCOME

Explain the safe and proper use of connectors.

## OBJECTIVES

Upon completion of this chapter, you should be able to:

1. Indicate the compatibility of connectors with snap hooks and carabiners.
2. Summarize the features and design elements of connectors.
3. Identify pre-inspection elements for connectors.
4. Perform a Clearance Calculation.

## INTRODUCTION

This equipment connects your harness to the anchorage. There are many assorted components and subcomponents that attach, including:

- Snap hooks and carabiners
- Lanyards
- Energy absorbers
- Self-retracting devices (SRDs)
- Safety ropes and fall arresters
- Horizontal lifelines systems

## CONNECTORS

### Snap Hooks and Carabiners

**Definition of a Snap Hook:**
A connector in the shape of a hook with an auto-locking gate.

**Definition of a Snap Carabiner:**
A connector in the shape of an oval with an auto-locking gate.

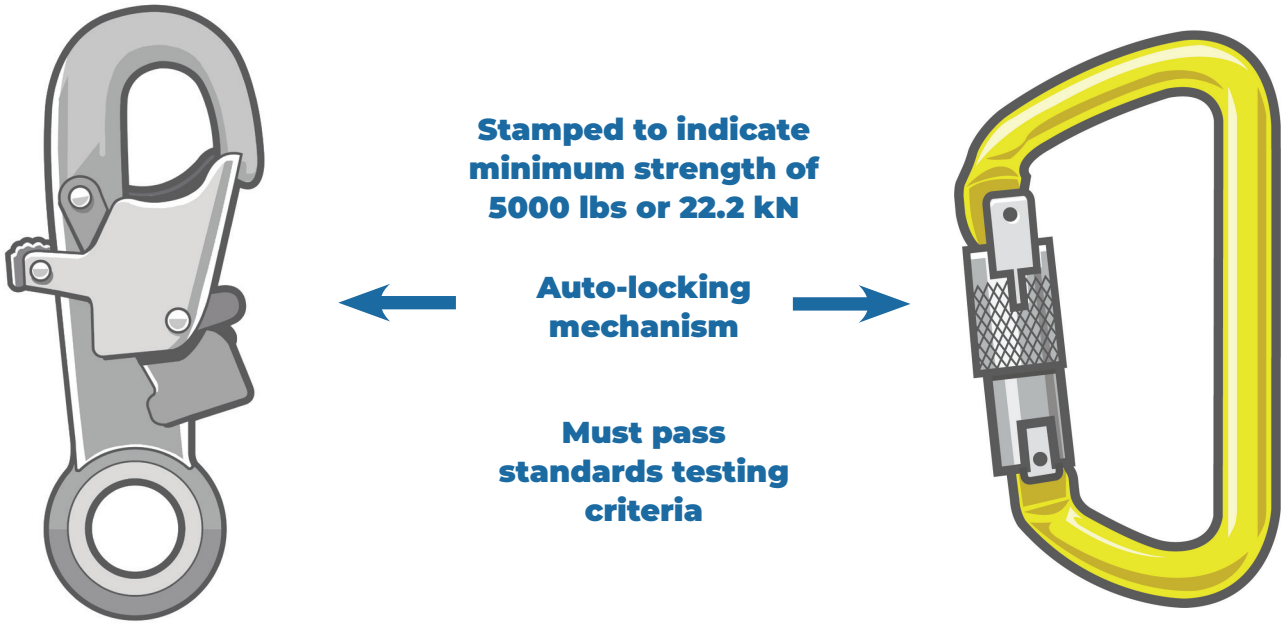
**Non-locking or manual locking snap hooks and carabiners are not allowed in any fall protection system**. While the auto-locking mechanism provides a greater level of safety, the gates are still the weakest component of both devices. The auto-locking mechanism reduces the possibility of unintentional engagement, but only proper orientation and compatibility can eliminate risk.

**MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:**

- ✓ Complete a pre-use inspection prior to use.
- ✓ Complete formal inspections on an annual basis by a competent person (manufacturer defined). Record inspection in an equipment logbook.
- ✓ Remove unsafe equipment from service and either destroy or return to the manufacturer for possible repair.

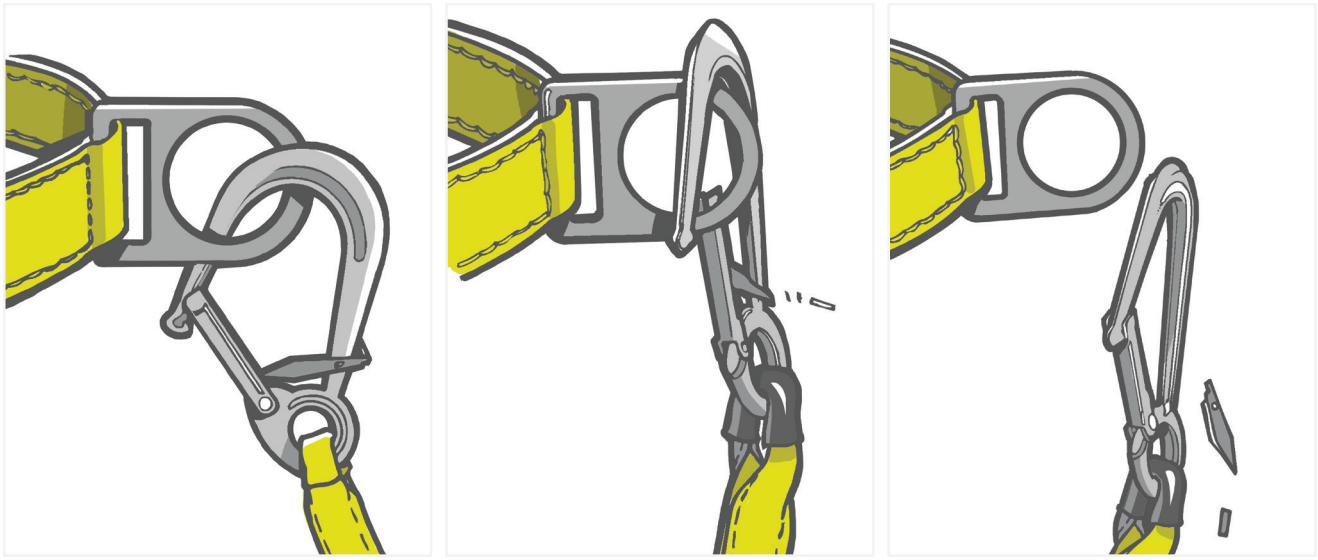
**PRE-USE VISUAL INSPECTION REQUIREMENTS:**

- ✓ Check all snap hooks and carabiners for manufacturer's labeling indicating MBS of 5000 lbs (22.2kN).
- ✓ Check for cracks, corrosion and deformation.
- ✓ Ensure gates are functioning properly, automatic closing and auto-locking.



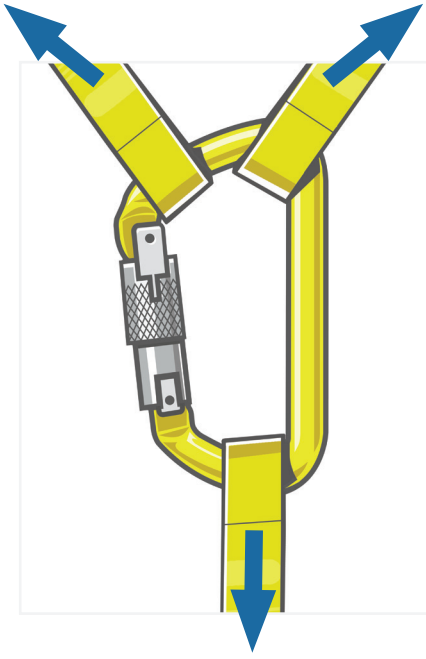
## HAZARD!
## Non-Compatible Snap Hook Connections

### Forced Roll-Out

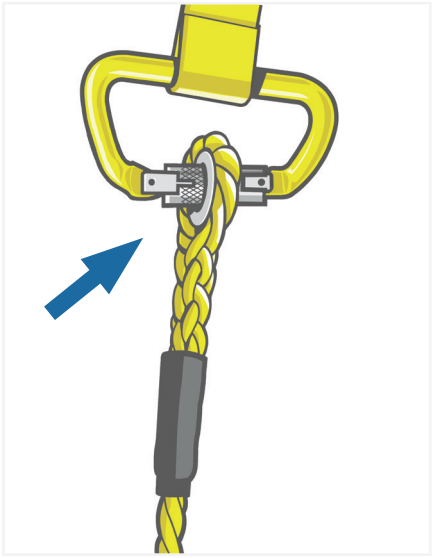


## HAZARD!
## Improper Carabiner Alignments

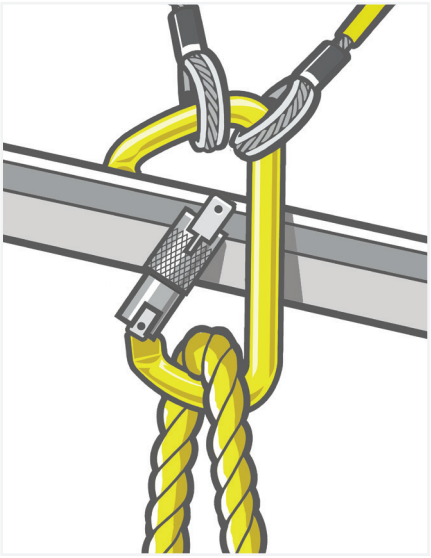
### Three-Way Loading



### Cross-Gate Loading



### Open Gate Loading

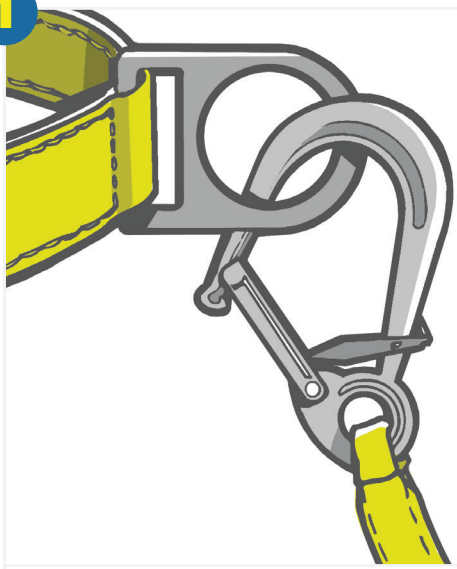


## Activity: Compatible Connections

**As noted earlier, you must create compatible connections when attaching fall protection equipment. Below are various methods of connecting components.**

For each diagram below, indicate whether the connection is acceptable or unacceptable.

1

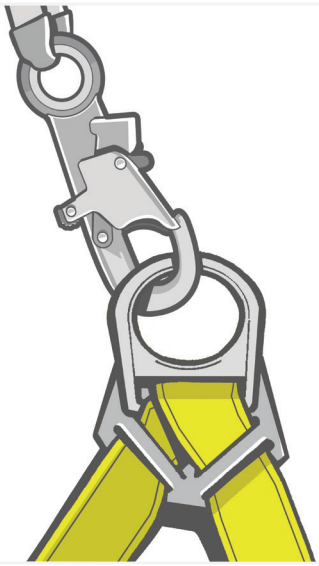


**Acceptable or Unacceptable**

2

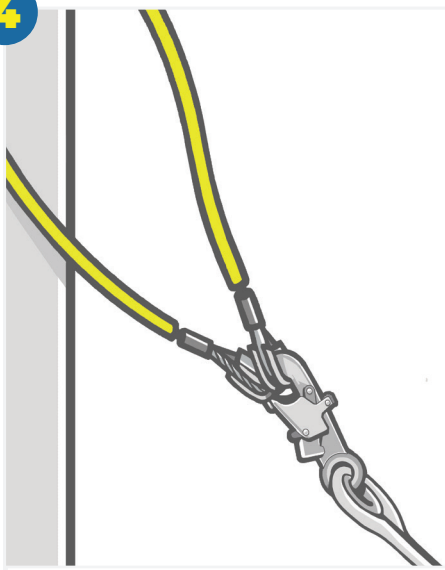
**Acceptable or Unacceptable**

3



**Acceptable or Unacceptable**

4



**Acceptable or Unacceptable**

## NOTES

## Lanyards

**Definition:**
A connecting means typically made of a length of strong material with connecting components (snap hooks or carabiners) at either end.

Generally, one end of the lanyard attaches to the worker and the other end to a suitable anchor point.

**Materials:**
- Nylon - strong, lightweight with some chemical resistance
- Polyester - strong, lightweight, with some chemical resistance and increased abrasion protection
- Steel - very strong, very resistant to heat and several chemicals, requires an energy absorber
- Nomex/Kevlar/Technora - strong and heat resistant

**Lengths:**
- Typically 4, 5, or 6 feet (1.2, 1.5 or 1.8 metres)
- Available in additional lengths

**Lanyard Features:**
- Lanyards may be purchased with one or more of the following features:

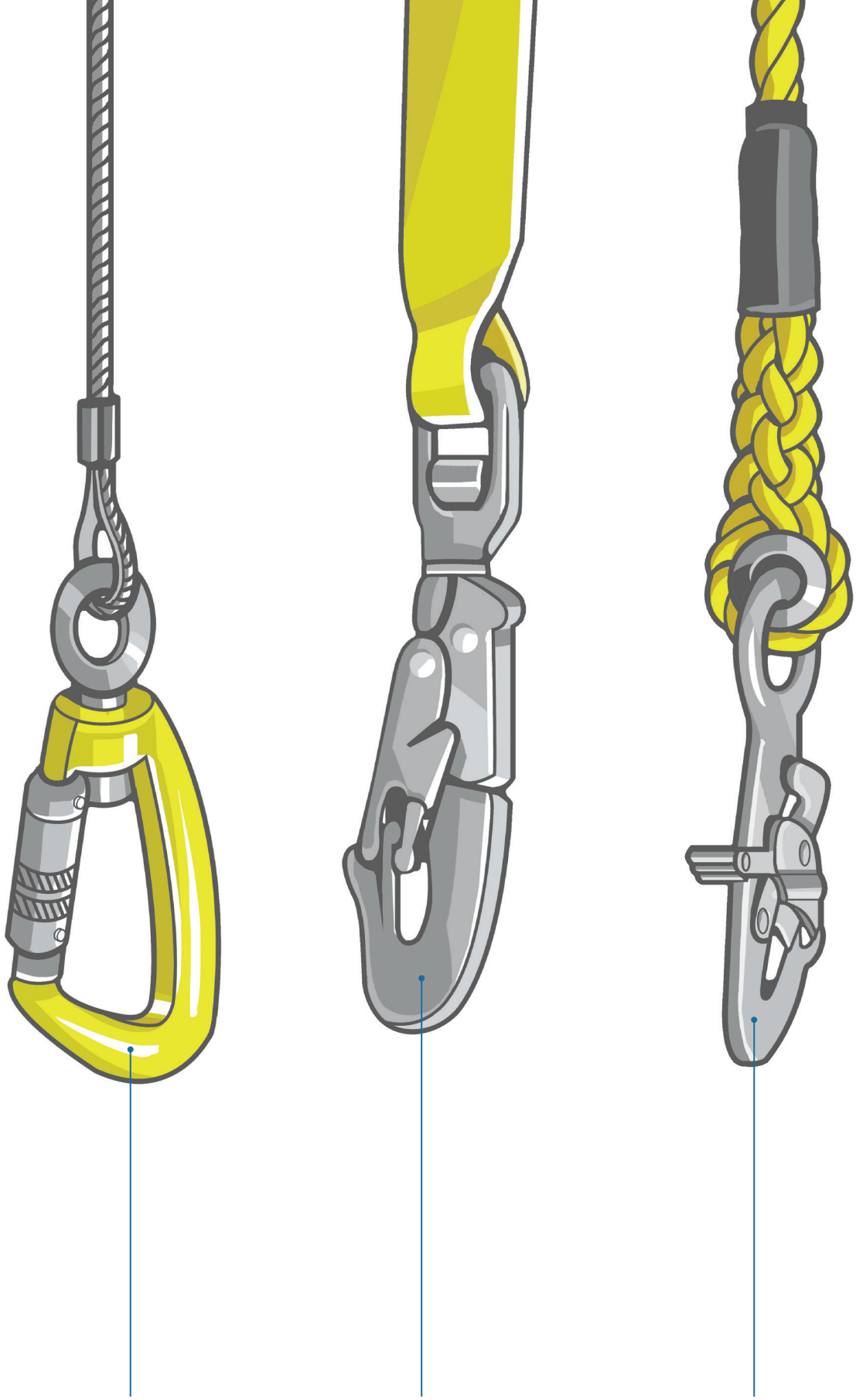
| FEATURE | DESCRIPTION |
|---|---|
| Adjustability | Allows user to change length |
| Elasticity | Reduces excess slack, lowering tripping risks |
| Twin Legs | Facilitates continuous connection to structure, even when mobility is required |
| Tie-Back | Allows user to tie lanyard back onto itself, eliminating the need for an anchorage connector |

**MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:**

- ✓ Complete a pre-use inspection prior to use.
- ✓ Complete formal inspections on an annual basis by a competent person (manufacturer defined). Record inspection in an equipment logbook.
- ✓ Remove unsafe equipment from service and either destroy or return to the manufacturer for possible repair.

**PRE-USE VISUAL INSPECTION REQUIREMENTS:**

- ✓ Check all lanyards for manufacturer's labeling.
- ✓ Check synthetic webbing and rope for cuts, tears, burns, worn stitching, excessive abrasion, chemical contamination and UV degradation.
- ✓ Check all connector components for cracks, corrosion and deformation.
- ✓ Check wire rope for broken strands, kinks, bird caging, bent or stretched eyelets, arc strikes and intact swags.



**Types:** **Steel Cable** **Webbing** **Rope**

## Energy Absorbers

As part of a lanyard or as a separate unit, energy absorbers serve to reduce the arrest forces that occur during a fall on both the anchor point and the worker. Energy absorbers use a variety of mechanisms, such as tearing, stretching or ripping to lengthen the deceleration distance and decrease arrest forces.

Previous versions of this training described two classes of energy absorbers. Each was classified according to the maximum weight the device could absorb, to accommodate the wide range in worker height and weight. Class E4 was designed for workers weighing 45 kg-115 kg, while Class E6 was intended for those weighing 90 kg-175 kg.

The CSA updated standard **Z259.11 Energy Absorbers and Lanyards** in late 2017. The current standard specifies the requirements of use, design, testing, labelling and marking of personal energy absorbers and lanyards.

Changes to CSA standard Z259.11 include:

- Updated definitions
- Eliminated energy absorber classes; Classes E4 and E6
- Revised dynamic fall test
- Modified lanyard mass test and drop test
- Enhanced labelling requirements.

Additions to CSA standard Z259.11 include:

- The Class Y lanyard
- Minimum performance factors, the maximal deceleration force and an average deceleration factor for energy absorbers
- A static resistance test for the Class Y lanyard.

The energy absorber product label must warn the user to read the absorber's instructions prior to use. The label must also indicate the maximum free fall distance; taking into account the anchor point above the D-ring, the maximum deployment, the maximum deployment factor adjusted to the nearest 0.1, and the range of allowed masses (the weight of the worker with his equipment). This information must be marked or labelled in a durable and readable manner, in both French and English.

Additionally, the product label must include the:

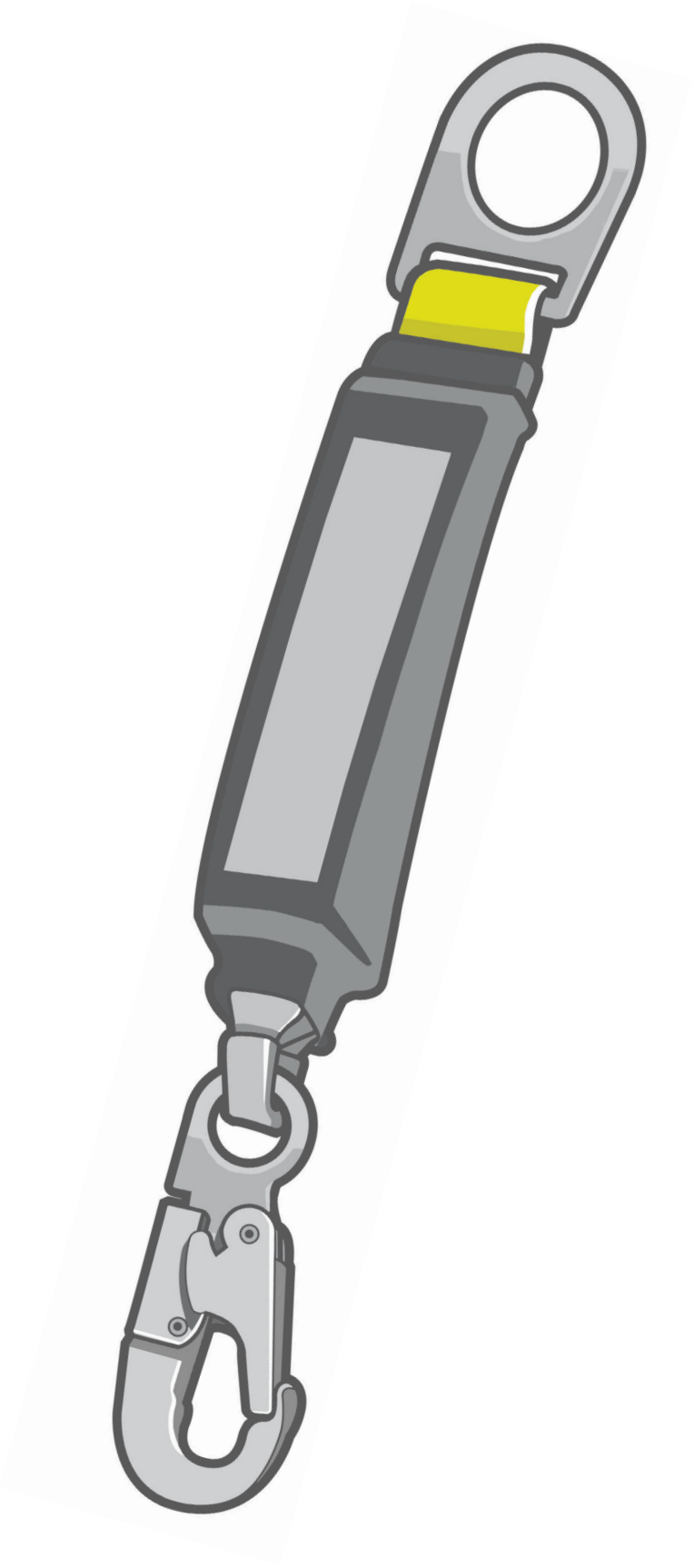
- Name of the manufacturer
- Maximum mass of the worker specified by the manufacturer
- Model number
- Certification body (where certified)
- Manufacturing date.

**MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:**

- ✓ Complete a pre-use inspection prior to use.
- ✓ Complete formal inspections on an annual basis by a competent person (manufacturer defined). Record inspection in an equipment logbook.
- ✓ Remove unsafe equipment from service and either destroy or return to the manufacturer for possible repair.

**PRE-USE VISUAL INSPECTION REQUIREMENTS:**

- ✓ Check for manufacturer's labeling.
- ✓ Check visible webbing for cuts, tears, burns, worn stitching, excessive abrasion, chemical contamination and UV degradation.
- ✓ Check all connector components (D-rings, snap hooks) for cracks, corrosion and deformation.
- ✓ Check housing for tears and soft spots.
- ✓ Check to ensure energy absorber has not deployed or extended.
- ✓ Ensure load indicators on applicable energy absorbers are intact.



## Self Retracting Lifelines / Self Retracting Devices

A Self Retracting Device performs a tethering function while allowing vertical movement (below the device) to the maximum working length of the device.

Similar to a seat belt mechanism, the device locks-off when speeds such as those generated in a fall are achieved.

Previous versions of this training included three classifications of Self Retracting Lifelines (SRLs)—Types (SRL) 1, 2 and 3. These SRLs were classified according to the length of the lifeline. The position in which the device is used is now the primary classification variable. Length is the secondary variable.

The CSA updated standard **Z259.2.2-17- Self Retracting Devices** in 2019 to update the self-retracting lifelines' classifications and inspections. Four classifications of equipment are listed:

1. **SRL:** The self-retracting lifeline is higher than the D-ring on the worker.
2. **SRL-R:** The self-retracting lifeline is higher than the D-ring on the worker and has a rescue device.
3. **SRL-LE:** The self-retracting lifeline is lower than the D-ring on the worker or the self-retracting lifeline can lean against a sharp edge (LE if for Leading Edge).
4. **SRL-LE-R:** The self-retracting lifeline meets the SRL-LE standards and has a rescue device.

**CAUTION**

The new standard requirements apply to **new** equipment. SRLs currently in use are deemed safe. Removal of your equipment from use or a change to your equipment inspection, is not immediately required.

- Keep the cable from running over sharp edges or bends.
- Refrain from leaving the cable extended for prolonged periods of time.
- Minimize swing fall hazard by remaining below the device.
- Anchor SRLs above the worker's head. Unless otherwise specified by the manufacturer, do not use the SRL on its side.

## Inspection

The new inspection requirements are an important change for the worker. Previously the inspection and revalidation of this equipment was completed within a certain amount of years according to the lifeline classification, without flexibility. The new standard for inspection requirement is based on the lifeline's use and exposure.

Inspection Criteria Under the New Standard:

| TYPE OF USE | INSPECTION AND REVALIDATION CYCLE |
|---|---|
| Infrequent to Light | » Annual inspection<br>» Equipment revalidation every five years |
| Moderate to Heavy | » Semi-annual inspection<br>» Equipment revalidation every two years |
| Severe to Continuous | » Inspection every three or six months<br>» Annual revalidation |

### General Guidelines for Usage

- Inspect and test the locking mechanism before each use.
- Connect one worker to the dorsal D-ring.
- Verify the load indicator has not been activated.
- Use a tag line to retrieve the snap hook when required.

### The Importance of Using a Swivel

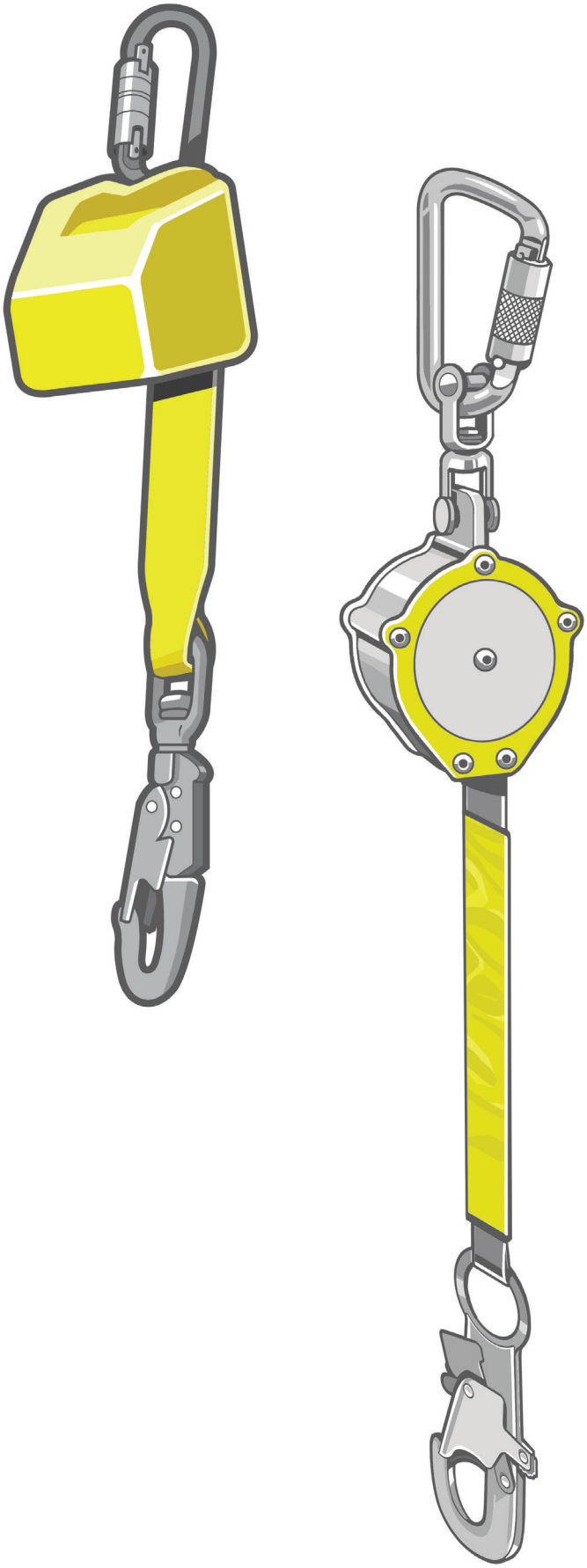
Previously, it was strongly suggested that you use a swivel at the end of the lifeline to allow for a pivoting action and avoid twisting. With the new standard the use of a swivel is mandatory.

**MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:**

- ✓ Complete a pre-use inspection prior to use.
- ✓ Complete formal inspections on an annual basis by a competent person (manufacturer defined). Record inspection in an equipment logbook.
- ✓ Remove unsafe equipment from service and either destroy or return to the manufacturer for possible repair.

**PRE-USE VISUAL INSPECTION REQUIREMENTS:**

- ✓ Check for manufacturer's labeling.
- ✓ Ensure SRLS/SRDs have a current certification sticker.
- ✓ Check visible webbing for cuts, tears, burns, worn stitching, excessive abrasion, chemical contamination and UV degradation.
- ✓ Check wire rope for broken strands, kinks, bird caging, or bird nesting, bent or stretched eyelets, arc strikes and intact swages.
- ✓ Check all connector components (D-rings, snap hooks) for cracks, corrosion and deformation.
- ✓ Check locking mechanism by giving a hard tug on lifeline.
- ✓ Ensure load indicators are not deployed.



## Vertical Lifelines and Fall Arresters

### Definition:

A flexible line or rigid rail attached to a structure along which a fall arrester can travel.

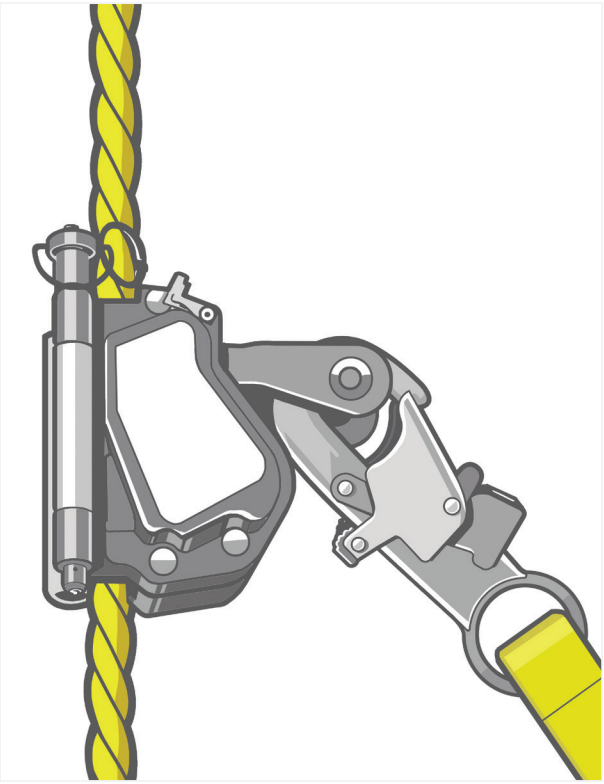
A vertical lifeline is made of synthetic fibre, wire, or metal. In the event a worker falls, the fall arrester (also known as a "Grab") will quickly **lock-off**, thus limiting the free fall distance.

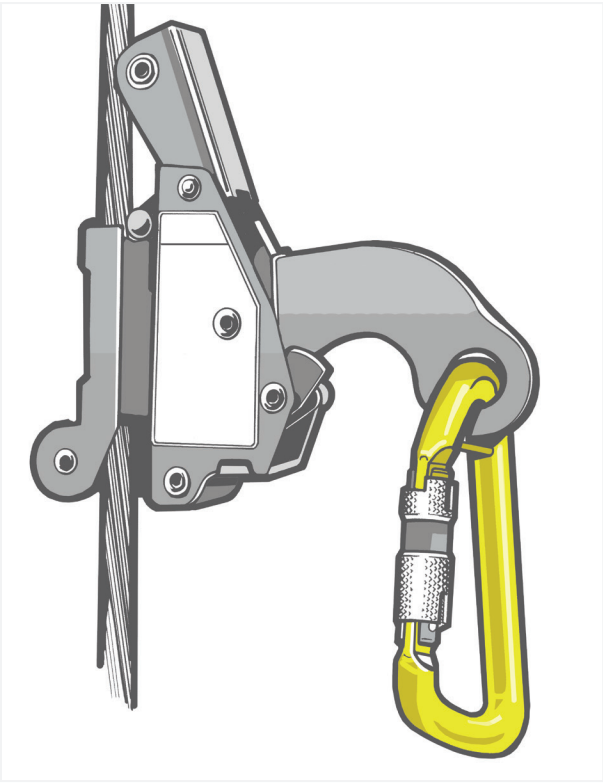
### General Guidelines for Usage:

- There are two different types of fall arresters: automatic and manual.
- A vertical lifeline must have a minimum breaking strength as per the equipment standard it meets.
- A vertical lifeline must extend to within 4 feet (1.2 m) of the ground.
- Must be installed and used so the swing drop distance does not exceed 4 feet (1.2 m).
- Cable and rigid rail systems are predominantly used on fixed ladders.
- Typically, rope grabs are designed for dorsal D-ring connection. Cable and rigid rail grabs are designed for sternal D-ring connection (front of the harness).
- Manual fall arrester and synthetic rope fall arresters must have a panic-grab proof feature.

**CAUTION**

- Ensure the vertical lifeline and fall arrester (grab) are compatible.
- Ensure arrow on the grab is pointed in the UP direction.
- Unless otherwise specified by the manufacturer, vertical lifeline systems are designed for one worker at a time.
- Keep the vertical lifeline free from all surrounding hazards such as moving machinery.



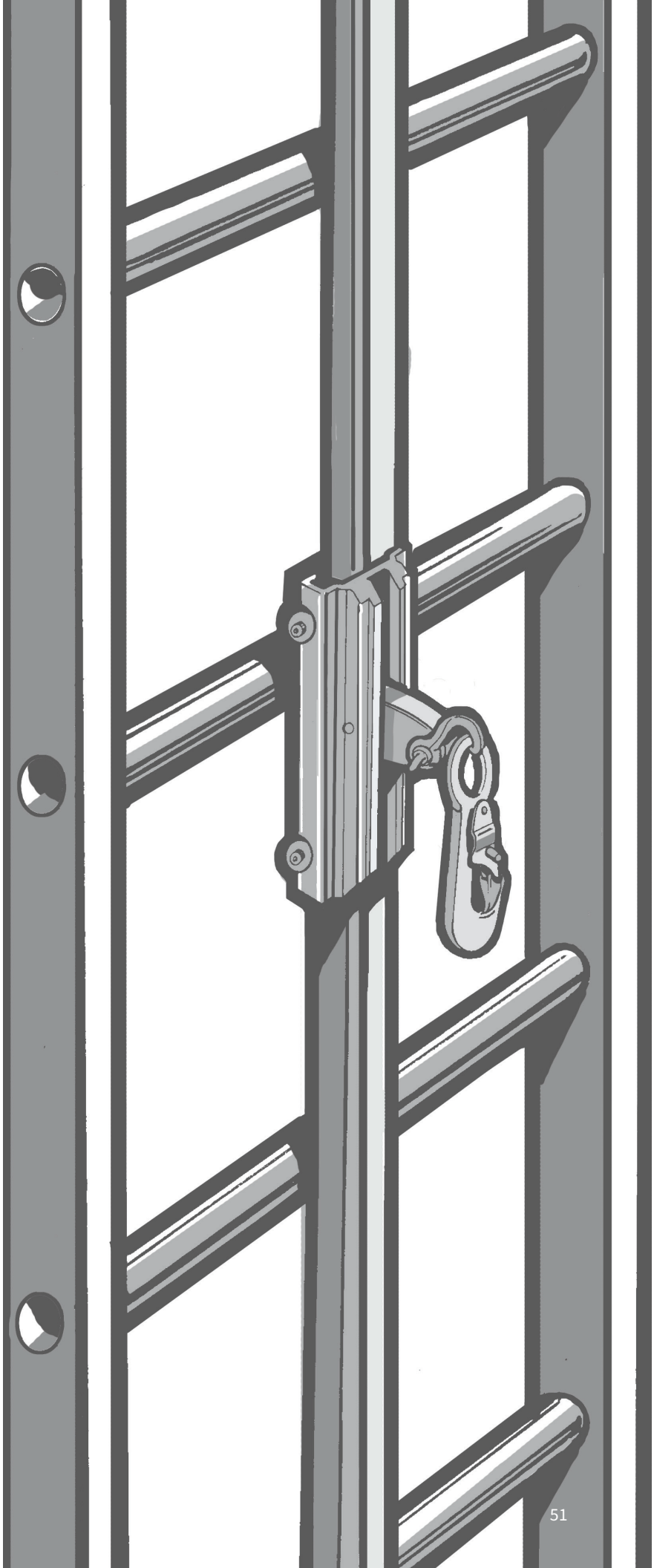


**MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:**

- ✓ Complete a pre-use inspection prior to use.
- ✓ Complete formal inspections on an annual basis by a competent person (manufacturer defined). Record inspection in an equipment logbook.
- ✓ Remove unsafe equipment from service and either destroy or return to the manufacturer for possible repair.

**PRE-USE VISUAL INSPECTION REQUIREMENTS:**

- ✓ Check for manufacturer's labeling.
- ✓ Check webbing and rope for cuts, tears, burns, worn stitching, excessive abrasion, chemical contamination and UV degradation.
- ✓ Check wire rope for broken strands, kinks, bird caging, bent or stretched eyelets, oxidation and proper tension.
- ✓ Check all connector components (D-rings, snap hooks) for cracks, corrosion, deformation and properly functioning gates.
- ✓ Ensure arrester will lock-off on lifeline (proper orientation).
- ✓ Check life safety rope and fall arrester compatibility.



## Free Fall

Free fall is the distance you fall freely, with nominally no force applied to slow you down. The greater the free fall distance, the more energy the fall produces and the more violent the shock is to your body and fall protection system components. The table below shows how the free fall distance is measured:

| CALCULATING FREE FALL DISTANCE (FF) | FORMULA |
|---|---|
| Anchor point **above** attachment point | **FF** = Lanyard - Distance between attachment and anchor point |
| Anchor point **below** attachment point | **FF** = Lanyard + Distance between attachment and anchor point |
| Anchor point **level** with attachment point | **FF** = Lanyard length |

Refer to Appendix D for free fall distance requirements in your area.

## Calculating Required Clearance

The anchorage location is the starting point for the Required Clearance Calculation. When setting up and using a personal fall arrest system, Required Clearance (RC) and swing fall hazards are critical issues that must always be top of mind. Whether you are working from an aerial lift, erecting steel, on scaffolding or performing any other type of work at height, you require enough clearance below you to arrest your fall before striking the ground or any other obstruction. The result of a fall involving a failure to calculate the proper Required Clearance always ends the same—with injury or death.

Required Clearance is defined as the height at which a worker must attach to an anchorage to avoid contact with a lower level. The Required Clearance always begins at the anchor. **If this clearance is greater than the Actual Clearance (AC) from your position to a physically lower level or obstruction, you must find an alternate fall protection or fall prevention solution.**

## Factors Considered in Required Clearance Calculations

Calculating required clearance involves several factors; all with the potential to impact how far you may fall. These factors include: anchor deflection, vertical lifeline rope stretch during a dynamic event, heavier workers, leading edge attachments, aerial lift bounce, and several more.

Advanced level courses go into detail on how to perform these calculations. However, the intent of this course is to focus on a set of common factors that develop a simple and safe required clearance calculation. Each of these factors are described below.

**Required Clearance Equation:**

**RC = L + DD + H + SM**

**RC** =
Required Clearance below the anchor point to the level below or obstruction

**L** =
Lanyard Length

**DD** =
Deceleration Distance

**H** =
Height of Suspended Worker

**SM** =
Safety Margin

### Lanyard Length (L)

Lanyard type and length vary depending on the connecting system used. Shock absorbing lanyards are the most common and may be of fixed length or adjustable. Regardless, consider your system to be a fixed length system, since after you fall you are unable to make real time adjustments mid fall to the initial working length of the lanyard. Thus, this course focuses on fixed length lanyards.

SRDs and vertical lifelines with automatic rope grabs are also commonly found today. Because of this, additional distances must be factored into the Required Clearance calculation to accommodate factors such as device activation distance and equipment stretch.

### Deceleration Distance (DD)

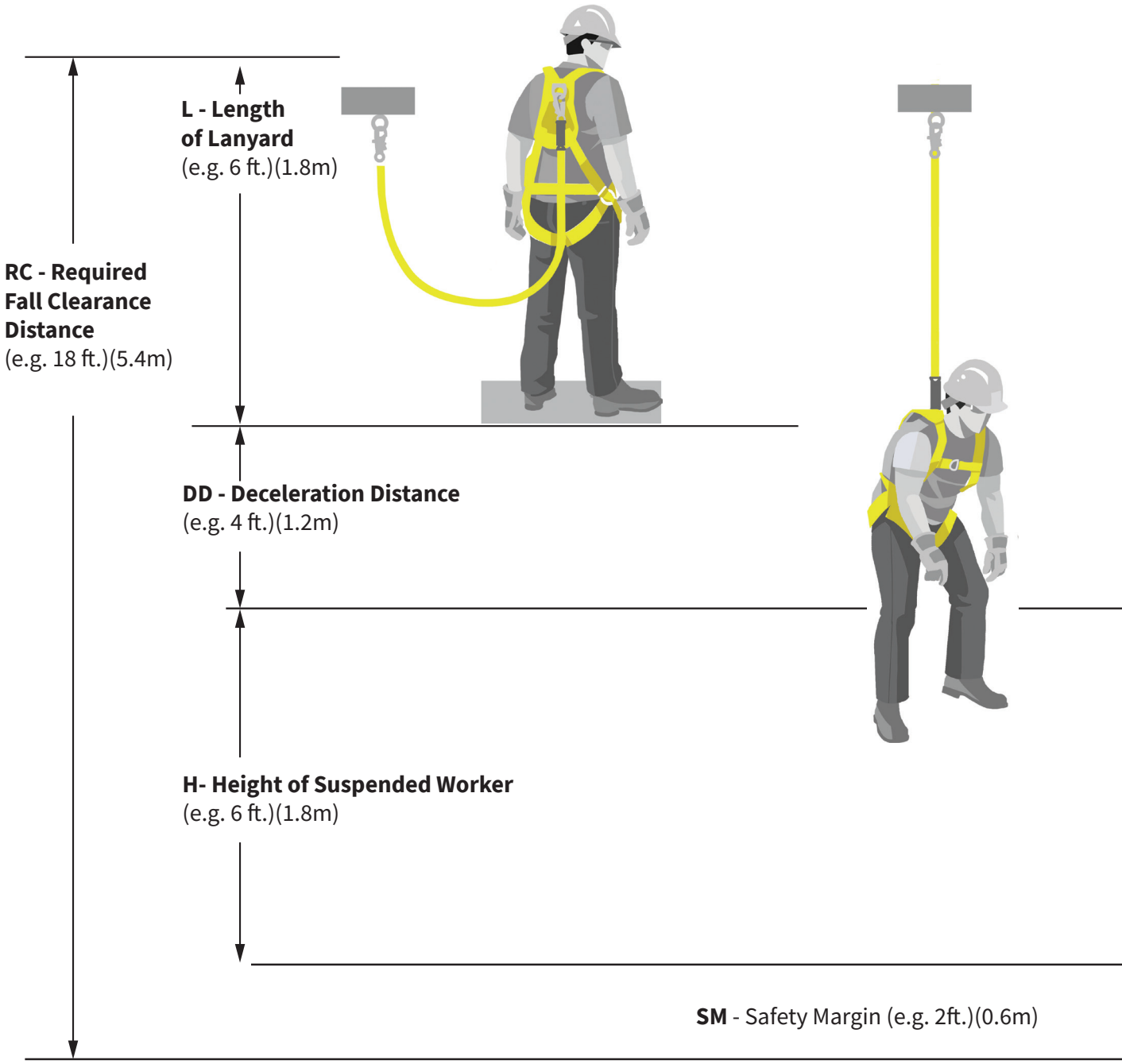
This is the distance you travel while the system applies forces to arrest your fall. Many parts of the fall arrest system are involved in dissipating the energy generated during a fall, including the deployment of Personal Energy Absorbers (PEAs) ratcheting of the SRDs or the anchorage system itself. Each component absorbs energy as it deploys, stretches, deflects or sags.

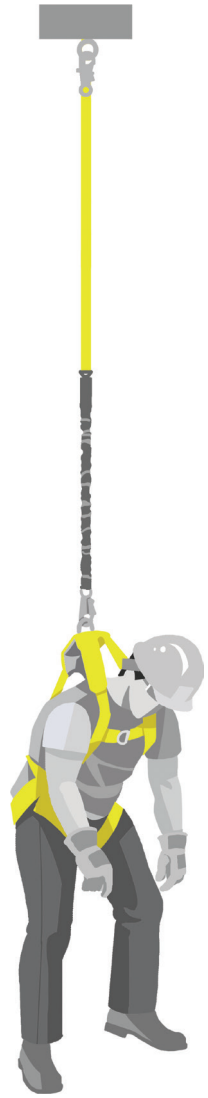
### Height of the Worker (H)

A typical worker stands 6 ft tall. Although the D-ring sits lower on the back of a 5 ft worker, you need to consider that in a fall the harness stretches upwards and the D-ring flips 180 degrees, orientating face up. This harness stretch varies between 1 ft (0.3m) for a properly worn and fitted harness to 2.5 ft (0.75 m) for a stretch style harness. For simplicity, calculate required clearance based on a conventional harness that stretches 1 ft (0.3m).

### Safety Margin (SM)

The calculated Required Clearance must never equal your actual measured clearance. You must build in a safety margin to allow for equipment, situation, or worker variance, for example a taller or heavier worker, equipment from a different manufacturer, etc.


L - Length
of Lanyard
(e.g. 6 ft.)(1.8m)
RC - Required
Fall Clearance
Distance
(e.g. 18 ft.)(5.4m)
DD - Deceleration Distance
(e.g. 4 ft.)(1.2m)
H- Height of Suspended Worker
(e.g. 6 ft.)(1.8m)
SM - Safety Margin (e.g. 2ft.)(0.6m)



**Nearest Obstruction**
(SM) (e.g. 2 ft.)(0.6m)

## REQUIRED CLEARANCE CALCULATION EXAMPLE

### Imperial

**RC = L + DD + H + SM**

**= 6’ + 4’ + 6’ + 2’**

**RC = 18’**

### Metric

**RC = L + DD + H + SM**

**= 1.8m + 1.2m + 1.8m + 0.6m**

**RC = 5.4m**

**It is imperative you understand the basic method for calculating fall distance to prevent injury or worse for you or your coworker.**

### ACTIVITY:

**Use the blank formulas below to calculate safe fall distances.**

RC = ___ + ___ + ___ + ___

RC = _____

RC = ___ + ___ + ___ + ___

RC = _____

RC = ___ + ___ + ___ + ___

RC = _____

## Horizontal Lifeline Systems (HLLs)

Horizontal Lifeline Systems are highly specialized systems that permit worker movement along an elevated horizontal surface. Because of the many variables associated with their design, installation and use, they must be engineered to ensure the utmost safety of the workers using the system.

### Activity: List the variables associated with the design and use of Horizontal Lifeline Systems.

1) _____

2) _____

3) _____

4) _____

5) _____

6) _____

Based on the variables identified above, it is apparent that there is **no set minimum anchor point strength requirement for all horizontal lifeline systems**. Each system has its own anchor point strength requirements based on the system's overall design and designer (professional engineer or manufacturer).

**CAUTION**

Adhere to the following when designing and installing horizonal lifeline systems:

- All systems must be certified prior to use by a professional engineer or competent person as specified by the manufacturer or professional engineer.
- Ensure sufficient clearance for the system.
- Do not exceed the number of workers permitted on the line.
- Always maintain proper lifeline tension.
- Must confirm clearance using manufacturer's instructions.

**MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:**

- ✓ Complete a pre-use inspection prior to use.
- ✓ Complete formal inspections on an annual basis by a competent person (manufacturer defined). Record inspection in an equipment logbook.
- ✓ Remove unsafe equipment from service and either destroy or send back to the manufacturer for possible repair.

**PRE-USE VISUAL INSPECTION REQUIREMENTS:**

- ✓ Check for manufacturer's/ engineer's labeling.
- ✓ Check date of recertification or formal inspection.
- ✓ Check rope for cuts, tears, burns, worn stitching, excessive abrasion, chemical contamination and UV degradation.
- ✓ Check wire rope for broken strands, kinks, bird caging, bent or stretched eyelets and oxidation.
- ✓ Check lifeline for proper tensioning.
- ✓ Check all connector components for cracks, corrosion, deformation and properly functioning gates.
- ✓ Check integrity of anchorage and anchorage connectors.
- ✓ Ensure nothing is moved into the potential fall zone.

## EXERCISE

1. What is the minimum breaking strength for a horizontal lifeline anchor?

2. What is the hazard associated with snap hooks (both locking and non-locking)?

3. How do you prevent roll-out from occurring?

4. Non-locking snap hooks can be used within a travel restraint system.
   True
   False

5. Where is a carabiner's greatest strength?

6. Tie-back lanyards can be choked around a structure.
   True
   False

7. How do you calculate Required Clearance?

8. What type of lanyard must always incorporate an energy absorber?

9. What is the difference between the four types of SRDs under the updated CSA standard?

10. What types of SRDs go to the manufacturer for yearly revalidation?

11. Fall arresters can be connected to any type of vertical lifelines.
    True
    False

12. How many workers are allowed on a vertical lifeline?

13. If an inspection reveals an unsafe condition, what must you do with the equipment?

14. How often does a formal inspection need to be completed?

## NOTES

# CHAPTER 5:

# Body Holding Devices

## OUTCOME

Demonstrate the safe and proper use and selection of a full body harness.

## OBJECTIVES

Upon completion of this chapter, you should be able to:

1. Describe the full body harness CSA classifications.
2. Identify the hazards associated with improper use of a body harness.
3. Summarize the guidelines for the selection of a full body harness.
4. Demonstrate the guidelines for the pre-use inspection, donning and doffing of a full body harness, including a partner check.

## INTRODUCTION

A full body harness is a body holding device used to protect workers from falls by distributing the force of the fall over a large area of the body, ensuring the subject of the fall remains suspended in an upright position after the fall has occurred. It is designed to minimize the risk of injuries caused by suspension.

## BODY HOLDING DEVICES

### Definition:

Equipment worn by the worker to support the body or restrain the worker from reaching the fall hazard, in the event of a fall.

### Advantages:

» Adjustable, allowing for a secure fit
» Forces distributed over greater area of the body
» Longer suspension time before severe discomfort occurs
» Upright resting position after a fall
» For use with travel restraint and personal fall arrest systems.

### Disadvantages:

» Requires training for proper use
» Slightly more cumbersome to use.

Full Body Harness

**CAUTION**

» All oil sands sites have banned the use of safety belts.
» Improper adjustment of the harness fit (i.e. sub-pelvic strap positioned in the lower back)
» Selecting improper size for the user
» Attaching connector to an incorrect D-ring position on the harness
» Leg straps cross buckled or not properly tensioned
» Twisted harness webbing
» Extra webbing not properly managed.

**MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:**

✓ Complete a pre-use inspection prior to use.
✓ Complete formal inspections on an annual basis by a competent person (manufacturer defined). Record inspection in an equipment logbook.
✓ Remove unsafe equipment and either destroy or send to the manufacturer for possible repair.

**PRE-USE VISUAL INSPECTION REQUIREMENTS:**

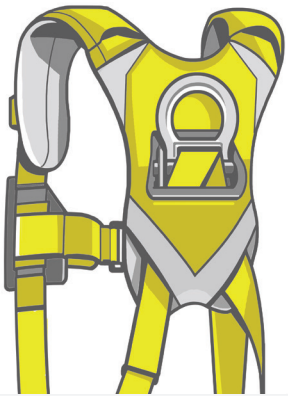
✓ Check harness for manufacturer's labeling.
✓ Check webbing for cuts, tears, burns, worn stitching, excessive abrasion, chemical contamination and UV degradation.
✓ Check all metal component (buckles, grommets, D-rings, etc.) for cracks, corrosion, deformation and missing hardware.
✓ Check for missing keepers.
✓ Check for modifications such as cut straps or items stitched to webbing.

## Harness Types

Full body harnesses are available with a variety of different connecting points. Harnesses are differentiated by the function they perform. The Type 'A' harness is the most basic harness. It is used for fall arrest when connected to the dorsal D-ring. Although all harnesses have the dorsal D-ring for fall arrest purposes, they can also have multiple points of attachment as described below.

### Type 'A' - Arrest

The Type 'A' connection, commonly referred to as the dorsal D-ring, is the proper connection point for almost every fall arrest system. This connection may include an extension or integral energy absorber.



### Type 'P' - Positioning

This harness has a D-ring located on each side of the worker's waist. It is used primarily by individuals in a work positioning situation.

### Type 'D' - Descent

This harness has D-ring(s) located in the front of the harness at mid-torso height. It is used for controlled descent, rescue or self-retrieval situations.

### Type 'L' - Ladder Climbing

This harness has a D-ring located at chest level in the front of the harness.It is used as an attachment point for connecting to a ladder climbing device.

### Type 'E' - Entry/Exit

This harness has two D-rings located on top of the shoulder straps and is used predominately in confined space situations.

## Harness Donning

Properly don the full body harness to allow for increased suspension time and minimize injuries during a fall. Be sure to follow the manufacturer's written instructions for donning.

Although each harness has unique instructions based on its design, there are four key adjustments to remember when donning a harness properly.

**NOTE**
To ensure proper fit, conduct a harness partner check after donning and adjusting the full body harness.

## HARNESS INSPECTION

**MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:**

- ✓ Complete a pre-use inspection prior to use. Some manufacturers require a post use inspection.
- ✓ Complete formal inspections on an annual basis by a competent person (manufacturer defined). Record inspection in an equipment logbook.
- ✓ Remove unsafe equipment from service and either destroy or return to the manufacturer for possible repair.

**PRE-USE VISUAL INSPECTION REQUIREMENTS:**

- ✓ Check harness for manufacturer's labeling.
- ✓ Check webbing for cuts, tears, burns, worn stitching, excessive abrasion, chemical contamination and UV degradation.
- ✓ Check all metal component (buckles, grommets, D-rings, etc.) for cracks, corrosion, deformation and missing hardware.
- ✓ Check for missing keepers.
- ✓ Check for modifications such as cut straps or items stitched to webbing.

### 4. Body Landmark:

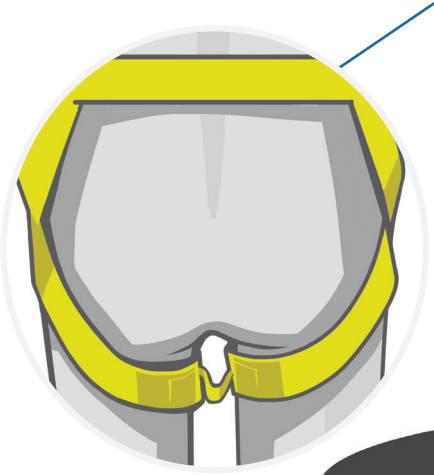
Ensure the dorsal D-ring lies down the center of the spine between the shoulder blades.

### 3. Body Landmark:

Ensure the chest strap (if present) is positioned the proper distance below the neck line and prevents the shoulder straps from coming off the body.

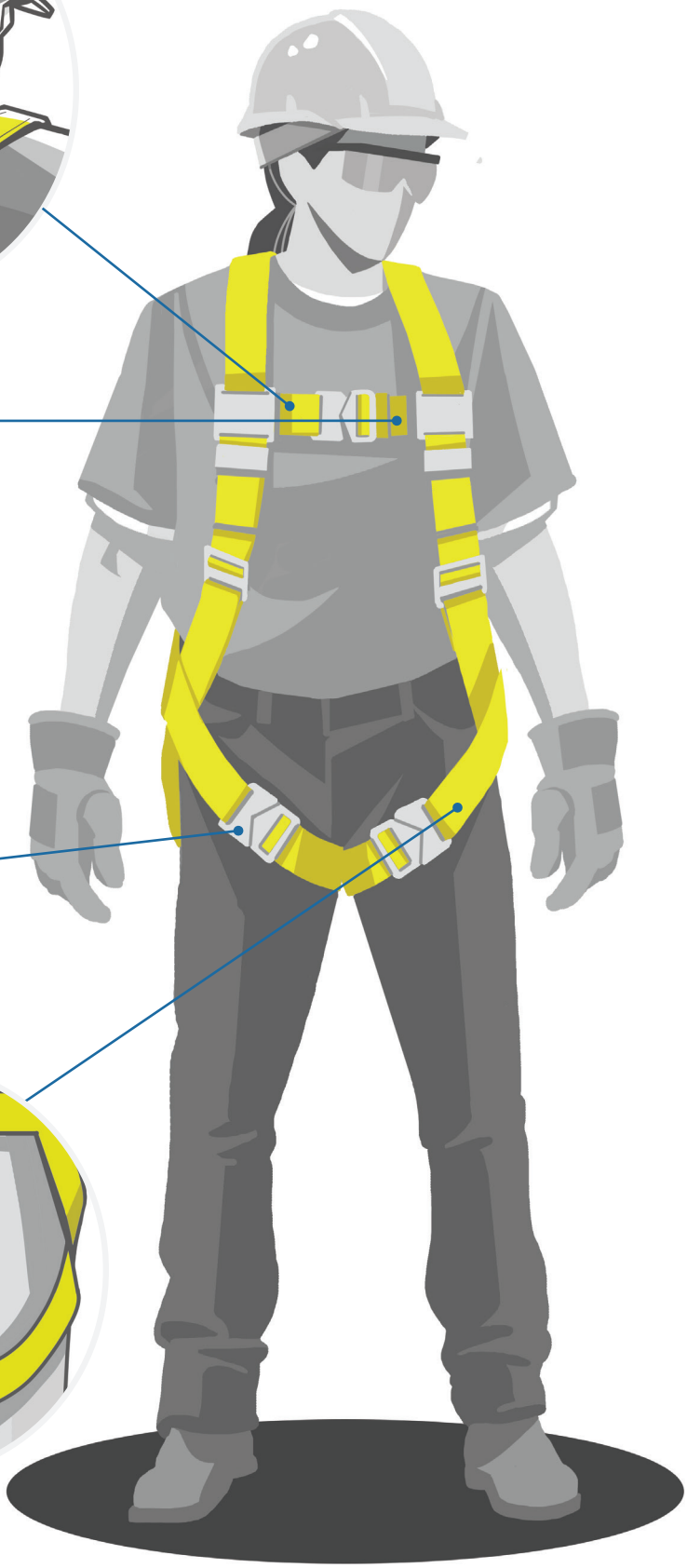
### 2. Body Landmark:

Ensure leg straps are properly positioned, not twisted/crossed-over and have proper tension.



### 1. Body Landmark:

Ensure the sub-pelvic strap lies directly below and not across the buttock.



## BODY HARNESS PRACTICAL EXERCISE

### Step 1:

Inspection - Complete a pre-use visual inspection of the harness per the criteria identified

### Step 2:

Buckles and Twists – Lay out the harness on a flat surface, or hang up and undo all twists in the webbing and ensure all buckles are undone and hang free

### Step 3:

Pockets – Empty pockets of keys or other obstructions that lie between the leg strap and the body

### Step 4:

Donning – Don the harness ensuring it goes on twist free

### Step 5:

Sub-Pelvic Strap – Adjust sub-pelvic strap to just beneath the buttocks; this is typically done by adjusting the torso length on a harness

### Step 6:

D-ring - Position dorsal D-ring along the spine at shoulder blade height. If the D-ring is adjustable it can be done after Step 8

### Step 7:

Leg Straps – Connect leg straps and adjust tension; straps should be snug, but not tight, free from twists and not crossed over, “high and tight”

### Step 8:

Chest Strap - (if present) positioned correctly so as to firmly keep the shoulder straps in position

### Step 9:

Keepers - Perform strap management, use keepers or strap holders provided by the manufacturer

### Step 10:

Partner Check – a partner checks that steps 4-9 are done correctly

### Step 11:

Doffing – Remove harness in reverse order

### Step 12:

Storage – Hang in a clean and dry environment from the dorsal D-ring

## EXERCISE

1. What are the four key adjustments when fitting a harness properly?

2. What type of fall arrest system attaches to the chest level (Sternal) D-ring on a harness?

3. What is the appropriate fall arrest attachment point for all full body harnesses?

# CHAPTER 6:

# Working at Elevated Locations

## OUTCOME

Describe specific applications for work at elevated locations.

## OBJECTIVES

Upon completion of this chapter, you should be able to:

1. Explain the correct application of work positioning.
2. Discuss guidelines for working on ladders.
3. Identify the fall protection systems used for elevated work platforms.

## INTRODUCTION

Persons at risk of falling typically prevent their fall by maintaining a firm attachment using their feet on a flat surface, hands and feet on a more vertical surface, or a combination of hands and feet with an external device that may support a worker in a vertical work location. These types of attachment to a structure are the methods of primary attachment. Maintaining the worker's primary attachment mitigates the fall hazard.

There are a wide variety of temporary work platforms and personal carry devices, including:

» Ladders
» Aerial lifts
» Scaffolding

## SPECIALTY SOLUTIONS/ SITUATIONS

### Work Positioning

The purpose of work positioning is to free up the worker's hands and better position the worker to complete the job. This can be accomplished by anchoring a belt or a saddle to the structure. Workers typically position themselves off to structures such as fixed ladders, towers, and rebar/form work.

### Ladders

Ladders serve as an excellent means of accessing elevated work areas, but despite ladders being an excellent work tool, they can be dangerous if not operated and maintained in the proper fashion. Falling accidents from ladders account for a significant percentage of the total number of falls in the work place each year.

### Ladder Hazards and General Safety Practices

Injury statistics show that the use of ladders presents many hazards. Injuries involving ladders frequently cause permanent disability.

Adhere to general ladder safety practices to reduce your risk of injury when using a ladder:

- Use the correct ladder for the job or situation.
- Conduct a visual pre-use and post-use ladder inspection.
- Maintain three-point contact as you move on the ladder.
- Face the ladder rungs at all times.
- Stay within the side rails of the ladder.
- Never stand any higher than the third rung from the top of the ladder.
- Assess hazards that may arise from the work area.

In addition to adhering to ladder safety rules, a worker should also incorporate the use of a personal fall arrest system when working from a ladder.

### Activity: Ladder Questions

**At what height is fall protection required on a portable ladder?**

**Is a fall arrest system required when climbing a portable ladder?**

**When a personal fall arrest system is not feasible, what requirements are necessary to allow a worker to use a portable ladder above 3 m (10 ft)?**

1) _____

2) _____

3) _____

**CAUTION**

Work positioning systems normally take the place of the worker's hands and are thus considered a primary means of protection. A PFAS must be used whenever a work positioning system is utilized to provide the required secondary means of protection.

## EQUIPMENT INSPECTION: WORK POSITIONING DEVICE

### MANUFACTURERS INSPECTION AND RE-CERTIFICATION REQUIREMENTS:

- ✓ Complete a pre-use inspection prior to use.
- ✓ Complete formal inspections on an annual basis by a competent person (manufacturer defined). Record inspection in an equipment logbook.
- ✓ Remove unsafe equipment from service and either destroy or return to the manufacturer for possible repair.

### PRE-USE VISUAL INSPECTION REQUIREMENTS:

- ✓ Check for manufacturer's labeling.
- ✓ Check rope for cuts, tears, burns, worn stitching, excessive abrasion, chemical contamination and UV degradation.
- ✓ Check all hardware components for cracks, corrosion, deformation and properly functioning gates.

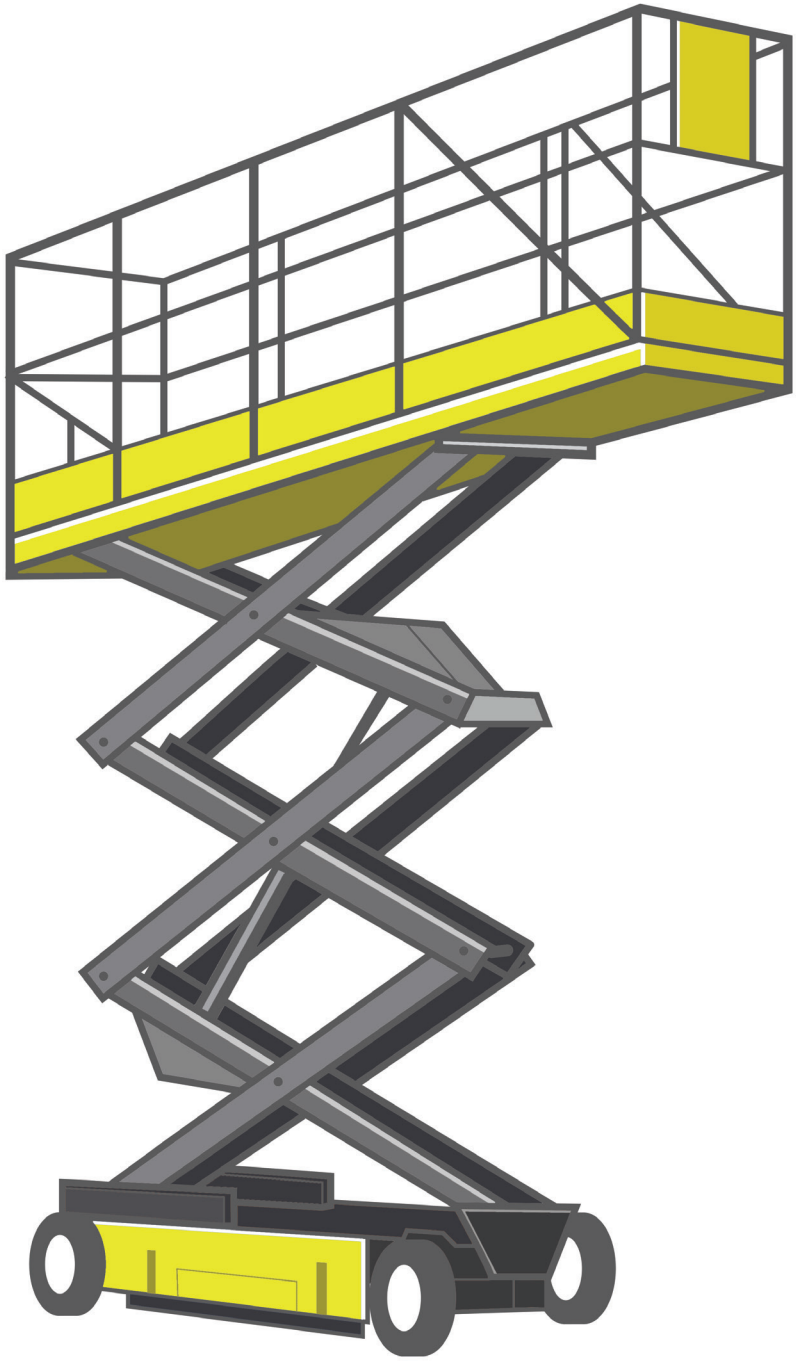
## Mobile Elevating Work Platform (MEWP)

Mobile Elevated Work Platforms are telescoping or articulating units used for positioning a personnel-carrying basket, bucket, platform or other device at an elevated work location. Workers may use many types and styles of aerial lifts on a daily basis.

Regardless of the type, these lifts can provide a safe manner for workers to access elevated work areas when used correctly.However, over the years several workers have been ejected or fallen from aerial lifts due to user error or contact from other machinery or structure. As such, workers are required to use either a travel restraint or a personal fall arrest system while working in these lifts at elevated locations.

### KEY POINTS TO REMEMBER

- Use the lift in accordance with manufacturer's specifications.
- When using a travel restraint or personal fall arrest system, connect to the approved anchor point on the lift specified by the manufacturer or professional engineer.
- Select a connector, such as an adjustable lanyard, that allows the worker sufficient movement to complete the job, yet minimizes free fall distance.



## Scaffolding

Scaffolding can be divided into two major categories; suspended scaffolding and supported scaffolding. Workers erecting, using or dismantling scaffolding from either of these categories require some form of fall protection when working over 3 m (approx. 10 ft). The fall protection requirement for suspended scaffolding is a personal fall arrest system. For supported scaffolding, fall protection may be provided in the form of either a guardrail, travel restraint or personal fall arrest system.

When using a fall arrest system on suspended scaffolding, the anchor points for the system must be independent of the scaffolding. The best anchor point for a fall arrest system on a supported scaffolding is the structure beside or above the scaffolding. Using the scaffolding as the anchor point is a last resort, and requires approval from an engineer or system designer. It is the responsibility of the worker to ensure the scaffolding is engineer certified for use as an anchor point before employing as part of a personal fall arrest system.

**CAUTION**
Refrain from using scaffolding as an anchor point for a personal fall arrest system without the approval of the manufacturer or an engineer.

## EXERCISE

1. When practical, what rules must a worker follow to allow them to work from a ladder?

2. A fall arrest system is required during the erection and dismantling phases of scaffolding.
   True
   False

3. Workers can anchor their fall protection system on properly erected scaffolding.
   True
   False

4. What is the fall protection system on a suspended scaffold?

5. When is fall protection required on ladders?

6. A fall arrest system is required when using a work positioning system or descent control device.
   True
   False

7. Travel restraint should be your first choice when working in an aerial lift.
   True
   False

## NOTES

# CHAPTER 7:

# Equipment Care

## OUTCOME

Explain the proper care of fall protection equipment.

## OBJECTIVES

Upon completion of this chapter,
you should be able to:

1. Describe the pre-use inspection, maintenance and storage criteria for fall protection equipment.
2. Use a pre-use inspection to identify when to remove fall protection equipment from service.

## INTRODUCTION

One of the keys to a successful fall protection program is proper inspection, storage and maintenance of the equipment. As a rule of thumb, always comply with the manufacturer's specific instructions.

## EQUIPMENT CARE

### Inspection

Similar to other safety equipment, fall protection equipment must be inspected on a regular basis. It is the responsibility of the worker to complete the inspection process designed to detect any potential problems with the proper functioning of the equipment.

### When should a worker inspect his/her fall protection equipment?

### Inspection of equipment can be divided into two categories:

**Hardware:**
Any component which is made of metal.

Look for malfunction, cracks, corrosion, burrs, discoloration, bends, deformation and any other feature making the piece of hardware look different from when it was new. Ensure all moving components function properly such as locking gates on snap hooks and carabiners.

**Software:**
Any synthetic component of the system.

Look for missing labels, melting, stiffer areas, worn stitching, abrasion, chemical damage, discoloration, or any other signs of general damage. Attempt to inspect the inside of certain synthetics, such as three strand rope lanyards or lifelines. Look for any signs indicating excessive exposure to ultra-violet light or contact with harmful chemicals, such as solvents, cleansers, bleaches or other work site corrosive.

### GENERAL GUIDELINES FOR EQUIPMENT CARE

- Equipment which has seen fall arresting service must be removed from service.
- Equipment inspected and recertified by the manufacturer qualified person may be returned into service.
- Do not use fall protection equipment for purposes other than fall protection.
- Adhere to all manufacturers' specifications for inspection, storage and maintenance of their equipment.

## Activity: Equipment Inspection

Inspect each item. Using the chart below, indicate whether the item has passed or failed inspection. Provide a reason for failure where applicable.

| ITEM NUMBER | PASS / FAIL | REASON FOR FAILURE |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |

## Maintenance

### Software:

Synthetic material is often soiled with various substances.

### Solution:

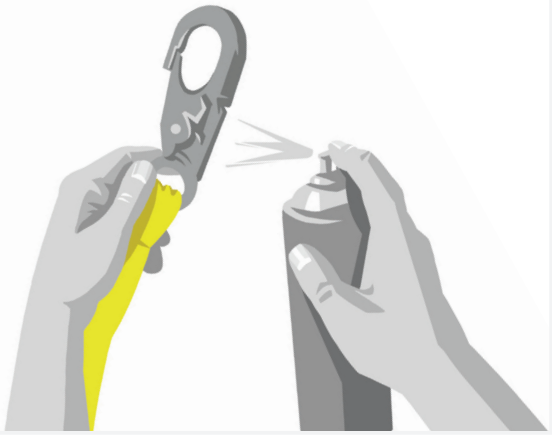
Where no damage has occurred, hand wash using warm water, a mild non-detergent soap or manufacturer approved cleaning solution and a soft bristle brush. Hang to dry.

### Hardware:

The locking mechanisms on the hardware may become sticky due to dirt or other substances.

### Solution:

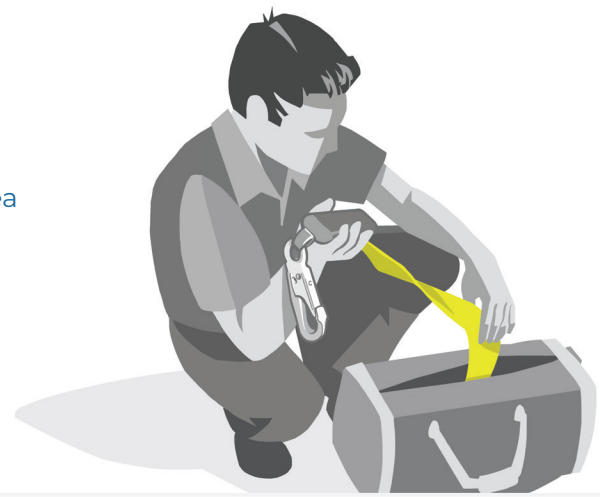
Lubricate all moving mechanisms according to manufacturer's recommendations. Wipe any excess lubrication away to prevent attracting grit.



## Storage

**Follow these basic rules for proper storage:**

1. Store equipment in a ..... , ..... environment.
2. ..... wet equipment to dry before storing it away.
3. Avoid storing the equipment in an area which has excessive exposure to ..... .
4. ..... of your own personal fall protection equipment.



## EXERCISE

1. What should you look for when conducting a pre-use inspection of equipment?

2. When should equipment be taken out of service?

3. What should you do if you identify worn or damaged equipment?

# CHAPTER 8:

# Rescue

## OUTCOME

Describe the need for rescue and self rescue.

## OBJECTIVES

Upon completion of this chapter,
you should be able to:

1. Identify the factors to consider in a pre- and post- fall rescue plan.
2. Explain the effects of suspension trauma and the techniques to mitigate them.
3. Identify the criteria to consider for a fall rescue of an employee working alone.
4. Discuss the necessary contents of a basic fall rescue protection kit.

## INTRODUCTION

The first step in achieving a prompt rescue is to develop the rescue plan. One of the key principles to keep in mind during a rescue is personal safety.

# RESCUE

## Rescue Concepts, Principles and Planning

As you have learned during this program, there are four components to a complete personal fall arrest system. The fourth component is rescue, which involves ensuring that each suspended worker can be promptly and safely delivered to ground level. It is not permitted for companies to rely on 911 or other emergency services to provide rescue in all situations. In many cases, an outside agency may not be able to provide prompt rescue for various reasons.

### Why should a company maintain on-site rescue capabilities?

Rescue technique training is beyond the scope of this course as it may require extensive practice with various systems to safely and effectively retrieve a suspended worker. Too often, persons not trained in rescue are seriously injured attempting to rescue a co-worker. One of the key principles to keep in mind during a rescue is personal safety. Although you may not be trained in rescue, there are several things that can be done prior to beginning work to help ensure a prompt rescue.

1. Develop a **Rescue Plan** prior to starting the job.
    - Identify rescue personnel and communication method.
    - List types and location of rescue equipment.
    - Define the procedures for rescue techniques.
    - Identify methods to protect the rescuer during the rescue.
    - Contact outside emergency services.
2. Ensure the fall protection system is set up properly.
3. Choose the fall protection system that allows for the easiest rescue, for example a SRD-R.

## Rescue Plan

In the event a person is suspended in a harness, we now recognize the importance of promptly retrieving the worker to avoid suspension trauma. The first step in achieving a prompt rescue is to develop the rescue plan.

In situations where emergency services may not be capable of completing the rescue, the employer must further develop the rescue plan to ensure a prompt rescue.

Address the following topics in the rescue plan:

- ☐ Fall hazard areas
- ☐ Factors contributing to falling accidents
- ☐ Difficult rescue areas
- ☐ Fall protection methods and equipment
- ☐ Equipment inspection
- ☐ Role of each worker in the event of a rescue
- ☐ Location and directions to nearest medical facility
- ☐ Primary and secondary evacuation routes
- ☐ Method of deployment for emergency services
- ☐ Ambulance meeting locations
- ☐ Probable rescue procedures
- ☐ Rescue equipment and location
- ☐ Terrain considerations
- ☐ Rescue anchor options

## Suspension Trauma

A person suspended in a full body harness may succumb to suspension trauma which occurs due to reduced blood circulation and lack of movement causing blood to pool in the legs. The length of time a person can hang in a harness before developing suspension trauma varies greatly and depends on many factors such as harness type and fit, injuries sustained in the fall, level of consciousness and individual physiology. The symptoms of suspension trauma can include nausea, sweating, dizziness and unconsciousness.

If not addressed immediately, the effects of suspension trauma may result in permanent medical complications and even death. This is the main reason for prompt rescue requirements at any work site. All rescue personnel must be trained to recognize the signs and symptoms of suspension trauma and the procedure for lowering a victim who may be experiencing this condition.

If you are suspended in your full body harness, try these actions to delay the effects of suspension trauma:

- Place one or both feet onto surrounding structure to elevate the legs.
- Bring your knees to your chest and hold.
- Flex and release leg muscles.
- Use suspension relief straps attached to your harness. For harnesses that are not equipped, these straps are sold separately and need to be attached to your harness prior to falling.

**CAUTION**

**Prolonged Suspension**

Avoid prolonged harness suspension at all times, whether in practice, training or after a fall.

**CAUTION**

Assume the person suspended in the harness has supsension trauma. Follow standard first aid procedures.

## BODILY REACTIONS TO HARNESS SUSPENSION

### 3. BRAIN

» Oxygen deprivation of the brain may lead to fainting and eventual death.

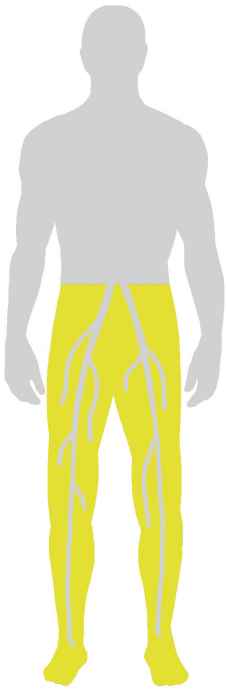
### 2. HEART



» Drop in blood return to the heart.

» Oxygen supply to the brain and other vital organs is reduced.

### 1. LEGS



» Femoral veins compressed by harness leg straps.

» Skeletal muscle pumps in legs are less active or completely inactive.

» This causes blood to pool in the victim's legs.

## Post Fall Protocol / Options

Each employer or contractor has specific post fall protocol / options. Because these options may vary from site to site, it is important to check with your employer. Have a plan as you cannot rely on 911. Additional training is required to be a Rescuer.

Examples of post fall protocol could include:

- Contact Emergency Services
- Ensure rescue is complete
- Gather witness statements
- Complete incident report
- Clean up site and remove used equipment from service
- Meet with safety officer, foreman and site superintendents
- Review fall protection plans
- Replenish all first aid and rescue kits
- Replace used fall protection equipment

**CAUTION**

Contact emergency services after a fall where a worker is suspended in their fall protection system.

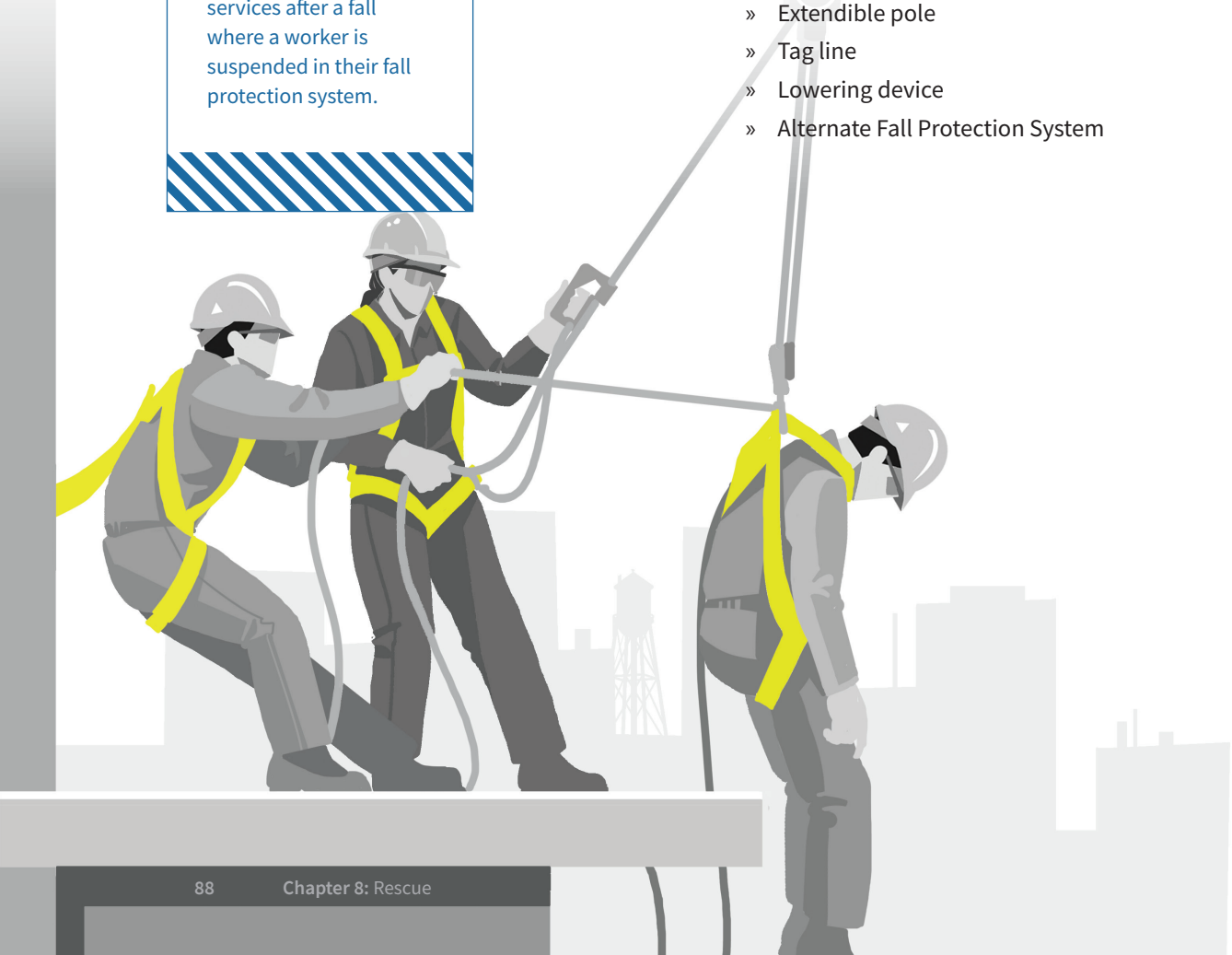
## Working Alone

For workers who are alone at height, the rescue component must also address the method of communicating to others that a fall has occurred and that assistance is required. What is meant by working alone? A person is alone at work when they are on their own; when they cannot be seen or heard by another person.

## Rescue Equipment

Rescue equipment is a very important part of the rescue program. It is important to establish a rescue kit containing all of the necessary tools used during a rescue. Ensure a complete rescue kit is present whenever workers are working at height. Below is a sample list for a basic rescue kit:

- Rope
- Raising device
- Cable slings
- Carabiners
- Rescue cradle
- Rescue ladder
- Remote hook
- Extendible pole
- Tag line
- Lowering device
- Alternate Fall Protection System



## EXERCISE

1. What must you ensure when considering 911 as part of your rescue plan?

2. What can you do prior to work starting to ensure you can conduct a safe and prompt rescue?

3. What can you do to delay the effects of suspension trauma?

4. What is the definition of working alone? What considerations do you need to take in your rescue plan?

5. List some rescue equipment that you have available on your worksite.

# CHAPTER 9:

# Assessing Fall Hazards - Practical Application

## OUTCOME

Identify the proper controls to prevent fall hazards.

## OBJECTIVES

Upon completion of this chapter,
you should be able to:

1. Evaluate a fall protection system.

## INTRODUCTION

To provide proper fall protection for workers, it is critical to gain an understanding of the hazards associated with the task. The first step in the process is to conduct a fall hazard assessment of the task. This assessment analyzes each step in the task and provides solutions aimed at reducing or eliminating the chance of falling.

## ASSESSING FALL HAZARDS

To provide proper fall protection for workers, it is critical to gain an understanding of the fall hazard situation. The first step in the process is to conduct a fall hazard assessment. This assessment process analyzes the key aspects of the situation and provides abatement methods aimed at reducing or eliminating fall accidents or injuries.

The fall hazard assessment is typically completed using a form provided or created by the employer (see Appendix B for a sample form). Many of these forms are customized to the workplace or the company, but there are also several generic versions available.

Regardless of the version used, most hazard assessment forms ask questions which include, but are not limited to:

- Description of the work area / surface
- Number of workers
- Type of work performed
- Frequency of the work duty performed
- Distance to the surface below
- Description of surface below
- Identifying other hazards in the work area
- Calculating Required Clearance.

Upon completion of a fall hazard assessment, the worker is able to identify the proper fall protection method for the situation or evaluate the fall protection system already in place. For the Practical Exercise on the next page, you will assess the fall hazards present for the given situation to determine the proper controls.

## Fall Hazards Practical Exercise

The worker has been tasked with completing final inspection of a newly erected steel structure. As part of his duties, he must climb over the guardrail and walk out on the lower horizontal beam.

Look at each illustration and answer the corresponding questions.

What are the potential hazards to the worker given the current system?

What are the possible solutions?

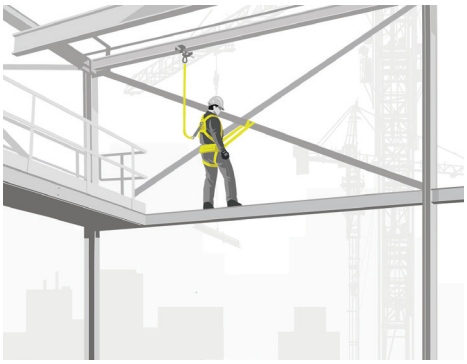
| | | |
|---|---|---|
| **L = Lanyard** | **6 ft** | **1.8 m** |
| **DD = Deceleration** | **4 ft** | **1.2 m** |
| **H = Height of Suspended Worker** | **6 ft** | **1.8 m** |
| **SM = Safety Margin** | **2 ft** | **0.6 m** |

What systems is the worker using?

What is the worker's required clearance?

Are there any other hazards or problems with the system components?

Is there anything missing for the worker to complete the task?



# APPENDICES

# APPENDIX A

## Jurisdictional Requirements for Fall Protection

### When Fall Protection is Required

OH&S regulations specify when fall protection for workers working at heights is required, based on:

» How high up they are (typically 3 metres or higher);
» The surface or platform they work on, for example, vehicles, scaffolding, sloped roofs; and
» What they are at risk of falling through, on or into, for example, machinery, hard surfaces, water.

Although the approach is the same, specific criteria vary by location across Canda:

| JURISDICATION | FALL PROTECTION MANDATORY FOR WORKERS WORKING: |
|---|---|
| **Federal** | » On unguarded structure or vehicle > 2.4 m above nearest safe level, moving parts of machinery or other surface/thing likely to cause injury by contact;<br>» On temporary structure > 6 m above permanent safe level;<br>» On ladder > 2.4 m above nearest permanent safe level where worker can't use at least one hand to hold ladder (OHS Regs, Sec. 12.10(1)) |
| **Alberta** | » On portable ladder 3 m or higher (OHS Code, Sec. 137(1))<br>» On temporary or permanent work area or structure where there's risk of falling:<br>i. 3 m or more;<br>ii. < 3 m but unusual possibility of injury exists;<br>iii. Into or onto a hazardous substance or object;<br>iv. At a permanent work area, a vertical distance of more than 1.2 metres and less than 3 metres.<br>v. At a permanent work area, a vertical distance of more than 1.2 m and less than 3 m |
| **British Columbia** | Where they risk falling 3 m or more<br>» Where they risk falling < 3 m but risk of injury is greater than risk of injury from impact on flat surface (OHS Reg., Sec. 11.2(1)) |
| **Manitoba** | Where they risk falling:<br>» 3 m or more<br>» < 3 m but risk of injury is greater due to surface or item they may land on<br>» Into operating machines or moving parts<br>» Into water or other liquids<br>» Into or onto a hazardous substance or object<br>» Thru an opening on a work surface<br>» >1.2 m from area used as path for wheelbarrows or similar equipment<br>» (Workplace Safety & Health Regs., Sec. 14.1(1)) |

| JURISDICATION | FALL PROTECTION MANDATORY FOR WORKERS WORKING: |
|---|---|
| **New Brunswick** | Where they risk falling from:<br>» Unguarded work area:<br>i. 3 m or more above nearest safe level<br>ii. Above surface or thing that may hurt on contact<br>iii. Above open top tank, pit or vat<br>iv. Work platform 3 m or more above permanent safe level and from which they may fall if platform tips or fails<br>» Communication or power transmission tower or similar structure 3 m or more-high<br>» In a work area that a govt official says requires a fall-arrest system (OHS General Regs., Sec. 49(1)) |
| **Newfoundland & Labrador** | Where they risk fall from work area:<br>» 3 m or more above nearest safe surface or water<br>» Above surface or thing that could cause injury were worker to fall on it<br>» Above open tank, pit or vat containing hazardous material (OHS Regs., Sec. 141(a)-(c)) |
| **Nova Scotia** | » 3 m or more above nearest safe surface or water<br>» Less than 3 m when the work area is above one of the following:<br>i. a surface or thing that could cause injury to the person on contact that's worse than an injury from landing on a solid, flat surface<br>ii. exposed hazardous material, such as in an open tank, pit or vat (Workplace Health Safety Regs., Sec. 21.2(1)) |
| **Ontario** | GENERAL INDUSTRY<br>Where they risk falling 3 m or more (Ind. Est. Regs., Sec. 85)<br>CONSTRUCTION<br>Where they risk falling:<br>» > 3 m<br>» > 1.25 m if work area used as path for wheelbarrows or similar equipment<br>» Into operating machinery<br>» Into water or another liquid<br>» Into or onto a hazardous substance or object<br>» Through an opening on work surface (Const. Proj. Regs., Sec. 26);<br>» When getting on or off suspended platform, suspended scaffold or boatswain's chair (Const. Proj. Regs., Sec. 141(1)) |

| JURISDICATION | FALL PROTECTION MANDATORY FOR WORKERS WORKING: |
|---|---|
| **Prince Edward Island** | » 3 m or more above nearest safe surface or water<br>» Above surface or thing that could cause injury were worker to fall on it<br>» Above open tank, pit or vat containing hazardous material (Fall Prot. Regs., Sec. 2(1)) |
| **Québec** | GENERAL INDUSTRY<br>Where they risk falls of > 3 m unless protected by equivalent safety device or safety net or they` re just using some means of egress or ingress (Reg. respecting OH&S, Sec. 346)<br>CONSTRUCTION<br>Where they risk falls of > 3 m<br>» Where they risk falling:<br>i. i. Into dangerous liquid or substances<br>ii. ii. Onto moving components<br>iii. iii. Onto dangerous equipment or material<br>iv. iv. From 1.2 m or more when using a wheelbarrow or vehicle<br>v. (Safety Code for Const. Ind., Sec. 2.9.1.) |
| **Saskatchewan** | Where they risk falls of:<br>» 3 m or more<br>» < 3 m but there's a chance of injury (OHS Regs., Sec. 116(2)) |
| **Northwest Territories & Nunavut** | » 3 m or more above grade or floor level<br>» Over a pit or shaft or operating machinery<br>» Where a fall could lead to drowning (General Safety Regs., Sec. 57(1)) |
| **Yukon** | » Where they risk falls of 3 m or more<br>» Where they risk falls of < 3 m but there's an unusual risk of injury<br>» Where they risk falling into pits, shafts, machinery, water or bulk material that can shift (OHS Regs., Sec. 1.37) |

## APPENDIX B

# Sample Only

## General Hazard Assessment and Inspection Form:

## Location/Project #: Date/Time:

**Areas to discuss and review for Hazards**

| Conducted by: | (Name) | (Position) |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

**Here are some common areas that should be reviewed on any work site. This sample is to be used as an aid. All possible hazards must be assessed for each individual project.**

**Sample concerns include Fall Protection, Ladders, Egress/Access, Housekeeping, Equipment, Guards, PPE, Overhead Obstructions, Material Storage, Weather Condition, WHMIS, Signage, Electrical, Scaffolds, Worker Competence, Material Handling, Musculoskeletal Injuries, Public, Working Alone, Other Trades etc.**

| Item # | Priority | Identified Hazards | Specific Location of Hazard |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| Corrective Action: | | | |

| Item # | Recommended Action: | Name: | Date: |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| Copies to: | (For Action) | (For Information) |
|---|---|---|
| | | |
| | | |
| | | |
| Superintendent Signature: | | Date: |

**Hazard Priority (Status): 1 – Imminent Danger 2 – Serious 3 – Minor 4 – Ok 5 – Not Applicable**

## APPENDIX C

# Sample Fall Protection Plan

| |
|---|
| **COMPANY / WORK SITE NAME:** |
| **ADDRESS / LOCATION:** |
| **Fall Hazards**<br>Identify all existing and potential fall hazards associated with the work site |
| |
| **Fall Protection Systems to be Used**<br>Identify the fall protection systems to be used at the work site to protect workers from the fall hazard (i.e. travel restraint, personal fall arrest system, safety net, control zone, etc.) |
| |
| **Anchors to Be Used During the Work**<br>Identify the anchords, both eningeered and improvised, that workers are to use |
| |
| **Clearance Distance(s) to be Confirmed**<br>Clearance distances must be sufficient to prevent a worker from striking the ground, an object, or level below the area |
| |
| **Procedures**<br>Identify detailed procedures to assemble, inspect, use, maintain and dismanlte the fall protection system identified above |
| |
| |
| |
| |
| |
| **Rescue Plan**<br>Describe the procedures that will be followed if a worker falls and needs to be rescued |
| |
| |
| |
| |
| **This Fall Protection Plan was Developed by:** |

| | | |
|---|---|---|
| **Name:** | **Signature:** | **Date:** |

| Workers signing this form acknowledging that they have reviewed and understand this fall protection plan. | | | |
|---|---|---|---|
| **Date** | **Print Name** | **Signature** | **Trained in the safe use of the fall protection equipment?** |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |
| | | | Yes ☐ No ☐ |

# APPENDIX D

## Jurisdictional Requirements for Fall Protection

### Maximum Fall Arrest Free Fall Distances & Arresting Forces

Fall arrest systems don't prevent falls, but they can stop the worker from plunging too far. However, the action of arresting a fall can put a lot of stress on the body, creating physical shock that can injure or even kill the worker. Accordingly, fall arrest systems are subject to strict design, use and installation requirements regarding:

» How far they can let a worker fall before arresting it; and

» How much force they can exert on the worker's body in arresting the fall.

| JURISDICATION | MAXIMUM FREE FALL DISTANCE (ASSUMING NO SHOCK ABSORBER USED) | MAXIMUM ARRESTING FORCE (IN KILONEWTONS (KN)) |
|---|---|---|
| **Federal** | 1.2 metres | 8 kN |
| **Alberta** | 1.2 metres | 6kN (unless worker is using E6 shock absorber ) |
| **British Columbia** | 1.2 metres | Not specified in Regs. but WorkSafeBC guidelines stipulate 8 kN |
| **Manitoba** | 1.2 metres | 8 kN |
| **New Brunswick** | 1.8 metres | 8 kN |
| **Newfoundland & Labrador** | 1.22 metres | As specified in CSA standard applicable to equipment used |
| **Nova Scotia** | As specified in latest version of CSA standard CSA Z259.16, "Design of active fall-protection systems" | As specified in latest version of CSA standard CSA Z259.16, "Design of active fall-protection systems" |
| **Ontario** | GENERAL INDUSTRY<br>1.5 metres<br><br>CONSTRUCTION<br>0.6 metres | GENERAL INDUSTRY<br>8 kN<br><br>CONSTRUCTION<br>8 kN |
| **Prince Edward Island** | 1.22 metres | As specified in CSA standard applicable to equipment used |

| JURISDICATION | MAXIMUM FREE FALL DISTANCE (ASSUMING NO SHOCK ABSORBER USED) | MAXIMUM ARRESTING FORCE (IN KILONEWTONS (KN)) |
|---|---|---|
| **Québec** | 1.2 metres | As specified in CSA standard applicable to equipment used |
| **Saskatchewan** | 1.2 metres | 8 kN |
| **Northwest Territories & Nunavut** | 1.2 metres | 8 kN |
| **Yukon** | 1.2 metres | As specified in CSA standard applicable to equipment used |

# APPENDIX E

## Where and When a Fall Protection Program is Required

Although required fall protection measures are roughly the same across Canada, nine jurisdictions require employers to codify everything in a written document called a fall protection program or plan. Here's a look at where fall protection programs are required and under which circumstances.

| JURISDICATION | FALL PROTECTION MANDATORY FOR WORKERS WORKING: |
|---|---|
| **Alberta** | Workers are at risk of falling 3 or more metres and there are no guardrails |
| **British Columbia** | Workers are at risk of falling 7.5 metres or more metres and there are no guardrails or fall arrest systems are not practicable |
| **New Brunswick** | Code of practice required when fall protection is required (See A above), and one of the following 3 things is true:<br>i. Workers are working at height of 7.5 metres or more<br>ii. Employer uses a safety monitor and work procedures when weatherproofing as means of fall protection<br>iii. A government officer requires a written code of practice |
| **Newfoundland & Labrador** | Fall arrest systems or safety nets are the principle means of fall protection |
| **Nova Scotia** | Fall protection is required and maximum fall distance is less than 7.5 metres |
| **Prince Edward Island** | Fall arrest systems or safety nets are the principle means of fall protection |
| **Saskatchewan** | Workers are at risk of falling 3 or more metres and there are no guardrails or similar barriers in place |
| **Yukon** | Workers are at risk of falling 7.5 or more metres and there are no guardrails |

# LIFE SAVING RULES

## CONFINED SPACE

**Obtain authorization before entering a confined space**

- I confirm energy sources are isolated
- I confirm the atmosphere has been tested and is monitored
- I check and use my breathing apparatus when required
- I confirm there is an attendant standing by
- I confirm a rescue plan is in place
- I obtain authorization to enter

## WORKING AT HEIGHT

**Protect yourself against a fall when working at height**

- I inspect my fall protection equipment before use
- I secure tools and work materials to prevent dropped objects
- I tie off 100% to approved anchor points while outside a protected area

## WORK AUTHORIZATION

**Work with a valid permit when required**

- I have confirmed if a permit is required
- I am authorized to perform the work
- I understand the permit
- I have confirmed that hazards are controlled and it is safe to start
- I stop and reassess if conditions change

## ENERGY ISOLATION

**Verify isolation and zero energy before work begins**

- I have identified all energy sources
- I confirm that hazardous energy sources have been isolated, locked, and tagged
- I have checked there is zero energy and tested for residual or stored energy

## LINE OF FIRE

**Keep yourself and others out of the line of fire**

- I position myself to avoid:
  - Moving objects
  - Vehicles
  - Pressure releases
  - Dropped objects
- I establish and obey barriers and exclusion zones
- I take action to secure loose objects and report potential dropped objects

## BYPASSING SAFETY CONTROLS

**Obtain authorization before overriding or disabling safety controls**

- I understand and use safety-critical equipment and procedures which apply to my task
- I obtain authorization before:
  - Disabling or overriding safety equipment
  - Deviating from procedures
  - Crossing a barrier

## DRIVING

**Follow safe driving rules**

- I always wear a seatbelt
- I do not exceed the speed limit, and reduce my speed for road conditions
- I do not use phones or operate devices while driving
- I am fit, rested and fully alert while driving
- I follow journey management requirements

## HOT WORK

**Control flammables and ignition sources**

- I identify and control ignition sources
- Before starting any hot work:
  - I confirm flammable material has been removed or isolated
  - I obtain authorization
- Before starting hot work in a hazardous area I confirm:
  - A gas test has been completed
  - Gas will be monitored continually

## SAFE MECHANICAL LIFTING

**Plan lifting operations and control the area**

- I confirm that the equipment and load have been inspected and are fit for purpose
- I only operate equipment that I am qualified to use
- I establish and obey barriers and exclusion zones
- I never walk under a suspended load

## FIT FOR DUTY

**Be in a state to perform work safely**

- I will be physically and mentally in a state to perform my assigned duties
- I commit to not being under the influence of alcohol or drugs
- I will inform a supervisor immediately if I or a co-worker may be unfit for work

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**EnergySafetyCanada.com**