



## 24-Hr Fall Protection Competent Person Module 4

### Aerial Safety

<b>Section 4.1 Aerial Safety Tools and Equipment .....</b>	<b>3</b>
4.1.1 Safety Nets .....	3
4.1.2 Warning and Control Lines.....	5
Warning Lines.....	5
Control Lines .....	6
4.1.3 Retractable Lifelines.....	6
4.1.4 Dee-rings, Carabiners, and Snaphooks .....	7
4.1.5 Anchor Points.....	8
4.1.6 Holes and Other Openings.....	9
<b>Section 4.2 Scaffolds.....</b>	<b>10</b>
4.2.1 Supported Scaffolds .....	12
Scissor Lifts .....	12
4.2.2 Suspended Scaffolds .....	13
Boatswains' Chair.....	13
<b>Section 4.3 Aerial Work Platforms.....</b>	<b>14</b>
4.3.1 Extensible and Articulating Boom Lifts .....	14
4.3.2 Manually-Propelled Elevating Work Platforms .....	15
<b>Section 4.4 Ladders.....</b>	<b>16</b>



4.4.1 Step Ladders.....	17
4.4.2 Extension Ladders .....	18
4.4.3 Fixed Ladders .....	18
4.4.4 Climbing Ladder Fall Arrest Systems .....	18
<b>Section 4.5 Fall Protection Requirements for Roofwork .....</b>	<b>19</b>
4.5.1 Low-Sloped Roofs.....	19
4.5.2 Steep Roofs .....	19
<b>Section 4.6 Working at Heights Over or Near Water .....</b>	<b>20</b>

## Section 4.1 Aerial Safety Tools and Equipment

When performing construction work at elevated heights, it's crucial to have access to a wide range of tools and equipment to ensure safety. Necessary items include safety nets, retractable lifelines, dee-rings, carabiners, snaphooks, scaffolds, ladders, and more. Additionally, specific requirements must be met when conducting roofwork and when working near or above water. This module will provide detailed information on aerial safety, covering all the essential aspects to promote a safe working environment.

### 4.1.1 Safety Nets

Safety nets are devices designed to deflect and absorb the energy of a fall. Also, they reduce the distance a worker can fall when working at heights. As a result, these nets reduce the likelihood of a person being injured. Safety nets are crucial in the construction industry because they allow people to work at heights without limiting their movement. The following list shows the key requirements for safety net systems:

- **Installation:** Safety nets should be installed close to the working surface but no more than 30 feet below it. Keep the fall area from the walking or working surface to the net unobstructed, especially on bridges, multi-story buildings, or structures.
- **Horizontal extension:** The net must extend horizontally based on the vertical distance from the working surface:
  - Up to five feet vertical distance: Eight feet horizontal extension
  - More than five feet but up to ten feet vertical distance: Ten feet horizontal extension
  - More than ten feet vertical distance: 13 feet horizontal extension
- **Clearance:** Safety nets must have enough space below them to avoid contact with any surface or structures.
- **Impact force and drop testing:** Safety nets must be able to handle the impact of a 400-pound bag ( $30 \pm 2$  inches in diameter) of sand dropped on them.
  - To perform a drop test, drop the bag of sand from at least 42 inches above the highest walking/working surface at which workers are exposed to fall hazards. Ensure the weight can be safely retrieved after the test.
  - Drop tests must be done after installation, relocation, repairs, and at six-month intervals if left in one place. If drop-testing isn't possible, a CP must confirm the net's compliance through inspection.
  - For USACE jobs, EM 385-1-1 states that testing must be supervised by a QP and in the presence of the USACE supervisor/ Contracting Officer (KO or CO) or Contracting Officer Representative (COR).
- **Inspections and maintenance:** The nets should be inspected weekly for wear, damage, and deterioration. Any defective parts must be taken out of service. After any event that

could make the net less safe, an inspection is also necessary. Items that fall into the net must be removed promptly.

- **Mesh and border specifications:** Each safety net mesh opening must not exceed 36 square inches, with no side longer than six inches. Mesh crossings must be secured to prevent enlargement. Each net or section must have a border rope or webbing with a minimum breaking strength of 5,000 pounds.
- **Panel connections:** Connections between safety net panels must be as strong as the integral net components and spaced no more than six inches apart.

When using safety nets, keep in mind the following tips:

- Use only shackles and hooks made of forged steel.
- When debris nets are used with safety nets, secure them on top of the safety net. Ensure that they do not compromise the design, construction, or performance of the safety nets.
- Remove any materials, scrap pieces, equipment, and tools that have fallen into the safety net as soon as possible and at least before the next work shift.
- Protect safety nets from sparks and hot slag resulting from welding and cutting operations.
- Provide noncombustible barriers for welding or cutting operations above the nets and increase the frequency of inspections proportionate to the potential for damage.

Below is an image of a drop test being performed on a safety net.

**Image 1 Drop Test**



\*Source: usnetting.com

## 4.1.2 Warning and Control Lines

Warning lines and control lines are used to protect workers while doing roofing work, leading edge work, and overhand bricklaying.

### Warning Lines

If workers are engaged in roofing activities on low-sloped roofs with unprotected sides and edges six feet or more above lower levels, then a Warning Line System (WLS) along with a safety monitor system can be implemented. Warning lines are composed of either ropes, wires, or chains, and are supported by stanchions. To keep workers safe when working on roofs, follow these rules for using a WLS:

- 1) Warning lines should be put around all sides of the roof work area.
  - If no mechanical equipment is used, keep the warning line at least six feet from the roof edge.
  - If mechanical equipment is used, keep the warning line at least six feet from the roof edge in the same direction as the mechanical equipment, and at least ten feet from the roof edge in the direction perpendicular to the mechanical equipment.
- 2) A path should be created using two warning lines to connect access points, material handling areas, storage areas, and hoisting areas to the work area.
- 3) When not in use, access paths should be blocked with a barricade where they meet the warning line, or the path should be moved to prevent direct entry into the work area.
- 4) The rope, wire, or chain should be marked with highly visible material at intervals of no more than six feet.
- 5) The lowest point of the rope, wire, or chain should be at least 34 inches from the walking/working surface, and its highest point should be at most 39 inches from the surface.
- 6) Stanchions should be strong enough to withstand a force of at least 16 pounds applied horizontally at 30 inches above the walking/working surface and perpendicular to the warning line, without tipping over.
- 7) The rope, wire, or chain should have a minimum tensile strength of 500 pounds and support the loads put on the stanchions without breaking.
- 8) The warning line should be attached to each stanchion so that pulling on one section won't make adjacent sections go slack before the stanchion tips over.
- 9) Access limits should indicate that no employee is permitted to enter the area between a roof edge and a warning line unless they're doing roofing work there.
- 10) Additional fall protection is required when working outside the WLS.
- 11) Mechanical equipment on roofs should be used or stored only in areas protected by a warning line system, guardrail system, or PFAS.



For contractor employees engaged in non-roofing activities on low-sloped roofs with unprotected sides or edges, similar guidelines apply, such as setting up the warning line at least 15 feet from the edge or nearest edge of a hole and making sure no work is performed between the warning line and the hole or edge.

By following these rules, WLSs can effectively keep workers safe from falls while they work on roofs.

### **Control Lines**

Control lines are used in CAZs to restrict access to certain areas such as where leading edge work or overhand bricklaying is being done. CAZs are areas where certain work can be done without using guardrail systems, PFAS, or safety net systems. Access to the zone is restricted.

Note that USACE does not consider CAZs a suitable method for controlling exposure to fall hazards. Therefore, they cannot be used alone as a fall protection method. For leading edge work, control lines must be placed between six feet and 25 feet from the edge, while for precast concrete members, control lines must be placed between six feet and 60 feet from the edge. The line must extend the entire length of the edge, connecting to a guardrail system or wall.

For overhand bricklaying, control lines must be placed between ten feet and 15 feet from the working edge. The line must enclose all workers and be parallel to the edge.

Control lines are made of ropes, wires, or tapes, flagged at intervals of no more than six feet, and need to meet specific height and strength requirements. Specifically, control lines should be set up with the lowest point (including sag) no less than 39 inches from the walking/working surface, and the highest point no more than 45 inches from the walking/working surface (50 inches for overhand bricklaying operations). In terms of strength, control lines must possess a minimum breaking strength of 200 pounds.

On floors and roofs without pre-installed guardrail systems, CAZs must be enlarged to include all access points, material handling areas, and storage areas. For work that requires removal of guardrails, only the portion necessary for that day's work can be removed.

Overall, CAZs help manage fall risks during construction. Adhering to guidelines for control lines, marking, and access restrictions ensures that only authorized personnel are exposed to potential fall hazards while performing necessary tasks. Proper setup and maintenance of these zones help maintain a safe working environment.

### **4.1.3 Retractable Lifelines**

A retractable lifeline is a fall arrest device that should be used with other parts of a Fall Arrest System. Specific notes related to retractable lifelines are listed below:

- They should only be used by one person at a time.
- Lifelines should be inspected and maintained regularly.
- The lifelines must be installed correctly to stop a person's descent quickly if they fall.
  - If the free fall distance is two feet or less, the lifeline anchor point should be able to withstand a minimum tensile load of 3,000 pounds.
  - If the free fall distance is more than two feet, then the lifeline anchor point should be able to withstand a minimum tensile load of 5,000 pounds.

#### 4.1.4 Dee-rings, Carabiners, and Snaphooks

Hardware includes snaphooks, carabiners, dee-rings, and connectors. Dee-rings, carabiners, and snaphooks all serve a similar purpose in the construction industry, which is explained below.

- A dee-ring is a piece of hardware that is shaped like the letter D, which is used as a hooking device in most cases. It is sometimes attached to the end of a strap, chain, cable, or rope.
- A carabiner is an alternative type of dee-ring. It is a metal ring with a spring-loaded gate that is used as a connector.
- A snaphook is a type of connector that has a hook-shaped member with a closed keeper that can be opened to attach an object and automatically closes to secure the object when released.

Please take note of the following technical specifications regarding dee-rings, carabiners, and snaphooks:

- Snaphooks and carabiners must have a minimum gate strength of 3,600 pounds in all directions (see ANSI/ASSP Z359.12).
- Dee-rings, carabiners, O-rings, and snaphooks should have a minimum tensile strength of 5,000 pounds.
- Dee-rings and snaphooks must be double locking.
- Dee-rings and snaphooks should undergo regular inspection and maintenance.
- Unless explicitly designed, the connections of dee-rings, carabiners, or snaphooks to webbing, rope, wire rope, each other, HLL, or any incompatible object in shape or dimension are strictly prohibited.
- Connectors, adjusters, and any buckles used as adjusters should be able to withstand a minimum tensile load of 3,372 pounds. They must be made of drop-forged, pressed, or formed steel or equivalent materials, and have a corrosion-resistant finish. All surfaces and edges must be smooth to prevent damage to interfacing parts of the system.
- All connecting components used in PFAS must be compatible and used properly.

- Note: The requirements for hardware and connectors outlined in ANSI/ASSP Z359.12 take precedence over the corresponding requirements outlined in ANSI/ASSP Z359.1.

The image below illustrates the difference between carabiners and snaphooks.

**Image 2 Carabiners and Snaphooks**



**Carabiner**

**Snaphook**

\*Source: [surrivalsullivan.com](http://surrivalsullivan.com)

#### **4.1.5 Anchor Points**

An anchor point is a secure attachment point for lifelines, lanyards, or deceleration devices. The anchor point must be separate from any anchorage used for supporting or suspending platforms.

The following list provides guidelines for anchor points:

- When attaching a positioning device system, the anchor points must support at least twice the potential impact load of an employee's fall or a minimum of 3,000 pounds.
- For PFAS, anchor points should be capable of supporting at least 5,000 pounds per person OR designed and installed under the supervision of a QP and by part of a complete fall arrest system that maintains a safety factor of at least two.
- Permanent anchor points need to be labeled with their design capacity.
- Anchor points must be regularly inspected and maintained according to the manufacturer's recommendations.



#### 4.1.6 Holes and Other Openings

According to OSHA,

- A hole is a space in a floor, roof, or other walking/working surface that is two inches or larger.
- An opening is a gap or void in the walking/working surface, platform, roof, wall, or floor that is at least 30 inches high and 18 inches wide.
- A skylight is a window on the roof used to let natural light enter a building.

Holes, openings, and skylights can be dangerous because workers can fall through them, so precautions must be taken to ensure that does not happen. Remember these safety guidelines for holes, wall openings, and skylights to keep everyone safe at work:

Holes:

Covers can be used to protect workers from holes. When using covers as part of the Passive Fall Protection System, ensure that they fulfill the following requirements:

- Strong enough to support at least twice the weight of a worker, equipment, and material combined
- Properly secured to prevent them from moving accidentally
- Labeled with the word "HOLE", "COVER", or "Danger, Roof Opening-Do Not Remove" OR color-coded (red or orange "X")
- Designed in a manner that considers all equipment and material present in the workplace

If there's no cover, someone must watch the hole at all times, or there must be a standard railing to stop falls.

Wall openings:

- If workers are doing anything near wall openings that have a drop of six feet or more outside and less than 39 inches inside, they must be protected by a guardrail system, restraint system, or positioning device system.

Skylights:

- Skylights must have a standard screen or railing around them. If not, there must be a different type of fall protection system to stop people from falling through them. If none of these can be done, there must be a Fall Protection Plan to keep people safe from falling.

By following these guidelines, workplaces can lower the chance of falls and accidents, making it safer for everyone.

## Section 4.2 Scaffolds

When setting up or taking down scaffolding, a CP must determine the feasibility and safety of providing fall protection. For these cases, fall protection is required when the installation and use of such protection is feasible and does not create a greater danger.

Once the scaffolding is up and employees are working ten feet or higher above the ground, a guardrail or fall protection system is needed. Always follow the manufacturer's guidelines as they may differ and fall protection may be needed at lower heights.

Before anyone goes onto the scaffold, a CP must check it at the beginning of the shift and if the scaffold integrity is changed. Scaffolds may never be loaded beyond their maximum intended loads or rated capacities, whichever is less. A CP must assess the feasibility and safety of providing fall protection for workers erecting and dismantling scaffolds. If providing fall protection isn't feasible, a detailed explanation for approval by the USACE supervisor or by the KO or COR must be documented.

Additional fall protection is required, depending on the scaffold type. Some of the requirements are listed below and the full list can be found in 1926 Subpart L:

- **Catenary, float, needle beam, ladder jack scaffolds, and Boatswains' Chair:** PFAS must be used.
- **Single-point and two-point adjustable suspension scaffolds:** Both PFAS and guardrail systems must be used.
- **Crawling boards (chicken ladders):** Protection options include PFAS, guardrail systems, or a  $\frac{3}{4}$  inch grabline.

The following guidelines outline the requirements for PFAS on scaffolds:

- **Attachment points:** PFAS must be connected to a vertical lifeline, HLL, or structural member of the scaffold.
- **Vertical lifelines:** Vertical lifelines should not be used with single or two-point adjustable suspension scaffolds containing overhead components.
- **HLLs:** It is imperative that HLLs are fastened to multiple scaffold structural members or suspension lines, and not solely to suspension ropes.
- **Independent support:** In the event of suspension rope failure, when using lanyards on suspension scaffolds, independent support lines with automatic locking devices are mandatory.

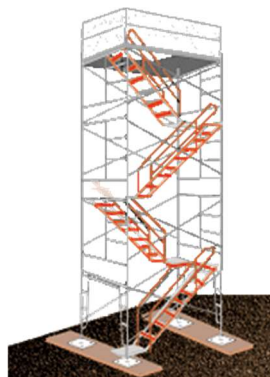
- **Prohibited connections:** Vertical lifelines, independent support lines, and suspension ropes are prohibited from being linked to each other or using the same anchor point.

The following guidelines outline the requirements for guardrails on scaffolds:

- **Installation:** Guardrails must be installed along all open sides and ends of platforms prior to being accessed by employees, other than those involved in erection or dismantling.
- **Height specifications:** The top edge height for guardrails needs to be within the range of 38 inches and 45 inches above the platform surface, adhering to specific conditions for different scaffold types.
- **Midrails and panels:** If tools, equipment, or materials are stacked higher than the toeboard, put up paneling or screening to protect employees below.
- **Strength requirements:** Guardrails should be capable of withstanding a force of at least 100 pounds for single or two-point adjustable suspension scaffolds, and 200 pounds for other types of scaffolds.
- **Surface and safety:** Guardrails should have a smooth surface to prevent injuries and avoid snagging.
  - Rails should not extend beyond terminal posts unless it is deemed safe.
- **Prohibited materials:** Steel or plastic banding should not be employed as top or midrails.
  - Manila or synthetic ropes must undergo regular inspections.
- **Crossbracing:** Crossbracing is acceptable as midrails when the crossing point is positioned between 20-30 inches above the platform, and as top rails if between 38-48 inches above the platform.

Below is OSHA's image of a scaffold with built-in ladders.

**Image 3 Scaffold**



### 4.2.1 Supported Scaffolds

A supported scaffold is a platform that's supported by rigid ground supports, such as brackets, poles, posts, legs, frames, or outriggers. These scaffolds can hold a lot of weight, but it's important to make sure the structural supports are braced to prevent tilting, wobbling, or other movements. These instructions apply for supported scaffolds:

- Guardrails or PFAS must be used.
- If the height to base width ratio is more than 4:1 then it must be restrained from tipping by guying, tying, bracing, or equivalent means.
- The poles, legs, posts, frames, and uprights must be on adequate firm foundation capable of supporting the load without settling or displacement. They must also be plumb and braced to prevent swaying and displacement.

### Scissor Lifts

A scissor lift is a type of supported scaffold and is also known as a self-propelled elevating work platform. It includes a vertical mechanical platform that operates solely along a vertical plane, moving straight up and down. When using a scissor lift on a USACE job, the following additional safety measures must be followed:

- The lift must have standard guardrails and anchorages according to ANSI/ASSP Z359.1.
- A restraint system must be used in addition to the guardrails. The lanyards used in the restraint system should be short to prevent falls.
- A body belt or full-body harness should always be worn and attached to a secure anchor when operating the lift at any height.
- Use of a Self-Retracting Device (SRD) is prohibited unless permitted by the SRD manufacturer and used according to the manufacturers' instructions.
- All gates or chains should be kept closed, latched, and secured.
- Feet should be kept on the floor (no standing on rails).
- Ladders should not be used on the scissor lift platform.
- All employees must be trained before using a scissor lift.
- Controls and warning stickers on the lift should be easy to read.

Below is an image of a scissor lift.

**Image 4 Scissor Lift**



Source: jlg.com

## **4.2.2 Suspended Scaffolds**

Suspended scaffolds are temporary platforms that hang from overhead structures, such as rooftops, and are supported by non-rigid means like ropes, cables, or chains. The following guidelines apply to all suspended scaffolds:

- All suspension scaffold support devices, such as outrigger beams, cornice hooks, parapet clamps, and similar devices, must rest on surfaces capable of supporting at least four times the load imposed on them by the scaffold operating at the rated load of the hoist.
- Suspension scaffold outrigger beams, when used, must be made of structural metal or equivalent strength material. They must also be restrained to prevent movement.
- Ropes must be inspected for defects by a CP prior to each work shift and after every occurrence which could affect a rope's integrity.

### **Boatswains' Chair**

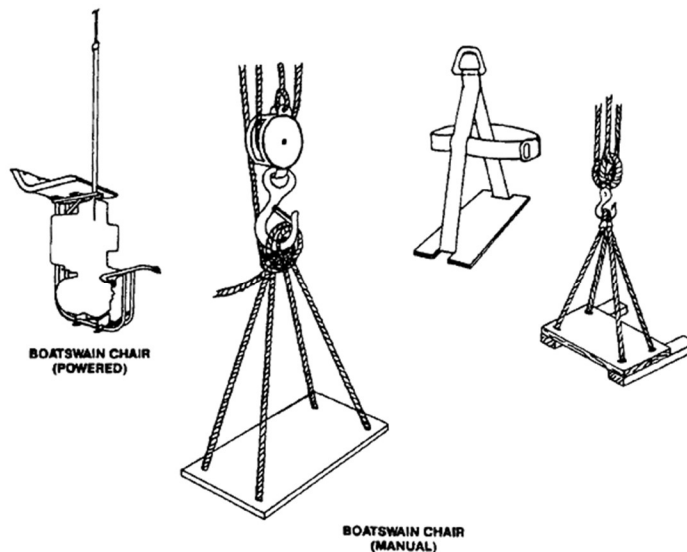
A Boatswains' Chair (or bosun chair) is used for suspending a person from a rope in a chair to perform work at heights. They should only be used if the work is of a relatively short duration and there are no other practical means of access. A worker in a Boatswains' Chair is extremely vulnerable. Please keep the following guidelines in mind when using a Boatswains' Chair:

- A full-body harness should always be used with the Boatswains' Chair to prevent falls.
- The PFAS should be separate from the anchor used for the Boatswains' Chair.

- A QP must check the equipment annually and the equipment should be checked daily before use, especially non-permanent anchor systems.
- Proper training is necessary for using the equipment safely.
- All rigging lines should be able to hold at least 5,000 pounds.
- A Rescue Plan should be in place with the fire department before starting any work at heights.
- Ropes need to be protected from getting damaged at contact points (provide padding).

Below is OSHA's image of a Boatswains' Chair. It includes both a powered version and manual version.

**Image 5 Boatswains' Chair**



## Section 4.3 Aerial Work Platforms

Aerial Work Platforms (AWPs), also known as non-scissor lifts, can be broken up into extensible boom lifts, articulating boom lifts, manually-propelled elevating work platforms, aerial ladders, and vertical towers. Some of these will be discussed further in this section.

### 4.3.1 Extensible and Articulating Boom Lifts

An extensible boom lift, also known as a telescopic boom lift or straight boom lift, is a type of AWP that uses a telescoping arm to reach high places. An articulating boom lift is similar to an

extendible boom lift but consists of multiple hinged sections which can be controlled to extend the lift in different directions, including 'up and over' applications.

For extendible and articulating boom lifts, it is important to follow these safety guidelines:

- Use restraint systems or PFAS.
  - Workers must anchor themselves to the boom or bucket as per the manufacturer's specifications and instructions.
  - For USACE jobs, anchoring to the boom may only be used if allowed by the manufacturer and approved by the CP.
  - For USACE jobs, the lanyards should be short enough to prevent workers from climbing out of the basket and lanyards with built-in shock absorbers are acceptable.
- Avoid tying off to an adjacent pole or structure unless a safe device for 100% tie-off is used for the transfer.
- Always stand firmly on the floor of the basket, and do not sit or climb on the edge of the basket or use planks, ladders, or other devices for a work position.
- Boom and basket load limits specified by the manufacturer must never be exceeded.

Below are images of an extendible boom lift and an articulating boom lift.

**Image 6 Extendible Boom Lift and Articulating Boom Lift**



**Extendible Boom Lift**



**Articulating Boom Lift**

\*Source: jlg.com

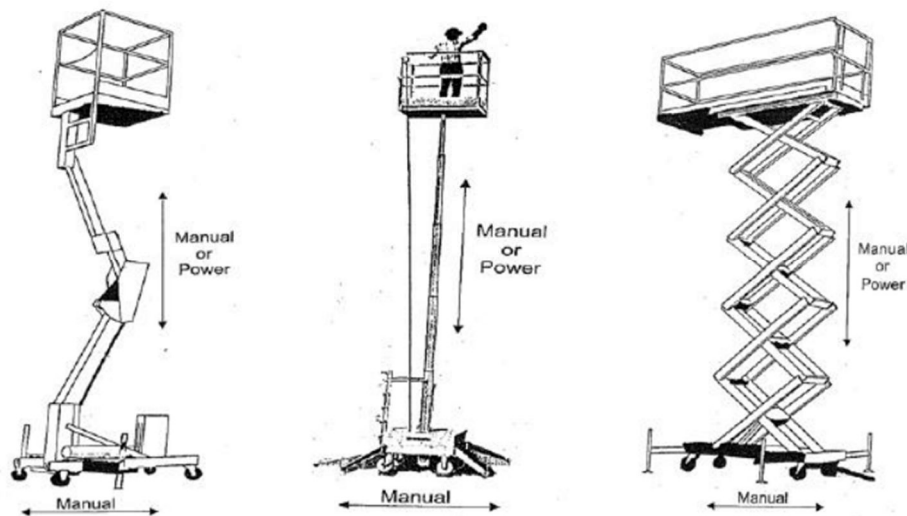
#### **4.3.2 Manually-Propelled Elevating Work Platforms**

A manually propelled elevated work platform (MEWP) is an aerial platform that is moved by pushing or pulling it to a new location. In addition to the guidelines for boom lifts, MEWPs have the following guidelines when being used on a USACE job:

- They must have standard guardrails.
- If the platform has anchorages meeting ANSI Z359, restraint systems must be used along with the guardrails.
- The lanyards should be short enough to prevent falls and stop workers from climbing out of or being pushed off the platform.
  - Lanyards with built-in shock absorbers are acceptable.
- SRDs are not permitted.
- Do not occupy the platform while it is being moved.
- Do not climb on or over the guardrails.

Below is an image that shows different MEWPs.

**Image 7 Manually-Propelled Elevating Work Platforms**



\*Source: purdue.edu

## Section 4.4 Ladders

When using ladders, it's important to keep the following guidelines in mind:

- All ladders must have a label indicating their type and weight capacity. This includes Type I-A (extra heavy duty, 300 pounds capacity), Type I (heavy duty, 250 pounds capacity), Type II (medium duty, 225 pounds capacity), and Type III (light duty, 200 pounds capacity).



- Ladders must be well-maintained with tight joints, securely attached hardware and fittings, and movable parts that operate freely.
- They should not be used to access a roof or platform unless the top extends three feet above the support point and is secured to prevent accidental movement.
- Regular inspections are necessary, and any ladders with defects should be taken out of service for repair. If a ladder cannot be repaired, it must be destroyed and disposed of.
- The feet of the ladder and other equipment should also be kept in good condition.
- Avoid leaning outside of the ladder rails.
- If a person cannot maintain their body's center line between the ladder rails while working, a PFAS is required.
- When climbing, always follow the "3-Point Rule," ensuring at least two hands and one foot, or two feet and one hand, are in contact with the ladder at all times.

There are different kinds of ladders. This includes step ladders, extension ladders, and fixed ladders, some of which are shown in the image below.

**Image 8 Kinds of Ladders**



\*Source: uline.com

#### 4.4.1 Step Ladders

A step ladder is defined as an A-shaped, self-supporting ladder which has two sets of hinged supports. The supports meet at the top and are held together by collapsible hinges. Remember these points about step ladder safety:

- Step ladders should not be longer than 20 feet.
- Workers should avoid standing on the top two steps.
- When using step ladders, make sure they're in the locked-open position for safety.

#### 4.4.2 Extension Ladders

An extension ladder is a type of ladder that can be adjusted to different lengths. Here are some safety tips to keep in mind about extension ladders:

- Two-section extension ladders longer than 48 feet should not be used.
- Multi-section extension ladders should not exceed 60 feet.
- The distance from the support structure to the foot of the ladder should be  $\frac{1}{4}$  the working length of the ladder.
- Extension ladders must be secured to prevent them from moving accidentally.
- They should not be used as platforms or runways in a horizontal position.

#### 4.4.3 Fixed Ladders

A fixed ladder is a vertical ladder permanently attached to a structure. It has the following requirements:

- Metal ladders and related parts must be painted or treated to resist rust and corrosion when needed.
- Fixed ladders over 24 feet high (20 ft for USACE jobs) must include fall protection, such as standard guardrails, work platforms, temporary floors, safety nets, engineered fall protection systems, or personal fall protection systems.

#### 4.4.4 Climbing Ladder Fall Arrest Systems

The specifications for Climbing Ladder Fall Arrest Systems (CLFAS) for USACE jobs are as follows:

- CLFAS components consist of the carrier, carrier mounting brackets, and the carrier sleeve.
  - The carrier comprises a rigid or flexible member securely attached to the climbing fixed ladder or adjacent structure.
  - The carrier sleeve (cable grab) is connected to the harness and moves along the carrier during climbing.
- Anchorage strength should be a minimum of 3,000 pounds.
- The connector, positioned between the front dee-ring of the harness and the carrier, must be nine inches long. It must be equipped with a panic grab.
- The free-fall distance when using a CLFAS should not exceed two feet.

- It is essential to ensure 100% transition at the top of the CLFAS for safe access to the work surface or roof above.
- CLFAS should not be installed on ladders equipped with three-quarter ( $\frac{3}{4}$ ) inch rungs, such as commercial off-the-shelf ladders, unless designed to withstand the fall forces.

## Section 4.5 Fall Protection Requirements for Roofwork

### 4.5.1 Low-Sloped Roofs

A low-sloped roof is a roof in which for every 12 inches of horizontal distance, the roof rises by less than four inches. See below for fall protection requirements when performing work on low-sloped roofs:

- When working within six feet of the edge:
  - Make sure workers are protected from falling using a guardrail, safety net, or personal fall protection systems.
  - Designated areas are not allowed.
- When working at least six feet but less than 15 feet from the edge:
  - Ensure worker protection with guardrail, safety net, or personal fall protection systems.
  - Designated areas are allowed for infrequent and temporary work but not for regular or lengthy jobs with fall hazards.
- When working 15 feet or more from the edge:
  - No fall protection system is needed if the work is infrequent and temporary.
  - For regular and lengthy work, use a guardrail, safety net, or personal fall protection systems, or designated areas.
  - Enforce a rule prohibiting workers from going near the edge without a fall protection system.

### 4.5.2 Steep Roofs

A steep roof is a roof in which for every 12 inches of horizontal distance, the roof rises by more than four inches. When working on steep roofs, traditional fall protection systems, such as guardrails, safety nets, or personal fall protection systems, must be used.

## Section 4.6 Working at Heights Over or Near Water

To prevent drowning hazards when working at heights over or near water, the following must be ensured:

- Personal flotation devices (PFDs) should typically be worn.
  - If additional hazards such as currents, intakes, dangerous machinery, or equipment are present, a fall protection system is required regardless of the fall distance.
  - If continuous fall protection is used to prevent workers from falling into the water, then the drowning hazard is eliminated and PFDs may not be required. Note that safety nets may not eliminate the drowning hazard.
- If using PFDs provides better protection, then personal fall protection equipment may not be needed.
- If both PFDs and personal fall protection equipment are used, the PFDs must not interfere with the proper use of the personal fall protection equipment.

By adhering to the requirements explained in this module, employers can ensure that aerial safety tools and equipment are utilized effectively, therefore minimizing the risk of falls and related injuries.