



**OSHAcademy**<sup>TM</sup>  
Occupational Safety & Health Training

# Fall Protection Program

Employees who conduct work on elevated surfaces are exposed to fall hazards and are required to receive fall-protection training. This course will aid in decreasing fall hazards by explaining the components of an effective fall-protection program, training requirements, and emergency response. Personal fall-arrest systems, fall-restraint systems, and other fall-protection systems will be discussed, with general instructions on how to properly inspect and maintain equipment. Fall protection on ladders, scaffolds, and aerial platforms are also important topics covered in this course.

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# OSHAcademy Course 714 Study Guide

## Fall Protection Program

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Contact OSHAcademy to arrange for use as a training document.

This study guide is designed to be reviewed off-line as a tool for preparation to successfully complete OSHAcademy Course 714.

Read each module, answer the quiz questions, and submit the quiz questions online through the course webpage. You can print the post-quiz response screen which will contain the correct answers to the questions.

The final exam will consist of questions developed from the course content and module quizzes.

We hope you enjoy the course and if you have any questions, feel free to email or call:

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## **Course Introduction**

### **Why We Need Fall Protection**

Falls are among the most common causes of serious work-related injuries and deaths in the workplace. Employers must take measures in their workplaces to prevent employees from falling off overhead platforms, elevated work stations or into holes in the floor and walls.

The U.S. Bureau of Labor Statistics data shows that falls to a lower level have been the most frequent type of fatal fall in the workplace. Most of those are caused by falls from roofs, ladders, scaffolds, non-moving vehicles, and building girders or other structural steel.

### **What the Fall Protection Standard Covers**

For general industry, the trigger height for providing fall protection is 4 feet. However, there are exceptions for work in construction, scaffolding, fixed ladders, dangerous equipment, and utility work. From the beginning, OSHA has consistently reinforced the “4-foot rule.”

## Module 1: Important Questions

### Why We Need Protection from Falling

We need protection because even those of us with experience working at heights can lose our balance or grip; we can slip, trip, or misstep at any time. We may think that our reflexes will protect us, but we're falling before we know it, and we don't have to fall far to be seriously injured. We've been falling since Day One. Until we get better at landing, we'll need protection from falling.

The construction industry experienced the highest frequency of fall-related deaths, while the highest counts of nonfatal fall injuries continue to be associated with the health services and the wholesale and retail industries. Particularly at risk of fall injuries are those working in:

- healthcare support
- building cleaning and maintenance
- transportation and material moving
- construction and extraction occupations

Fall injuries create a considerable financial burden: workers' compensation and medical costs associated with occupational fall incidents have been estimated at \$70 billion annually in the United States.

### When Fall Protection is Needed

Employers must set up the work place to prevent employees from falling off of overhead platforms, elevated work stations or into holes in the floor and walls. OSHA requires that fall protection be generally provided at elevations of four feet in general industry workplaces, five feet in shipyards, six feet in the construction industry and eight feet in longshoring operations. In some cases, such as working on scaffolds, protection must be provided if working at 10 feet or higher. In addition, OSHA requires that fall protection be provided when working over dangerous equipment and machinery, regardless of the fall distance.

Employers must also provide fall protection when:

- Employees are exposed to floor holes 2 inches in width or greater. Guard every floor hole into which a worker can accidentally walk (using a railing and toe-board or a floor hole cover).

- When employees may be struck by falling objects. Provide a guard rail with toe-board around every elevated open sided platform, floor or runway.
- When working over dangerous equipment. Regardless of height, if a worker can fall into or onto dangerous machines or equipment (such as a vat of acid or a conveyor belt) employers must provide guardrails and toe-boards to prevent workers from falling and getting injured.
- When portable ladders are used for access to an upper landing surface, the side rails must extend at least 3 feet (.9 m) above the upper landing surface. When such an extension is not possible, the ladder must be secured and a grasping device such as a grab rail must be provided to assist workers in mounting and dismounting the ladder.
- Fixed ladders must be provided with cages, wells, ladder safety devices or self-retracting lifelines when the length of climb is less than 24 feet (7.3 m) but the top of the ladder is at a distance greater than 24 feet (7.3 m) above lower levels.

### How Workers Fall

Below is a list in order of priority showing the types of falls that cause the most injuries. As you can see, most fall injuries are caused by falls from ladders.

1. Falls from ladders
2. Falls to lower levels (unspecified)
3. Falls from roofs
4. Falls from scaffolds or staging
5. Falls from non-moving vehicles
6. Falls from floors, docks, or ground level
7. Falls down stairs
8. Falls from girders or structural steel
9. Falls from piled of stacked material

## The Importance of the Fall Protection Program

An effective Fall Protection Program describes policies, plans, processes, procedures and practices that helps eliminate or reduce fall hazards, prevents falls, and ensures workers who may fall aren't injured.

You accomplish fall protection by doing the following:

- Make fall protection part of your workplace safety and health program.
- Identify and evaluate fall hazards.
- Eliminate fall hazards, if possible.
- Train workers to recognize fall hazards.
- Use appropriate equipment to prevent falls and to protect workers if they do fall.
- Inspect and maintain fall-protection equipment before and after using it.
- Become familiar with OSHA and company fall-protection rules.

## Your Role in the Fall Protection Program

Everyone in the workplace has a role to play in preventing falls.

- *Employers:* Identify fall hazards at the site. Eliminate the hazards, prevent falls from occurring, or ensure that if falls occur, employees aren't injured. Make sure that employees follow safe practices, use fall protection equipment properly, and are trained to recognize fall hazards.
- *Employees:* Follow safe work practices, use equipment properly, and participate in training. Learn to recognize unsafe practices, know the tasks that increase the risk of falling, and understand how to control exposure to fall hazards.
- *Architects and engineers:* Educate employers about hazards that could expose workers to falls during each phase of the project. When designing buildings and structures, consider fall protection and other safety needs of those who will do the construction work.

- *Building owners and managers:* Ensure that those who do exterior construction or maintenance work know how to protect themselves from falls, are aware of installed anchorages, and know how to use their fall-protection equipment.
- *Equipment manufacturers:* Ensure that fall-protection equipment meets federal OSHA and ANSI safety requirements and protects workers when they use it properly. Warn workers through instruction manuals and on equipment labels about the danger of using equipment improperly.
- *Lawyers:* Review your client's construction bids to ensure that they comply with OSHA requirements. The documents should clearly state the client's responsibilities for protecting workers from falls and for identifying and controlling hazards that cause falls.

## Real-World Falls

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### Cost estimator falls through skylight opening

On a Friday in June, an estimator arrived at a remodel job to look at a cedar-shake roof and estimate the cost of an addition that a construction crew was building. He spoke to the supervisor at the site and climbed to the roof through an open skylight, using a metal extension ladder.

However, he was unaware that the contractor had used a sheet of thin insulating material to cover three 2-by-6-foot skylight openings in the roof (it had rained the day before). He stepped onto the insulating material, fell through one of the skylights, and landed on his back, 15 feet below.

The supervisor and two subcontractors heard the estimator fall and rushed to the accident. One of the subcontractors used his cell phone to call emergency medical services. EMTs arrived about five minutes later, stabilized the victim and took him to a hospital where he underwent emergency surgery for spinal injuries.

**Findings:** The employer failed to properly cover the skylight openings on the roof or warn workers about the hazard.

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## Module 1 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. Which of the following is widely understood among general industry employers as the “trigger height” above the ground or lower level that requires action to protect employees from falls?**
  - a. 2 feet
  - b. 4 feet
  - c. 6 feet
  - d. 8 feet
  
- 2. Which of the following cause the most fall injuries?**
  - a. Falls down stairs
  - b. Falls from ladders
  - c. Falls from roofs
  - d. Falls from scaffolds
  
- 3. What should you do to accomplish effective fall protection?**
  - a. Be familiar with OSHA and company fall-protection rules.
  - b. Identify and evaluate fall hazards.
  - c. Check fall protection equipment annually.
  - d. Assign the job to someone else.
  
- 4. Who is responsible for making sure fall protection equipment is used properly?**
  - a. Employers
  - b. Employees
  - c. Owners
  - d. Building managers

**5. Who is responsible to follow safe work practices, use equipment properly, and participate in training?**

- a. Employers
- b. Owners
- c. Employees
- d. Building managers

## Module 2: Fall Protection Program Elements

### Fall Protection: One Component Within the SMS

A fall protection program is just one of the components within the company's safety management system (SMS), so let's first talk about systems.

#### What is a System?

Believe it or not, all companies have safety management systems. In fact, you cannot NOT have a safety management system in your company. The most efficient and effective SMSs are formal and organized with comprehensive written details describing specific safety policies, plans, programs, processes, procedures and practices. At the other end of the spectrum, they are informal, unorganized, inefficient, ineffective, and lacking in leadership.

To help us understand what a system is, take a look at the image of "Syssie" the cow. You're probably thinking, "What does a cow have to do with safety management systems?" Just read on.

Syssie the cow is actually a very complicated system that has structure, inputs, processes, outputs, behaviors, and results. You know Syssie is a cow because she has structure, inputs, processes and outputs: she looks like a cow, eats, processes food, and eliminates waste. If you watch Syssie for a while, you'll notice that she behaves like a cow: usually just eating grass all day. And finally, you'll see the results: she has babies and produces milk.

**The bottom line:** All systems have the same basic components, and all companies have safety management system. The challenge is to design, develop and deploy an effective fall protection program as part of your safety management system.

### Fall Protection Program Elements

The Fall Protection Program is just one part of the company's much larger Safety Management System. And, as with all systems, it also has structure, behavior, and results.

There should be at least seven major elements in a successful Fall Protection Program. These seven major elements include:

1. **Commitment:** All employees—including company executive officers, managers, and supervisors—are committed to making the Fall Protection Program succeed. An employer's attitude toward job safety and health is reflected by his or her employees. If the employer commits serious time and money into the Fall Protection Program, employees will see that and be equally serious about safety.

- 2. Accountability:** Everyone in the company, from top management to each employee, should be held accountable for following fall protection policies, plans, processes, procedures and safe work practices. To be held accountable, performance is measured and consequences result. Employee safety performance is evaluated and one of three consequences result:

  - It is rewarded. Safe performance is recognized and rewarded in some way.
  - It is punished. When justified, unsafe performance should result in some form of reprimand or disciplinary action.
  - It is ignored. Yes, ignoring performance is, itself, a consequence.
- 3. Involvement:** All employees, including managers and supervisors, should participate in making the Fall Protection Program succeed. Employee involvement helps ensure employees gain some ownership in fall protection procedures and practices, so they're more likely to use them when not being supervised.
- 4. Hazard prevention, identification, and control:** Employees anticipate potential fall hazards as they work throughout the day. Their awareness is such that actual fall hazards are identified and reported. Employees are involved in controlling fall hazards by eliminating or substituting the hazards, changing processes and procedures, and using fall protection systems.
- 5. Accident investigation:** Managers and supervisors promptly investigate all fall accidents and near misses, and then determine how to eliminate their causes. They conduct a thorough "analysis" for the express purpose of improving the safety management system, not assigning blame. Remember, fix the system, not the blame!
- 6. Education and Training:** All employees are educated about the fall hazards in the workplace and they receive training in how to safely accomplish tasks while working at elevation, and how to properly use fall protection equipment. The employer must provide training to each employee who is required to use fall protection. Each employee should be trained to know at least the following about fall protection:

  - why it is necessary
  - when it is necessary
  - how to properly don, doff, adjust and wear fall protection

- the limitations of fall protection
- the proper care, maintenance, useful life, and disposal of fall protection

Each employee is required to use fall protection and, before being allowed to perform work requiring fall protection, each employee must demonstrate:

- an understanding of the training
- the ability to use fall protection properly

It's important to know that the element which usually results in more OSHA citations is the failure to provide adequate fall protection training. If someone is seriously injured or dies as a result of a fall, OSHA compliance officers (and lawyers in lawsuits) will look long and hard at your training program because they know that it is the area that is more likely lacking in due diligence.

**7. Analysis and Evaluation:** Improving the Fall Protection Program using an effective analysis and evaluation process is one of the most important safety staff activities. Managers and supervisors, with help from other employees, should analyze and evaluate the program's strengths and weaknesses at least once a year. To do this, the employer should use these basic steps:

- Identify what you have.
- Compare what exists with what is known to work best.
- Make improvements as needed.

You can learn more about the elements of an effective safety management system in [Course 700](#).

### Prepare a Safety and Health Policy

Does your company have a written safety and health policy? It should. A written policy reflects commitment to a safe, healthful workplace, summarizes management and employee responsibilities, and emphasizes the safety and health program's role in achieving that goal. It allows managers and supervisors to make decisions about working at elevation without having to check with the employer. Keep the policy brief, commit to it, and enforce it. Take a look at a [sample policy](#).

## Designate Competent Persons and Qualified Persons

You'll find activities throughout OSHA's workplace safety and health rules that are required to be conducted by competent and qualified persons.

*Competent person* and *qualified person* are terms that federal OSHA created to designate individuals who have the training and expertise to evaluate hazardous conditions, inspect equipment, evaluate mechanical systems, or train others how to work safely.

### Who Can Be Competent and Qualified Persons?

The following definitions for competent and qualified persons are related to fall protection:

- **Competent Person:** A competent person is one who is capable of identifying existing and predictable fall hazards that are dangerous to employees, and authorized to stop work and take prompt corrective action to eliminate them.
- **Qualified Person:** A qualified person is one who, by possession of a recognized degree, certificate, or professional standing or who, by extensive knowledge, training, and experience, has successfully demonstrated the knowledge, skills, and ability to solve or resolve problems relating to fall protection at work.

### Determining Who Can Be a Competent or Qualified Person

Although federal OSHA defines competent and qualified persons, it doesn't provide specifics for determining who can assume these roles. The following guidelines may help:

- Know the OSHA rules that apply to your workplace. The rules will tell you if you need to designate a competent or a qualified person.
- If an OSHA rule that applies to your workplace requires a competent or a qualified person, note duties and responsibilities the rule requires the person to perform.
- If an OSHA rule that applies to your workplace requires a competent person, that person must have the authority to take prompt corrective measures to eliminate hazards.
- Determine the knowledge, training, and experience the competent or qualified person needs to meet the rule's requirements.
- Designate a person who has the knowledge, training, and experience that meets the rule's requirements.

## Real-World Falls

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Two journeyman electricians were relocating power poles to service job trailers at a landfill. They were using an older digger derrick truck that had a boom and an auger for drilling holes. The end of the boom had a motorized hoist for setting the poles and there were two side-by-side buckets on a separate onboard aerial work platform at the end of the boom.

At the start of the day, they drilled two holes for poles near a tall shop building and set the first of two 50-foot poles without incident.

They picked up the second pole using the hoist cable at the end of the digger derrick boom. A synthetic-fiber lifting strap was wrapped around the pole and attached to the hook. Another rope was attached to the eye of the strap so that the strap could be loosened from the ground. After they set the pole, one of the electricians was unable to remove the strap by tugging on it, so he decided to remove it from the aerial platform.

He climbed the onboard fixed ladder, grabbed the top of the bucket with both hands, and placed one foot on its outside lower lip. As he swung his other foot over the top of the bucket, it swiveled vertically and he fell, hitting parts of the truck and landing on the ground. His injuries included two fractured vertebrae and soft tissue.

### Findings

- The equipment was not regularly inspected and maintained in safe operating condition.
- The bucket leveling cable, which kept the bucket level as the boom was raised and lowered, broke under the electrician's weight, which caused the bucket to swivel.
- One of the electricians said that, from time to time, he had checked things on the truck, such as tires, lights, and oil and water levels, but had not performed a pre-operation inspection or thorough periodic inspection on the digger derrick or the aerial boom lift.
- The company field superintendent said the truck had not been thoroughly inspected in over two years.

Source: Oregon OSHA 2014

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## Module 2 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. Which program element usually results in more OSHA citations due to inadequate implementation?**
  - a. Commitment
  - b. Training
  - c. Accident investigation
  - d. Hazard identification
  
- 2. Safety policies are important because they allow managers and supervisors to \_\_\_\_\_.**
  - a. reflect management commitment
  - b. tell employees what to do in greater detail
  - c. emphasizes their control over employee behaviors
  - d. make decisions without having to check with the employer
  
- 3. A competent person is one who is can \_\_\_\_\_ hazards and is authorized to \_\_\_\_\_ them.**
  - a. correct, report
  - b. mitigate, monitor
  - c. identify, correct
  - d. view, mitigate
  
- 4. A \_\_\_\_\_ person is one who has successfully demonstrated his or her ability to solve or resolve problems relating to the subject matter, the work, or the project.**
  - a. qualified
  - b. authorized
  - c. competent
  - d. designated

- 5. If OSHA regulations require a competent person, that person must have \_\_\_\_\_.**
- a. the authority to take prompt corrective measures to eliminate hazards
  - b. the responsibility to report any infraction directly to OSHA
  - c. no other duties other than that of a competent person
  - d. a formal degree from an accredited college or university

## Module 3: Identifying and Evaluating Fall Hazards

### Fall Hazard Defined

A fall hazard is anything in the workplace that could cause an unintended loss of balance or bodily support and result in a fall. Fall hazards cause accidents such as the following:

- A worker walking near the edge of a loading dock falls to the lower level.
- A worker falls while climbing a defective ladder.
- A weak ladder collapses under the weight of a heavy worker carrying tools.
- A worker carrying a heavy box falls down a stairway.

Despite the examples above, the vast majority of fall hazards are foreseeable. You can identify them and eliminate or control them before they cause injuries.

### How to Evaluate Fall Hazards

The purpose of evaluating fall hazards is to determine how serious they are so you can eliminate or control the most serious hazards before they cause injuries. Let's at some important factors to consider when conducting a hazard evaluation.

### Identify Potential Falling Issues

One of the best procedures for identifying potential and actual fall hazards is to conduct a Job Hazard Analysis (JHA). For construction sites, conduct a Phase Hazard Analysis (PHA).

- A JHA is a technique that focuses on job tasks as a way to identify hazards before they occur. It focuses on the relationship between the worker, the task, the tools, and the work environment.
- A PHA (also known as a Safe Work Plan) should be submitted and approved prior to the start of all construction projects. The PHA analyzes the hazards on the project at each phase of construction. Be sure to evaluate each phase of the project from the ground up.

### Involve Others

To conduct an effective evaluation, you should involve others: the more eyes you have on a problem, the better. Involve those who may be exposed to fall hazards and their supervisors;

they'll help you identify the hazards and determine how to eliminate or control them. Involving others also strengthens your safety and health program. Your workers' compensation insurance carrier and OSHA will also help you evaluate fall hazards. Contact your insurance carrier to request a consultation.

### Identify Tasks That Could Expose Workers to Falls

Asking the right questions is extremely important when trying to identify areas of concern and tasks that present a risk of falling. Here are some questions to ask:

- Will workers be using portable ladders, supported scaffolds, aerial lifts, or suspension platforms to reach their work areas?
- Which ones will they use? How and where will they use the equipment?
- Will tasks expose workers to overhead power lines?
- Will they need to use scaffolds, ladders, or aerial lifts on unstable or uneven ground?
- Will they be working during hot, cold, or windy weather?
- Will workers need to frequently lift, bend, or move in ways that put them off balance?
- Will they be working extended shifts that could contribute to fatigue?

### Determine How Workers Will Access Elevated Surfaces to Perform Their Tasks

It's important to determine if employees are accessing elevated work surfaces safely. Ask the following questions:

- Will workers be using portable ladders, supported scaffolds, aerial lifts, or suspension platforms to reach their work areas?
- Which ones will they use?
- How and where will they use the equipment?

## Identify Hazardous Work Areas

Being aware of work areas that might pose a fall hazard is also very important. Work areas change regularly, so never assume that a work area that is safe today will be safe tomorrow. Work area factors that could increase the risk of falls include:

- Holes in walking/working surfaces that they could step into or fall through
- Elevated walking/working surfaces six feet or more above a lower level
- Skylights and smoke domes that workers could step into or fall through
- Wall openings such as those for windows or doors that workers could fall through
- Trenches and other excavations that workers could fall into
- Walking/working surfaces from which workers could fall onto dangerous equipment
- Hoist areas where guardrails have been removed to receive materials
- Sides and edges of walking/working surfaces such as established floors, mezzanines, balconies, and walkways that are four feet or more above a lower level and not protected by guardrails at least 39 inches high
- Ramps and runways that are not protected by guardrails at least 39 inches high
- Leading edges (edges of floors, roofs, and decks) that change location as additional sections are added
- Wells, pits, or shafts not protected with guardrails, fences, barricades, or covers

## Determine How Frequently Workers Will Do Tasks that Expose Them to Falls

The more frequently a worker is exposed to a fall hazard the more likely it is that the worker could fall.

## Determine If and How Workers Need to Move

Determine whether workers need to move horizontally, vertically, or in both directions to do their tasks. How workers move to perform tasks can affect their risk of falling. Knowing how they move to perform tasks can help you determine how to protect them.

## Determine the Degree of Exposure

Generally, the more workers that are exposed to a fall hazard, the more likely it is one could fall.

## Determine Hazardous Walking/Walking Surfaces

Identify walking-working surfaces that could expose workers to fall hazards. Examples: floors, roofs, ramps, bridges, runways, formwork, beams, columns, trusses, and rebar. Actually, there is no way to make a totally hazard-free walking-working surface in the workplace: it's dangerous to assume anything different.

## Determine Probability

The probability, or likelihood, of a fall depends primarily on on three factors (there are others):

1. **Frequency of exposure.** The more frequently a worker is exposed to a fall hazard the more likely it is that the worker could fall.
2. **Duration of exposure.** The longer a worker is exposed to a particular hazard, the greater the likelihood of a fall.
3. **Scope of exposure.** The greater the number of workers exposed to a hazard, or the greater number of similar hazards in a given area increases the likelihood of a fall.

## Determine Severity

Severity is an estimate of how serious the injury will be as a result of a fall. Estimating the severity of an injury for any given fall is difficult as it is really a matter of chance or luck.

A basic rule when it comes to severity of an injury after a fall is that, "it's not the fall that gets you, it's that sudden deceleration after." Seriously, the factors that determines the severity of a fall include:

1. **Distance of the fall.** A person in free-fall will accelerate until he or she reaches a terminal velocity of about 120 mph. As you can see by watching the video to the right, this does not always mean the body will suffer a fatal injury. Severity depends on the other factors as well.
2. **Speed of deceleration.** The faster you stop or decelerate at impact, the greater the impact forces on the body and severity of injury.

3. **Nature of the surface.** The "hardness" of the surface upon which the worker falls affects the intensity of the impact and the severity of injury.
4. **Orientation of the body at impact.** This is where the "luck" factor in a fall applies. While people fallen out of airplanes and lived, yet, other have fallen only a few feet and died. Severity of the injury also depends on the position of the body when it strikes the surface, and that is a matter of luck more than anything else.

### Determine Fall Distances

Determine fall distances from walking-working surfaces to lower levels.

**The four-foot rule.** In general industry, workers must be protected from fall hazards on walking-working surfaces where they could fall **four feet** or more to a lower level. examples of fall hazards from which employees must be protected by the "four-foot rule" include:

- holes and skylights in walking-working surfaces
- wall openings that have an inside bottom edge less than 39 inches above a walking-working surface
- established floors, mezzanines, balconies, and walkways with unprotected sides and edges

**The six-foot rule.** OSHA's construction standard requires the use of fall protection when construction workers are working at heights of **six feet** or greater above a lower level. This is called the "six-foot rule" and applies only to construction. For example, it might require fall protection according to the six-foot rule for a worker who is:

- on a ramp, runway, or another walkway;
- at the edge of an excavation;
- in a hoist area;
- on a steep roof;
- on, at, above, or near wall openings;
- on a walking or working surface with holes (including skylights) or unprotected sides or edges; or

- above a lower level where leading edges are under construction; on the face of formwork and reinforcing steel.

In all industries, workers must be protected at any height from falling onto or into dangerous equipment such as machinery with open drive belts, pulleys or gears or open vats of degreasing agents or acid.

### Controlling Fall Hazards and Exposure

Controlling hazards in the workplace, no matter what the situation, is generally done using a systematic method call the “Hierarchy of Controls.” It’s important to use this method, especially for fall protection. In descending order of preference, the hierarchy of controls for fall protection is as follows:

1. **Elimination or substitution.** For example, eliminate a hazard by lowering the work surface to ground level, or move (substitute) a process, sequence or procedure to a different location so that workers no longer approach a fall hazard. A common method is to use an extension tool that allows the worker to get the job done from ground level.
2. **Engineering controls.** Isolate or separate the hazard from workers through the use of guardrails or covers over exposed floor openings.
3. **Administrative controls.** These work practices or procedures signal or warn a worker to avoid approaching a fall hazard. Policies and procedures for using fall protection equipment and inspection procedures while working at elevation are examples of administrative controls.
4. **Fall protection equipment.** Fall protection equipment is used in conjunction with the other controls, and success is determined primarily by the quality of the equipment and the compliance to procedures. The primary uses for fall protection equipment are:
  - a. Fall restraint – to keep the worker away from the fall hazard to prevent a fall.
  - b. Fall arrest – to prevent injury if the worker does fall.
  - c. Safety nets – to safely catch the worker if a fall occurs.

It’s important to understand that the first priority is to eliminate the hazard. Never work at elevation if you don’t have to. Doing so may not prevent a fall, but it will likely decrease both the probability and severity of the injury.

### Module 3 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. The purpose of evaluating fall hazards is to determine how to eliminate or control them \_\_\_\_\_.**
  - a. as the result of a thorough accident investigation
  - b. anytime they might cause an injury
  - c. before they cause injuries
  - d. before OSHA can inspect after an accident
  
- 2. Which of the following might be able to help you identify fall hazards in your workplace?**
  - a. Those exposed to hazards
  - b. Insurance carrier
  - c. OSHA consultants
  - d. Any of the above
  
- 3. Workers in general industry must be protected from fall hazards on walking/working surfaces where they could fall \_\_\_\_\_ feet or more to a lower level.**
  - a. 2
  - b. 4
  - c. 6
  - d. 10
  
- 4. Which of the following is NOT one of the three primary factors that determine the probability of a fall accident?**
  - a. Distance to exposure
  - b. Frequency of exposure
  - c. Duration of exposure
  - d. Scope of exposure

**5. Ramps and runways should be protected by guardrails at least \_\_\_\_\_ high.**

- a. 24 inches
- b. three feet
- c. 39 inches
- d. 4 feet

## Module 4: Supported and Suspended Access

### What is Supported Access?

Portable ladders, supported scaffolds, and aerial lifts let you get to a work area and support you while you work. They make getting to a work area easy, but they can cause falls when they're not used properly.

### Portable Ladders

Portable ladders are versatile, economical, and easy to use. However, workers sometimes use them without thinking about using them safely. Each year, most workers are injured when they fall from ladders. Most of the falls are less than 10 feet.

Types of portable ladders: We use ladders to do all sorts of tasks, so it's not surprising that many types of ladders are available. Let's look at the most common types.

### Common types of portable ladders



#### **Straight Ladder (left)**

The most common type of portable ladder. Length cannot exceed 30 feet. Available in wood, metal, and reinforced fiberglass. Supports only one worker.



#### **Standard Folding Ladder (right)**

Folding ladders have flat steps, a hinged back, and is not adjustable. For use only on firm, level surfaces. Available in metal, wood, or reinforced fiberglass. Must have a metal spreader or locking arm and cannot exceed 20 feet. Supports only one worker.



**Extension Ladder (left)**

Extension ladders offer the most length in a general-purpose ladder. They have two or more adjustable sections. The sliding upper section must be on top of the lower section. Made of wood, metal, or fiberglass. Maximum length depends on material. Supports only one worker.



**Platform Ladder (right)**

Platform ladders have a large, stable platform near the top that supports one worker. Length cannot exceed 20 feet.



**Trestle Ladder (left)**

Trestle ladders have two sections that are hinged at the top and form equal angles with the base. Used in pairs to support planks or staging. Rungs are not used as steps. Length cannot exceed 20 feet.



**Tripod (Orchard) Ladder (right)**

Tripod ladders have a flared base and a single back leg that provides support on soft, uneven ground. Length cannot exceed 16 feet. Metal and reinforced fiberglass versions are available. Supports only one worker.

## How Falls from Ladders Occur

Most workers fall from unstable ladders that shift or tilt when the workers climb too high or reach too far beyond the side rails. Workers also fall when they slip on rungs while they're climbing or descending and when vehicles strike the ladders. Workers can reduce their risk of falling by doing the following:

- Inspect ladders frequently and maintain them.
- Match work tasks to appropriate ladders.
- Set up ladders correctly. Use the 1 to 4 rules. One foot out from wall for every four feet of height.
- Climb and descend ladders properly. Both hands should be free.
- Always use the three-point rule. "Two feet - One hand" or "Two hands - One foot" making contact at all times.



Stand at the base of the ladder with your toes touching the rails. Extend your arms straight out in front of you. If the tips of your finger just touch the rung nearest your shoulder level, the angle of your ladder has a 4:1 ratio.

## Required Ladder Safety Training

Before workers use ladders, a competent person must train them so that they understand the following:

- The nature of the fall hazards in the work area.
- How to use, place, and care for ladders.
- Maximum intended load-carrying capacities of the ladders.
- [OSHA's 29 CFR 1910.23-28](#) requirements for the ladders they use.

## Safe Ladder Practices

Keep the following in mind when you use a portable ladder:

- Select the most appropriate ladder for the task.
- Inspect the ladder before using it; make sure it's in good condition.

- Angle straight ladders and extension ladders properly. It should have a 4-to-1 slope (height to base).
- Protect the base of a ladder to prevent others from accidentally striking it.
- Select a ladder that will extend at least 36 inches above the access area, or provide a grab rail so that workers can steady themselves as they get on or off. Make sure that the ladder is stable. If the ladder could be displaced by work activities, secure it.
- Face the ladder when you climb or descend it, keeping at least one hand on the rails.
- Stay within the side rails when climbing or working from the ladder. You can reach out, but keep the rest of your body within the rails.
- Raise and lower heavy loads with a hand line or a hoist.
- Make sure metal ladders have steps and rungs with skid-resistant surfaces.
- Allow only one person on the ladder. Use a scaffold if two or more people need to work together.
- Never stand on top of a portable ladder.
- Never use ladders that have conductive side rails near exposed energized equipment.

### Supported Scaffolds

A supported scaffold is simply an elevated platform that has a rigid means of support. You can lay a board across a couple of tall buckets, and you have a supported scaffold - but not a safe one. Most supported scaffolds used for construction work are complex structures and workers need to know how to erect them, dismantle them, and work from them safely.

Of the many types of supported scaffolds, fabricated frame scaffolds are the most common. Like portable ladders, they're versatile, economical, and easy to use. You'll see them on construction sites as single supported platforms and multiple platforms stacked several stories high on modular frames.

## How Falls from Scaffolds Occur

Workers fall from scaffolds when components fail, planks break, handrails give way, and scaffold supports collapse. However, most scaffold accidents can be traced to untrained or improperly trained workers.

Fall-protection systems are required if you work on a supported scaffold more than 10 feet above a lower level. Guardrails at least 42 plus or minus 3 inches high are appropriate for most scaffold platforms. If you can't use a guardrail system, then you must use a personal fall-arrest system or restraint system. We'll discuss personal fall-arrest systems later in the course.

## Training for Those Who Work from Scaffolds

Those who work from scaffolds must be trained to recognize fall hazards and to control or minimize the hazards. Training must cover the following:

- Scaffold load capacity and the types of loads appropriate for the scaffold.
- When fall protection is required, the appropriate protection to use, and how to use it.
- How to use scaffold components.
- How to reach access areas.
- How to protect those below the scaffold from falling objects.
- How to avoid electrical hazards.

## Safe Practices While Working on Scaffolds

- Use ladders or stairs to reach platforms that are more than 2 feet above or below the access point.
- Don't climb cross-braces to reach a scaffold platform.
- Scaffolds must be able to support their own weight and at least four times the maximum intended load. The maximum intended load includes workers, equipment, and supplies.
- Platforms must not deflect more than 1/60 of the span when they are loaded.

- Platforms must be fully decked or planked between the front uprights and the guardrail supports.
- Don't use damaged scaffold components; repair or replace them immediately.
- Make sure a competent person inspects the components before each workshift.
- Don't modify components.
- Scaffold components made by different manufacturers may be mixed, provided they fit together without force and maintain structural integrity.
- Watch for slippery surfaces. Don't work on platforms covered with snow and ice.
- Stay off scaffolds during storms and strong winds unless a competent person determines that it's safe.
- Keep a safe distance from power lines and any other conductive source. Minimum clearance distances:
  - Uninsulated electrical lines: 10 feet
  - Insulated lines more than 300 volts: 10 feet
  - Insulated lines less than 300 volts: 3 feet
- Scaffolds must be erected, dismantled, or moved only under the supervision of a competent person. The competent person must be on site to direct and supervise the work.

## Aerial Lifts

Aerial lifts are designed to position workers and handle materials when a work surface isn't easy to reach. The American National Standards Institute (ANSI) classifies aerial lifts as "vehicle-mounted elevating and rotating work platforms" (ANSI A92.2-1969).

### Types of Aerial Lifts

Most aerial lifts have extensible or articulating mechanisms that can position workers up, down, or sideways. ANSI defines and sets operating standards for four different types of aerial lifts:

- Vehicle-mounted elevating and rotating lifts (ANSI A92.2 devices).
- Manually propelled elevating work platforms (ANSI A92.3 devices).
- Boom-supported elevating work platforms (ANSI A92.5 devices).
- Self-propelled elevating work platforms and scissor lifts (ANSI A92.6 devices).

### How Aerial Lift Falls Occur

Most accidents involving aerial lifts can be traced to untrained or improperly trained workers.

Reasons for falls:

- A hydraulic cylinder fails and causes the boom to drop.
- Outriggers are not used or improperly placed and the lift vehicle overturns.
- Workers are not tied off while they are in the bucket.
- Workers fall or are pulled off the platform when the lift vehicle is struck by another vehicle or moves unexpectedly.

### Appropriate Fall Protection

If you work from an aerial lift, you must be protected from falling. The type of fall protection you need depends on the type of lift you use. Most platforms must have a guardrail and each worker may be required to use a personal fall-arrest system: a full-body harness and lanyard attached to the boom or the platform.

### Safe Practices While Working on Aerial Lifts

Keep in mind the following when you use an aerial lift:

- Use the lift only for its intended purpose and follow the manufacturer's instructions. Keep the operating manual with the lift.
- Keep the lift level and stable; use outriggers and intermediate stabilizers.
- Never move the lift when the boom is up and workers are on the platform.

- Stand on the platform floor. Don't sit or climb on the edge of the basket, guardrail, or midrail.
- Be sure to close the access gate while you're working from the platform.
- Inspect the lift before using it to make sure that it's working properly and is in good condition.
- Know the lift's rated load capacity and don't exceed it.
- Stay at least 10 feet away from electrical power lines.
- Never use the lift during severe weather.
- Use warning signs or barricades to keep others out of the work area.
- Never tie off to equipment or to a structure next to the platform.

Portable ladders, supported scaffolds, and aerial lifts provide easy access to most elevated work areas. When they're not feasible or safe, however, the alternative is a suspended platform.

### **What is Suspended Access?**

Suspended access is a means of getting to difficult-to-reach work areas on a suspended platform. Usually the platform is an adjustable-suspension scaffold. The scaffold, typically suspended by wire rope from a rooftop anchor, has a hoist that workers use to reach the work area.

In some cases, however, even adjustable-suspension scaffolds may not be feasible or safe. When there is no other safe way to reach work area, a crane or a derrick can provide suspended access by hoisting a personnel platform to reach the work area.

### **Adjustable-Suspension Scaffolds**

A suspension scaffold is a temporary elevated platform that hangs by wire rope. Add a hoist to move the platform up or down, and you have an adjustable-suspension scaffold—but not necessarily a safe one. Suspension ropes, lifelines, platforms, hoists, overhead support devices, and tieback systems are critical to the safety of adjustable-suspension scaffolds.

## How Suspended Scaffold Falls Occur

Most accidents involving adjustable-suspension scaffolds happen when a primary suspension rope breaks. Workers die because they don't use personal fall-arrest systems or they use them incorrectly. Steel suspension ropes rarely break if they're correctly rigged, maintained, and inspected regularly. When the ropes aren't maintained, they weaken. If an ascending platform snags, an electric hoist that continues to operate can easily snap a weak rope. Pressure from the two steel discs that clamp to the support rope in sheave-type hoist motors can also break a weak rope.

Failing anchors also cause serious accidents. Too often, untrained workers attach lifelines and suspension ropes to "secure-looking" rooftop fixtures for convenience. These anchors fail because they aren't designed to support suspended loads.

Lifelines fail because workers hang them over unpadding edges, don't inspect them, or use ropes not designed for personal fall-arrest systems.

## Using Adjustable-Suspension Scaffolds

Before you use an adjustable-suspension scaffold, you need to know the engineering principles for anchoring and suspending the scaffold, how to rig the scaffold, how to operate the hoist, how to work safely from the scaffold, and what to do in an emergency.

In addition, a competent person must examine all direct connections that are part of the system and confirm that the connections will support the platform loads. You must also wear a personal fall-arrest system to protect yourself if a connection fails. Most fatal falls from suspended platforms result when a support rope fails and workers aren't wearing personal fall-arrest gear.

## When Fall-Protection Systems Are Required

If you work on an adjustable-suspension scaffold more than 10 feet above a lower level, you must be protected from falling.

- *Single-point and two-point adjustable-suspension scaffolds:* Personal fall-arrest systems and guardrail systems are required on single-point or two-point adjustable-suspension scaffolds. The top edge of guardrail must be between 36 inches and 45 inches above the platform surface. (The top edge can exceed 45 inches when necessary.)
- *Boatswain's chairs:* Personal fall-arrest systems are required for workers who use boatswain's chairs.

- *Multipoint adjustable-suspension scaffolds:* Personal fall-arrest systems and guardrail systems are required on multipoint adjustable-suspension scaffolds. The top edge of the guardrail must be between 36 inches and 45 inches above the platform surface. (The top edge can exceed 45 inches, when necessary.)

### What You Should Know About Descent-Control Devices

A descent-control device lets you descend a primary support rope—typically from a boatswain's chair—then lock the device when you reach the work area. The device works by friction, engaging the support rope and controlling the descent speed. Most workers start from the roof and work down the face of the building. When they reach the ground, they remove the descent equipment from the support rope and return to the roof for another drop.

### How Falls Occur

Most falls result from failure of the primary support rope or a supporting anchor, not the descent device. Support ropes fail because workers don't inspect them regularly or they misuse them. Anchors fail when workers simply assume they are secure. Descent devices, support ropes, and anchors rarely fail when workers know how to use them.

### Crane- and Derrick-Suspended Personnel Platforms

In some cases, workers may not be able to reach the work area with stairways, ladders, scaffolds, or aerial lifts. When there is no other safe way to reach the area, it may be necessary to use a crane or a derrick and a personnel platform to lift workers to the area. Employee safety - not practicality or convenience - must be the basis for your decision to use this method.

### How Injuries Occur

Workers rarely fall from suspended personnel platforms. Rather, most crane-related fatalities happen when the boom or another part of the crane contacts an energized power line. Other causes of serious accidents include:

- *Instability:* Unstable ground or support surface causes the crane to tip over.
- *Lack of communication:* The crane operator can't see the suspended platform while it is moving.
- *Rigging failure:* Platform loads are not properly rigged.
- *Boom failure:* The weight of the loaded platform exceeds the boom's load limit.

## Safe Practices

Safe practices for riding personnel platforms to the work area:

- Stay within the platform while it's moving.
- Wear a body belt or harness and use a lanyard; attach the lanyard to the lower load block or overhaul ball or to a structural member of the platform.
- Stay in view of the crane operator or signal person while you're on the platform.
- Before leaving the platform for the work area, secure it to the structure.

## Module 4 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. Each year, most workers are injured when they fall from ladders from a height that is \_\_\_\_\_.**
  - a. more than 15 feet
  - b. less than two feet
  - c. less than 10 feet
  - d. more than 10 feet
  
- 2. What causes most workers to fall from ladders?**
  - a. Ladders that buckle under too much weight
  - b. Unstable ladders that shift or tilt
  - c. Ladders that are too small for the task
  - d. Ladders are cracked or split
  
- 3. Most scaffold accidents can be traced to \_\_\_\_\_.**
  - a. improperly constructed scaffolds
  - b. improper use of fall protection
  - c. lack of common sense
  - d. untrained or improperly trained workers
  
- 4. When using an aerial lift, stay at least \_\_\_\_\_ away from electrical power lines.**
  - a. 4 feet
  - b. 5 feet
  - c. 10 feet
  - d. 12 feet

**5. What causes most falls from suspended scaffolds?**

- a. Failure of adjustable connectors
- b. Failure of control-descent device
- c. Failure of emergency descent device
- d. Failure of primary support rope or supporting anchor

## Module 5: Fall Protection Systems

### What is a Fall Protection System?

If workers will be exposed to fall hazards that you can't eliminate, you'll need to prevent falls from occurring or ensure that if workers do fall, they aren't injured. A fall protection system is designed to prevent or arrest falls.

### Types of Fall Protection Systems

There are seven general fall-protection systems:

- Personal fall-arrest system (PFAS): Arrests a fall
- Personal fall-restraint system: Prevents a fall
- Positioning-device system: Positions a worker and limits a fall to 2 feet
- Guardrail system: Prevents a fall
- Safety-net system: Arrests a fall
- Warning-line system for roofing work: Warns a worker of a fall hazard

### Other Fall-Protection Methods

The following methods may also be appropriate for preventing falls:

- Safety monitoring for roofing work: A method in which a person—rather than a mechanical system—warns roofers when they are in danger of falling. The monitor, who must be a competent person, is responsible for recognizing the hazards and warning workers about them.
- Catch platforms: Though not covered in OSHA standards, catch platforms are an acceptable method of protecting workers from falls.
- Covers for holes: Simple and effective when they're properly installed, rigid covers prevent workers from falling through temporary holes, openings, and skylights in walking/working surfaces.

- Fences and barricades: Use a fence or similar barricade to keep people away from wells, pits, and shafts.

### Identify and Evaluate Fall Hazards

Wherever possible, you need to try to eliminate fall hazards. In many situations, you won't be able to eliminate fall hazards. Make sure you identify hazards that you can't eliminate and evaluate each one. The evaluation will help you determine appropriate fall-protection systems for your work site. Consider the following:

- What is the fall distance from the walking/working surface to the next lower level?
- How many workers are exposed to the hazard?
- What tasks and work areas are associated with the hazard?
- How will the workers move—horizontally, vertically, or in both directions—to do their tasks?
- Are secure anchorages available or can they be easily installed near the hazard?
- Are there other hazards near the work area, such as overhead power lines?
- How will workers be promptly rescued if they are suspended in a personal fall-arrest system?

### Personal Fall-Arrest Systems (PFAS)

A personal fall-arrest system consists of an anchorage, full body harness (FBH), and connection systems, that work together to stop a fall and to minimize the arrest force. Other parts of the system may include a lanyard, a deceleration device, and a lifeline.

The personal fall-arrest system is effective only if you know how all of the components work together to stop a fall. Before you use a personal fall-arrest system, you should know the following:

- How to select and install a secure anchorage.
- How to select and use connectors.
- How to put on and use a full-body harness.

- How to correctly attach and use a lanyard.
- When a deceleration device is necessary.
- How to erect and use a lifeline.
- The correct procedures for using retractable devices.
- How to estimate fall distances.
- How to avoid swing falls.
- How to inspect and maintain the system.
- How you will be promptly rescued if you fall.

### The Anchorage

An anchorage is a secure point of attachment for lifelines, lanyards, or deceleration devices. How can you be sure that an anchorage is secure? An anchorage for a personal fall-arrest system must support at least 5,000 pounds. Anchorages that can't support 5,000 pounds must be designed and installed under the supervision of a qualified person and must be able to maintain a safety factor of at least two - twice the impact force of a worker free-falling 6 feet. If you don't know how much weight an anchorage will support, have a qualified person check it before you trust your life to it.

Anchorage strength is critical, but is not the only factor to consider. Also important:

- **Anchorage connector:** Unless an existing anchorage has been designed to accept a lanyard or lifeline, you'll need to attach an anchorage connector - a device that provides a secure attachment point. Examples include tie-off adapters, hook anchors, beam connectors, and beam trolleys. Be sure that the connector is compatible with the lanyard or lifeline and appropriate for the work task.
- **Attachment point:** The anchorage can be used only as the attachment point for a personal fall-arrest system; it can't be used to support or suspend platforms.
- **Location:** The anchorage should be located directly above the worker, if possible, to reduce the chance of a swing fall.

- **Fall distance:** Because a personal fall-arrest system doesn't prevent a fall, the anchorage must be high enough above a worker to ensure that the arrest system, and not the next lower level, stops the fall. Consider free-fall distance, lanyard length, shock-absorber elongation, and body-harness stretch in determining the height of an anchorage. Free-fall distance is the distance a worker falls before a personal fall-arrest system begins to stop the fall.
- **Connectors:** An anchorage, a lanyard, and a body harness are not useful until they're linked together. Connectors do the linking; they make the anchorage, the lanyard, and the harness a complete system. Connectors include carabiners, snap hooks, and D-rings.
- **Carabiner:** This high-tensile alloy steel connector has a locking gate and is used mostly in specialized work such as window cleaning and high-angle rescue. Carabiners must have a minimum tensile strength of 5,000 pounds.
- **Snap hook:** A hook-shaped member with a keeper that opens to receive a connecting component and automatically closes when released. Snap hooks are typically spliced or sewn into lanyards and self-retracting lifelines. Snap hooks must be high-tensile alloy steel and have a minimum tensile strength of 5,000 pounds. Use only locking snap hooks with personal fall-arrest systems; locking snap hooks have self-locking keepers that won't open until they're unlocked.
- **D-ring:** D-rings are the attachment points sewn into a full-body harness. D-rings must have a minimum tensile strength of 5,000 pounds.

## The Full-Body Harness

A Full-Body Harness (FBH) is used in general industry, construction and any other industry where work at height is required. Its use protects workers against falls from heights and allows for travel restraint, positioning, suspension and/or rescue.

The full-body harness has straps that distribute the impact of a fall over the thighs, waist, chest, shoulders, and pelvis. Full-body harnesses come in different styles, many of which are light and comfortable.

## Body Belts

Body belts have a strap with means both for securing about the waist and for attaching to other components such as a lanyard used with positioning systems, travel restraint systems, or ladder safety systems. Since 1998, OSHA standards which address fall hazards call for the use of body

harnesses rather than body belts when used as part of a personal fall arrest system. They should be used for positioning only.

### Purchasing an FBH for a Personal Fall-Arrest System

Before you purchase harnesses, make sure they fit those who will use them, they're comfortable, and they're easy to adjust. A full-body harness should include a back D-ring for attaching lifelines or lanyards and a back pad for support.

Keep the following in mind:

- The harness must be made from synthetic fibers.
- The harness must fit the user. It should be comfortable and easy to adjust.
- The harness must have an attachment point, usually a D-ring, in the center of the back at about shoulder level. The D-ring should be large enough to easily accept a lanyard snap hook.
- Chest straps should be easy to adjust and strong enough to withstand a fall without breaking.
- Use only industrial full-body harnesses (not recreational climbing harnesses).
- The harness must be safe and reliable. It should meet ANSI Z359.11 and CSA Z259.12-11 standards and the manufacturer should have ISO 9001 certification, which shows the manufacturer meets international standards for product design, development, production, installation, and service.

### Connection Systems - Lanyards

A lanyard is a specially designed flexible line that usually has a snap hook at each end. One snap hook connects to the body harness and the other connects to an anchorage or a lifeline. A special type of lanyard, called an "integrated" lanyard only has a snap hook at one end.

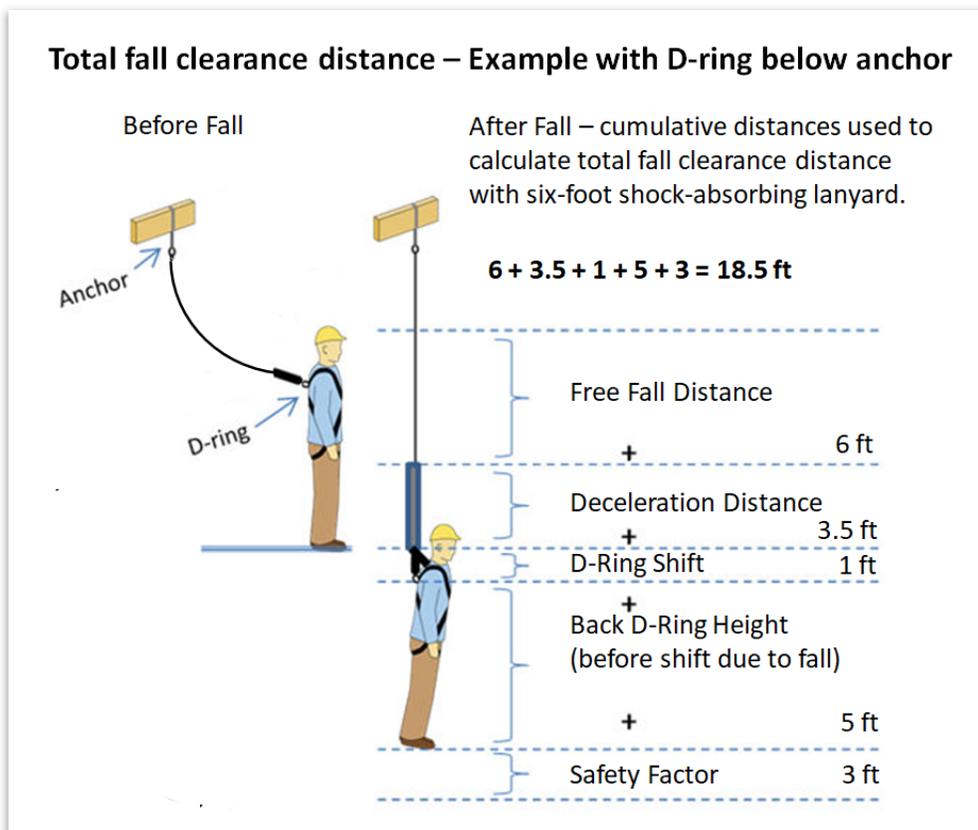
Lanyards must have a minimum breaking strength of 5,000 pounds. They come in a variety of designs, including self-retracting types that make moving easier and shock-absorbing types that reduce fall-arrest forces. Don't combine lanyards to increase length or knot them to make them shorter.

**Deceleration devices:** Deceleration devices protect workers from the impact of a fall and include shock-absorbing lanyards, self-retracting lifelines or lanyards, and rope grabs.

**Shock-absorbing lanyard:** A shock absorber reduces the impact on a worker during fall arrest by extending up to 3.5 feet to absorb the arrest force. OSHA rules limit the arrest force to 1,800 pounds but a shock-absorbing lanyard can reduce the force even more - to about 900 pounds.

Because a shock-absorbing lanyard extends up to 3.5 feet, it's critical that the lanyard stops the worker before the next lower level. Allow about 20 vertical feet between the worker's anchorage point and the level below the working surface. Always estimate the total distance of a possible fall before using a shock-absorbing lanyard.

**Example:** Lanyard length - free fall distance (6 feet) + deceleration distance (3.5 feet) + D-ring shift after the fall (1 foot) + Back D-ring height before the shift due to the fall (5 ft) + safety margin (3 feet) = 18.5 vertical feet from anchorage to lower level.



**Self-retracting lanyard/lifeline:** Self-retracting lanyards and lifelines offer more freedom to move than shock-absorbing lanyards. Each has a drum-wound line that unwinds and retracts as the worker moves. If the worker falls, the drum immediately locks, which reduces free-fall distance to about 2 feet - if the anchorage point is directly above the worker. Some self-retracting lanyards will reduce free-fall distance to less than one foot. Self-retracting lanyards are available in lengths up to 20 feet. Self-retracting lifelines, which offer more freedom, are available in lengths up to 250 feet.

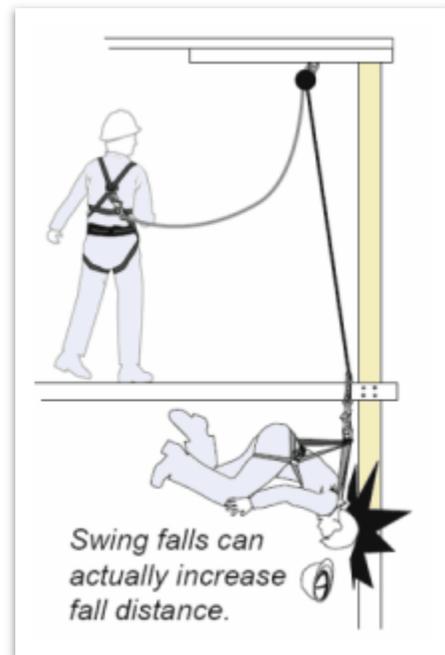
- Self-retracting lanyards and lifelines that limit free-fall distance to 2 feet or less must be able to hold at least 3,000 pounds with the lanyard (or lifeline) fully extended.
- Self-retracting lanyards that don't limit free-fall distance to 2 feet must be able to hold at least 5,000 pounds with the lanyard (or lifeline) fully extended.

### Beware of Swing Falls!

If you use a self-retracting lanyard or lifeline, work below the anchorage to avoid a swing fall. The farther you move away from the anchorage, the farther you will fall and the greater your risk of swinging back into a hard object. Swing falls are hazardous because you can hit an object or a lower level during the pendulum motion.

**Rope grab:** A rope grab allows a worker to move up a vertical lifeline but automatically engages and locks on the lifeline if the worker falls. When using a rope grab, keep the following in mind.

- The rope grab must be compatible with the lifeline.
- The rope grab must be correctly attached to the lifeline (not upside down).
- Keep the lanyard (between the rope grab and the body harness) as short as possible.
- Keep the rope grab as high as possible on the lifeline.



**Lifelines:** A lifeline is a cable or rope that connects to a body harness, lanyard, or deceleration device, and at least one anchorage. There are two types of lifelines, vertical and horizontal.

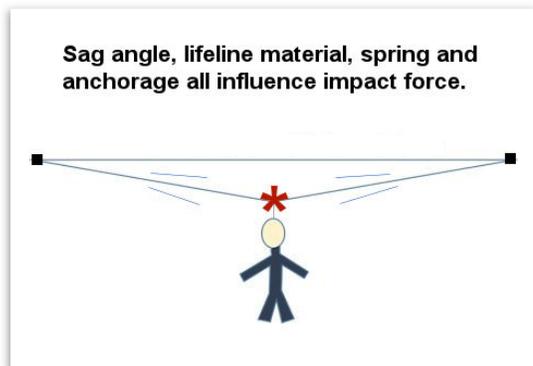
**Vertical lifeline:** A vertical lifeline is attached to an overhead anchorage and must be connected directly to a worker's full-body harness, lanyard, retractable device, or rope grab; it must have a minimum breaking strength of 5,000 pounds.

When a worker needs to move horizontally, however, a vertical lifeline can be hazardous due to the potential for a swing fall - the pendulum motion that results when the worker swings back under the anchor point. A swing fall increases a worker's risk of striking an object or a lower level during the pendulum motion.

**Horizontal lifeline:** Unlike a vertical lifeline, the horizontal lifeline stretches between two anchorages. When you connect a lanyard or rope grab to the horizontal lifeline, you can move about freely, thus reducing the risk of a swing fall. However, horizontal lifelines are subject to much greater loads than vertical lifelines due to what is called "sag angle".

**Sag angle** is the angle of horizontal lifeline sag when a fall occurs. According to OSHA Standard 1910.66 App C, when the angle of horizontal lifeline sag is less than 30 degrees, the impact force imparted to the lifeline by an attached lanyard is greatly amplified. For example, with a sag angle of 15 degrees, the force amplification is about 2:1 and at 5 degrees sag, it is about 6:1. But, as you'll see below, sag angle is not the only factor that determines force amplification.

**Impact force**, as used in this context, is the force or "shock" imparted to a lifeline by the attached lanyard. It's important to know that impact force is determined by a number of factors in addition to the sag angle of a horizontal lifeline. The type of material used for the lifeline, the amount of "spring" in the lifeline, and the elasticity of the horizontal supports at the end of a



fall. (T. Dranger, "Design of Horizontal Life Lines in Personal Fall Arrest Systems", *Engineering Journal*, Vol 52, No.2)

Calculating impact forces is not a simple matter, it can be dangerous if you assume impact forces can be safely reduced just by decreasing the sag angle of a horizontal lifeline. If horizontal lifelines are not installed correctly, they can fail at the anchorage points due to these impact forces. For this reason, horizontal lifelines must be designed, installed, and used under the supervision of a qualified person.

### Safe Practices for Personal Fall-Arrest Systems

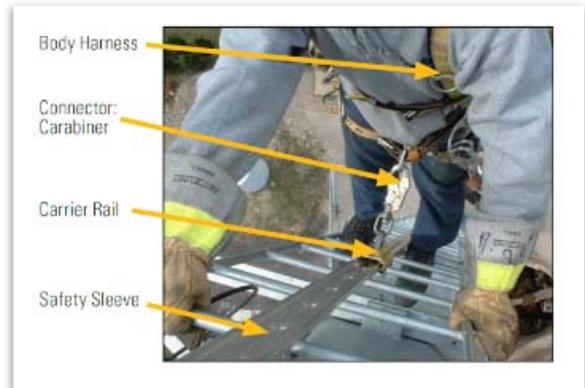
- Don't tie knots in rope lanyards and lifelines; knots can reduce strength by 50 percent.
- Don't tie lifelines or lanyards directly to I-beams; the cutting action of beam edges can reduce the rope's strength by 70 percent.
- Know how the sag angle of a horizontal lifeline can affect arrest forces on the anchorages. Remember that horizontal lifelines must be designed, installed, and used under the supervision of a qualified person.
- Think about the potential for a swing fall whenever you connect a lifeline to a personal fall-arrest system.
- Remember that a shock-absorbing lanyard will elongate before arresting a fall. The fall distance includes lanyard length (before the shock absorber extends), deceleration distance (shock-absorber extension), worker height, and a safety margin (allow 3 feet).

## Real-World Falls

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### Fall from a Telecommunications Tower

A worker was climbing down a 400-foot telecommunications tower when he lost his footing. The ladder safety device or system (consisting of the carabiner, carrier rail, safety sleeve and body harness) he used failed to arrest his fall. The safety sleeve did not activate correctly to stop the worker's fall, the chest D-ring ripped out of the body harness, and he plunged 90 feet to his death.



### Likely Causes of Incident

- The worker did not receive proper training on the ladder safety device he used.
  - The pawl of the sleeve was defective. The defect prevented the device from activating properly to stop a fall within 2 feet (.61 meters) of its occurrence (29 CFR 1926.1053(a)(22)(iii)). This was identified in a safety notice issued after the incident and as a result of OSHA's investigation.
  - The weight of the worker, his tools and equipment was more than the 310-pound rating of the body harness.
  - The safety sleeve was connected to the harness at the chest D-ring instead of to the navel D-ring as specified by the manufacturer of the ladder safety device.
  - The body harness was not a component of the manufacturer's ladder safety device.
-

## Module 5 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. A fall-arrest system \_\_\_\_\_ the fall and the fall-restraint system \_\_\_\_\_ the fall.**
  - a. allows, prevents
  - b. prevents, limits
  - c. limits, prevents
  - d. holds, limits
  
- 2. Which of the following is not one of the major components of a personal fall-arrest system?**
  - a. Anchorage
  - b. Net
  - c. Full-body harness
  - d. Connector
  
- 3. Anchorages that can't support 5,000 pounds must be designed and installed under the supervision of \_\_\_\_\_.**
  - a. the site project manager
  - b. an OSHA consultant
  - c. the safety manager
  - d. a qualified person
  
- 4. The harness must have an attachment point, usually a D-ring \_\_\_\_\_.**
  - a. in the center of the front at chest level
  - b. on the side at mid-back level
  - c. in the center of the back at about shoulder level
  - d. that is adjustable and removable

**5. Which of the following is true regarding lanyards?**

- a. They have a snap hook at each end.
- b. Do not combine lanyards.
- c. Minimum breaking strength is 5000 pounds.
- d. Each of the above is true.

## Module 6: Fall Protection Systems (Continued)

### Personal Fall-Restraint Systems

Unlike the personal fall-arrest system, which is designed to stop a fall, a personal fall-restraint system prevents a worker from reaching an unprotected edge and thus prevents a fall from occurring. The system consists of an anchorage, connectors, and a body harness or a body belt. The attachment point to the body belt or full body harness can be at the back, front, or side D-rings.

The anchorage for a fall-restraint system must support at least 3,000 pounds or be designed and installed with a safety factor of at least two. If you're not sure how much an anchorage will support, have a qualified person evaluate it.

### Positioning-Device Systems

Positioning-device systems make it easier to work with both hands free on a vertical surface such as a wall or concrete form. Positioning-device systems are also called Class II work-positioning systems and work-positioning systems.

The components of a positioning-device system—anchorage, connectors, and body support—are similar to those of a personal fall-arrest system. However, the systems serve different purposes. A positioning-device system provides support and must stop a free fall within 2 feet; a personal-fall-arrest system provides no support and must limit free-fall distance to 6 feet.

- *Anchorage:* Positioning-device systems must be secured to an anchorage that can support at least twice the potential impact of a worker's fall or 3,000 pounds, whichever is greater.
- *Connectors:* Connectors must have a minimum strength of 5,000 pounds. Snap hooks and D-rings must be proof-tested to a minimum load of 3,600 pounds without deforming or breaking.
- *Body support:* A body belt is acceptable as part of a positioning-device system. However, it must limit the arresting force on a worker to 900 pounds and it can only be used for body support. A full-body harness is also acceptable and must limit the arrest force to 1,800 pounds. Belts or harnesses must have side D-rings or a single front D-ring for positioning.
- *Connectors:* Belts or harnesses must have side D-rings or a single front D-ring for positioning. All connectors must have locking features to avoid unclipping.

## Guardrail Systems

A guardrail system consists of a top rail, midrail, and intermediate vertical member. Guardrail systems can also be combined with toeboards that prevent materials from rolling off the walking/working surface.

Guardrail systems must be free of anything that might cut a worker or snag a worker's clothing. Top rails and midrails must be at least ¼-inch thick to reduce the risk of hand lacerations; steel or plastic banding cannot be used for top rails or midrails. Other requirements for guardrails:

- Wire rope used for a top rail must be marked at least every 6 feet with high-visibility material.
- The top rail of a guardrail must be 42 plus or minus 3 inches above the walking/working surface. The top-edge height can exceed 45 inches if the system meets all other performance criteria.
- Midrails must be installed midway between the top rail and the walking/working surface unless there is an existing wall or parapet at least 21 inches high.
- Screens and mesh are required when material could fall between the top rail and midrail or between the midrail and the walking/working surface.
- Intermediate vertical members, when used instead of midrails between posts, must be no more than 19 inches apart.
- A guardrail system must be capable of withstanding a 200-pound force applied within 2 inches of its top edge in any outward or downward direction.
- Midrails, screens, and intermediate structural members must withstand at least 150 pounds applied in any downward or outward direction.

## Safety-Net Systems

Safety-net systems consist of mesh nets and connecting components.

- Safety-net openings can't be more than 6 inches on a side, center to center.
- Safety nets must not be installed more than 30 feet below the working surface.

- An installed net must be able to withstand a drop test consisting of a 400-pound sandbag, 30 inches in diameter, dropped from the working surface.
- Inspect safety nets regularly and remove debris from them no later than the start of the next work shift.

The minimum horizontal distance to the net's outer edge depends on how far below the working surface the net is placed.

Net's distance below work surface	Minimum horizontal distance from the edge of the working surface to the net's outer edge
Up to 5 feet	8 feet
5 to 10 feet	10 feet
More than 10 feet	13 feet

### Warning-Line Systems for Roofing Work

Roofing work refers to hoisting, storing, applying, and removing roofing materials and equipment; it includes work on related insulation, sheet metal, and vapor barriers, but does not include the construction of the roof deck or leading-edge work. A warning-line system for roofing work consists of ropes, wires or chains, and supporting stanchions that mark off an area within which roofing work can be done without guardrails, personal fall-arrest systems, restraint systems, or safety nets. Warning-line systems can only be used for roofing work on roofs that have slopes of 2:12 or less, vertical to horizontal. The purpose of the line is to warn roofers that they are near an unprotected edge.

The warning line must be at least 6 feet from an unprotected edge and meet the following criteria:

- Be flagged at least every 6 feet with high-visibility material.
- Be rigged so that the line is 34 to 39 inches from the walking/working surface.
- Have a minimum tensile strength of 500 pounds. Don't use plastic caution tape for a warning line.

- Be attached to each stanchion so that tension on one section of the line will not cause an adjacent stanchion to tip over. Stanchions must be able to support a force of at least 16 pounds applied horizontally in the direction of the roof edge without tipping over.

Those who do roofing work between the warning line and an unprotected roof edge must be protected with personal fall-arrest systems, restraint systems, guardrail systems, safety monitoring systems, or safety nets.

### Slide-Guard Systems

Are these slide guards adequate? Will they stop the fall? What's missing?

A slide-guard system prevents workers from sliding down a sloped roof. The system consists of a slide guard (typically 2-by-6-inch lumber) and at least two roof brackets. A slide-guard system can also be made at the work site without manufactured roof brackets.

It's important to understand that slide guard systems cannot be used by themselves as the primary fall protection system. They are not permitted to be used instead of conventional fall protection methods during roofing work (removal, repair, or installation of weatherproofing roofing materials, such as shingles, tile, and tar paper). However, slide guards may be used as part of a written, site-specific fall protection plan if the employer can prove that the use of conventional fall protection would be infeasible or create greater hazards.

Use these guidelines if slide guard systems are used:

- Roofs with slopes between 3:12 and 6:12 should have at least one slide guard below the work area, no closer than 6 inches from the eave.
- Roofs with slopes between 6:12 and 8:12 should have multiple slide guards no more than 8 feet apart vertically. The lowest slide guard must be no closer than 6 inches from the eave.
- The slide guard closest to the eave should be perpendicular to the roof surface. All other slide guards should be set at an angle not less than 60 degrees to the roof surface.
- Slide guards should provide continuous protection along the length of the roof.

### Manufactured roof brackets

Although it's not required we recommend using manufactured roof brackets.

- Install manufactured roof brackets according to the manufacturer's directions.

- Keep the information at the job site for those who want to review it.

### **Safety Monitoring for Roofing Work**

When other fall protection methods are not feasible and a competent person has developed a written plan, safety monitoring systems may be used. This is a method in which a person, rather than a mechanical system, warns workers doing repairs when they are in danger of falling. The monitor, who must be a competent person, is responsible for recognizing fall hazards and warning workers about them. Safety monitoring systems must meet the requirements of OSHA 29 CFR 1926.502(h).

Safety monitoring can be used only to protect those who do roofing work on roofs that have slopes less than or equal to 4 in 12 (vertical to horizontal) and widths no greater than 50 feet. Safety monitoring on roofs wider than 50 feet is not permitted unless a warning-line system also protects the workers.

The safety monitor's responsibilities:

- Recognize fall hazards.
- Warn employees when they are unaware of hazards or aren't working safely.
- Stay on the same walking/working surface as the workers to see them and to communicate with them while they are working.
- Avoid any other work or distracting activity while monitoring the workers.

Only those who are doing roofing work are permitted in the area controlled by the safety monitor. Mechanical equipment can't be used or stored in the area.

### **Catch Platforms**

Catch platforms, which consist of a stable platform and an attached standard guardrail, can protect roofers when other systems or methods are not feasible. Platform guidelines:

- The platform should not be more than 18 inches below the eave line of the roof.
- The platform should extend horizontally at least 2 feet beyond the eave line of the roof.
- The platform must have a standard guardrail and toeboard. The top guardrail should rise substantially (at least 12 inches) above the eave line of the roof. Install intermediate

rails or a solid barrier between the top rail and the platform to prevent a worker from sliding under the top rail.

### Covers for Holes

Simple and effective when they're properly installed, rigid covers prevent workers from falling through skylights or temporary openings and holes in walking/working surfaces.

Safety criteria for covers:

- Will support at least twice (2 times) the maximum expected weight of workers, equipment, and materials. Skylights are not considered covers unless they meet this strength requirement.
- Are secured to prevent accidental displacement.
- Have full edge bearing on all four sides.
- Are painted with a distinctive color or marked with the word HOLE or COVER.

### Fences and Barricades

Fences and barricades are warning barriers, usually made from posts and wire or boards, that keep people away from hazards such as wells, pits, and shafts.

### Protecting Workers from Falling Objects

You need to protect yourself from falling when you work on an elevated surface and be aware of those working above or below you. Protect yourself and others from falling objects with one of the following methods:

- *Canopies:* Make sure canopies won't collapse or tear from an object's impact.
- *Toeboards:* Toeboards must be least 3½ inches high and strong enough to withstand a force of at least 50 pounds applied downward or outward.
- *Panels and screens:* If you need to pile material higher than the top edge of a toeboard, install panels or screens to keep the material from dropping over the edge.
- *Barricades and fences:* Use them to keep people away from areas where falling objects could hit them.

When doing overhand bricklaying, keep materials and equipment (except masonry and mortar) at least 4 feet from the working edge. When doing roofing work, keep materials and equipment at least 6 feet from the roof edge unless there are guardrails along the edge. All piled, grouped, or stacked material near the roof edge must be stable and self-supporting. No amount of precaution will work if employees do not use safe work practices.

## Module 6 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. In a fall-restraint system, the attachment point to the body belt or full body harness can be at the back, front, or side D-rings.**
  - a. True
  - b. False
  
- 2. The top rail of a guardrail must be \_\_\_\_\_ plus or minus \_\_\_\_\_ inches above the walking/working surface.**
  - a. 39, 3
  - b. 42, 3
  - c. 47, 5
  - d. 49, 5
  
- 3. Safety nets must not be installed more than \_\_\_\_\_ below the working surface.**
  - a. 6 feet
  - b. 10 feet
  - c. 20 feet
  - d. 30 feet
  
- 4. The warning line must be at least \_\_\_\_\_ from an unprotected edge.**
  - a. 6 feet
  - b. 10 feet
  - c. 20 feet
  - d. 30 feet

- 5. Hole covers must support at least \_\_\_\_\_ the maximum expected weight of workers, equipment, and materials.**
- a. 1.5 times
  - b. 2 times
  - c. 3 times
  - d. 4 times

## **Module 7: Fall Protection Training**

### **Why Workers Should Be Trained on Fall Protection**

Workers need to know about workplace hazards to which they may be exposed, how to recognize the hazards, and how to minimize their exposure. The best way for them to learn is through training. Training ensures that they know about the hazards and can demonstrate how to protect themselves from falling.

Some employers assume that they can train their employees simply by showing them a fall-protection training video or online course (like this one!). But videos, lectures, online courses, etc., are not adequate because they do not provide the "hands-on" component of the training. Unfortunately, these training methods only provide instruction.

### **Employers: Your Responsibility**

If you're an employer, you're responsible for ensuring that your employees can recognize fall hazards and they know how to protect themselves before they're exposed to the hazards. You can't assume they know how to protect themselves from falls. If they're starting work on a new site, for example, they might not recognize fall hazards or know how to protect themselves unless you train them.

### **Required Training for Employees Exposed to Fall Hazards**

Workers who could be exposed to fall hazards must be trained to recognize the hazards and to know the procedures that minimize the hazards.

The employer should ensure each employee has been trained, as necessary, by a competent person qualified in the following areas:

- The nature of fall hazards in the work area;
- The correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection systems to be used;
- The use and operation of guardrail systems, personal fall arrest systems, safety net systems, warning line systems, safety monitoring systems, controlled access zones, and other protection to be used;
- The correct procedures for the handling and storage of equipment and materials and the erection of overhead protection; and

- The standards contained in OSHA and company safety regulations.

### The Training Format

As an employer, you can determine the training format. What's important is that, through training, your employees can recognize fall hazards and know procedures to minimize the hazards.

Who can do the training? It's important that the trainer knows the hazards at the work site, knows how to eliminate or control the hazards, and knows how to teach workers to protect themselves. That's why the trainer must be a competent person. (Recall that a competent person is one who can identify work-site hazards and who has management authority to control them.) The trainer must know and be able to explain the following:

- The nature of fall hazards at the work site.
- Procedures for erecting, maintaining, and disassembling fall protection systems.
- How to use and operate fall-protection systems.
- The role of each employee who may be affected by a safety-monitoring system.
- Restrictions that apply to mechanical equipment used during roofing work.
- Procedures for handling and storing materials and for erecting protection from falling objects.
- Requirements detailed in OSHA standards.
- Company policies and procedures.

### When to Train

Employees must be trained before they begin tasks that could expose them to fall hazards or before they use fall-protection systems. They must be retrained when you have reason to believe they don't recognize fall hazards, when they don't follow safe practices for using fall-protection systems, and when changes in the workplace or in the fall-protection systems used make their previous training obsolete.

## What to Put in Writing

The employer must keep a written record (certification) of each employee's fall-protection training. As a minimum, you need to include the employee's name, the training date, and the trainer's signature. Since this training involves procedures and practices that are used to prevent serious injury or death, I personally recommend you "certify" the employee as qualified to use the fall protection equipment and that they know procedures. Remember, to certify the employee as qualified, the employee must prove to the trainer or competent person that they have adequate knowledge and skills to perform the procedure or practice. A formal certification record should be developed to document any training that requires employees to know and use procedures and practices for dangerous tasks. See [sample certification record](#).

## Model Training Strategy

The "show and tell" model for on-the-job training (OJT) has been, and is still, the best method for training specific fall-protection safety procedures. Measurement knowledge and skills occurs throughout the OJT process while keeping the employee safe from injury while learning. If, in using this training method, the employee is not exposed to hazards that could cause serious injury, you may be able to delete step 3. Otherwise do not skip a step.

*Step 1: Introduction* - The instructor tells the trainee about the training. At this time, the instructor emphasizes the importance of the procedure to the success of the production/service goals, invites questions, and emphasizes accountability.

*Step 2: Instructor show and tell* - The instructor demonstrates the process. The instructor first explains and demonstrates safe work procedures associated with the task. In this step the trainee becomes familiar with each work practice and why it is important.



**Trainer:** Demonstrates and Explains

**Trainee:** Observes and Questions

*Step 3: Instructor show and ask*- The trainee tells the instructor how to do the procedure, while the instructor does it. This step is actually optional. It's important to include this step if injury is possible. There is an opportunity for the instructor to discover whether there were any misunderstandings, but protects the trainee because the instructor still performs the procedure.



**Trainer:** Demonstrates and Questions



**Trainee:** Explains and Observes

*Step 4: Trainee tell and show* - Now it's the trainee's turn. To further protect the employee, the Instructor must give permission for the trainee to perform each step. The trainee carries out the procedure but remains protected because the he or she explains the process before actually performing the procedure.



**Trainer:** Gives permission, Observes and Questions



**Trainee:** Gets permission, Explains and then Demonstrates

*Step 5: Conclusion* - The instructor recognizes accomplishment, reemphasizes the importance of the procedure, and how it fits into the overall process. The instructor also reviews the natural consequences (the injury/illness) and system consequences (reward/discipline) related to performance.

*Step 6: Document* - The trainee certifies (1) training accomplished, (2) questions were answered, (3) opportunities provided to do procedure, (4) accountabilities understood, and (5) intent to comply. The instructor certifies that the trainee has (6) demonstrated adequate knowledge and skill to complete the procedure.

## Real-World Falls

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### **Pipefitter falls from ladder**

A pipefitter was going to get a measurement at the top of a 25-foot fiberglass tank. With the help of a co-worker, he placed a ladder against the tank and tied off the bottom to pipes at the base of the tank. He climbed the ladder, stood on the top rungs, and took the measurement.

While he was descending, the ladder slipped against the slick fiberglass surface and twisted. The pipefitter lost his balance and fell 18 feet to the concrete floor. He died of massive head injuries.

**Findings:** The pipefitter had been on the job only four days and had no training in using ladders safely. Also, the ladder was defective and had not been tagged or removed from service; the side rails were twisted and dented, the rungs damaged, and the halyard was missing.

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## Module 7 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. Why does OSHA consider relying solely on videos, online courses, and classroom lectures inadequate for fall protection training?**
  - a. Lacks the required 10-hour training requirement
  - b. Limits the size of the class
  - c. Does not contain the hands-on component
  - d. Takes too much time
  
- 2. According to OSHA, which of the following is false regarding fall protection training?**
  - a. Must be provided to employees exposed to fall hazards
  - b. Must enable employees to recognize fall hazards
  - c. Must train employees on hazard mitigation procedures
  - d. Must correct all fall protection hazards prior to training
  
- 3. What is the response if the employer believes an employee who has been trained doesn't recognize fall hazards?**
  - a. Discipline the employee
  - b. Reassign the employee
  - c. Retrain the employee
  - d. Terminate the employee
  
- 4. Documentation of fall protection training must include which of the following at a minimum?**
  - a. Employee name, training date, trainer signature
  - b. Trainer name, training topic, employee signature
  - c. Employee name, training date
  - d. Training date, trainer signature

- 5. According to the text, what is the best method for training specific fall-protection safety procedures?**
- a. Group exercise
  - b. Guided discussion
  - c. Lecture
  - d. Show and tell

## Module 8: Inspection and Maintenance

### Caring for Equipment

When you use ladders, scaffolds, aerial lifts, and fall-protection systems you expect to get your job done safely. But do you pay attention to the condition of the equipment? Inspect the equipment frequently, keep it clean, store it properly, and it won't let you down.

### Inspection and Maintenance

To maintain their service life and high performance, it is very important that you inspect the components of personal fall-arrest, restraint, or positioning-device systems for damage or excessive wear **before and after each use**. Frequent inspection by a competent person should also be accomplished. Replace any component that looks damaged.

Note: If a fall arrest system has prevented a fall, you can't use it again, but don't throw it away. Use that harness to tell the story in training about how it saved a life. It's worth its weight in gold!

### Harness Inspection

It is very important that you inspect the components of personal fall-arrest, restraint, or positioning-device systems for damage or excessive wear **before and after each use**.

1. **Belts and Rings:** For harness inspections begin at one end, hold the body side of the belt toward you, grasping the belt with your hands six to eight inches apart. Bend the belt in an inverted "U." Watch for frayed edges, broken fibers, pulled stitches, cuts or chemical damage. Check D-rings and D-ring metal wear pads for distortion, cracks, breaks, and rough or sharp edges. The D-ring bar should be at a 90 degree angle with the long axis of the belt and should pivot freely.
  - Attachments of buckles and D-rings should be given special attention. Note any unusual wear, frayed or cut fibers, or distortion of the buckles.
  - Rivets should be tight and unremovable with fingers. Body side rivet base and outside rivets should be flat against the material. Bent rivets will fail under stress.
  - Inspect frayed or broken strands. Broken webbing strands generally appear as tufts on the webbing surface. Any broken, cut or burnt stitches will be readily seen.

2. **Tongue Buckle:** Buckle tongues should be free of distortion in shape and motion. They should overlap the buckle frame and move freely back and forth in their socket. Rollers should turn freely on the frame. Check for distortion or sharp edges.
3. **Friction Buckle:** Inspect the buckle for distortion. The outer bar or center bars must be straight. Pay special attention to corners and attachment points of the center bar.

## Lanyards

When inspecting lanyards, begin at one end and work to the opposite end. Slowly rotate the lanyard so that the entire circumference is checked. Spliced ends require particular attention. Hardware should be examined under procedures detailed below.

## Hardware

**Snaps:** Inspect closely for hook and eye distortion, cracks, excessive wear, and corrosion or pitted surfaces. The keeper or latch should seat into the nose without binding and should not be distorted or obstructed. The keeper spring should exert sufficient force to firmly close the keeper. Keeper rocks must provide the keeper from opening when the keeper closes.

**Thimbles:** The thimble (protective plastic sleeve) must be firmly seated in the eye of the splice, and the splice should have no loose or cut strands. The edges of the thimble should be free of sharp edges, distortion, or cracks.

## Lanyards

**Steel Lanyards:** While rotating a steel lanyard, watch for cuts, frayed areas, or unusual wear patterns on the wire. The use of steel lanyards for fall protection without a shock-absorbing device is not recommended.

**Web Lanyard:** While bending webbing over a piece of pipe, observe each side of the webbed lanyard. This will reveal any cuts or breaks. Paint or other substances should not be on the webbing as it may contaminate the material. Due to the limited elasticity of the web lanyard, fall protection without the use of a shock absorber is not recommended.

**Rope Lanyard:** Rotation of the rope lanyard while inspecting from end to end will bring to light any fuzzy, worn, broken or cut fibers. Weakened areas from extreme loads will appear as a noticeable change in original diameter. The rope diameter should be uniform throughout, following a short break-in period. When a rope lanyard is used for fall protection, a shock-absorbing system should be included.

## Shock-Absorbing Packs

The outer portion of the shock-absorbing pack should be examined for burn holes and tears. Stitching on areas where the pack is sewn to the D-ring, belt or lanyard should be examined for loose strands, rips and deterioration.

## Visual Indication of Damage to Webbing and Rope Lanyards

### Heat

In excessive heat, nylon becomes brittle and has a shriveled brownish appearance. Fibers will break when flexed and should not be used above 180 degrees Fahrenheit.

### Chemical

Change in color usually appears as a brownish smear or smudge. Transverse cracks appear when belt is bent over tight. This causes a loss of elasticity in the belt.

### Ultraviolet Rays

Do not store webbing and rope lanyards in direct sunlight, because ultraviolet rays can reduce the strength of some material.

### Molten Metal or Flame

Webbing and rope strands may be fused together by molten metal or flame. Watch for hard, shiny spots or a hard and brittle feel. Webbing will not support combustion, nylon will.

### Paint and Solvents

Paint will penetrate and dry, restricting movements of fibers. Drying agents and solvents in some paints will appear as chemical damage.

## Self-Retracting Lifelines

Look for cuts, frayed strands, or excessive wear in the line and damage to the housing. If the unit needs service, check the manufacturer's recommendations. Don't try to repair it yourself.

See [more information](#) about PFAS inspection and maintenance from Miller Fall Protection.

## Guardrail Systems

Frequently inspect manila, plastic, or synthetic rope used for top rails or midrails to ensure that the rope meets the minimum strength and rail height requirements. [See 1926.502(b)]

## Safety-Net Systems

Inspect safety nets for damage or deterioration weekly and after any event that could damage them. Remove defective components from service.

## Ladders

Remember, not just anyone can or should inspect ladders or fall protection equipment. A competent person must inspect ladders periodically. He or she must also inspect them immediately after any event that could damage them.

General: When inspecting ladders, generally look for loose steps or rungs (considered loose if they can be moved at all with the hand), loose nails, screws, bolts, or other metal parts. Look for cracked, spilt, or broken uprights, braces, or rungs, slivers on uprights, rungs, or steps. Also look for damaged or worn non-slip bases.

Step Ladders: On step ladders, make sure they are not wobbly (from side strain) and do not have loose, bent or broken hinge spreaders, or loose hinges. Make sure the stop on hinge spreaders are not broken. Finally make sure the steps are not broken, split or worn.

Extension Ladders: On extension ladders, make sure the extension locks are not loose, broken, or missing. Make sure locks seat properly while extended, and make sure the rope is not worn, rotted, cut, or defective in any way.

## Scaffolds

A competent person must inspect a scaffold and its components after it has been erected, before each shift, and after any event—including severe weather—that could damage it. The inspection should include the foundation, platform, guardrails, and access areas.

## Suspension scaffolds

A competent person must inspect suspension ropes before each shift and after any event that could damage them. Inspect and tighten wire rope clips to the manufacturer's recommendations at the start of each shift. Inspect manila or synthetic rope used for top rails or mid rails frequently to ensure that it meets the minimum strength and rail height requirements. [See 1926.502(b)].

## Crane- and Derrick-Suspended Personnel Platforms

- After the trial lift: Immediately after a trial lift, a competent person must inspect the rigging, personnel platform, and the base that supports the crane or derrick.

- After proof testing: A competent person must inspect the platform and rigging immediately after they have been proof tested.

### **Summary: Inspecting, Cleaning, and Storing Fall-Protection Equipment**

- Always follow manufacturers' instructions and warnings.
- Always inspect equipment before using it. Look for damaged or missing parts. Labels, warnings, and other instructions should be readable.
- If equipment looks like it needs repair, remove it from service and have a competent person examine it.
- Have a competent person inspect equipment regularly.
- Mark equipment with a unique code or item number. Identification numbers make it easier to keep track of the equipment and to document maintenance or repair.
- Wash synthetic rope and body harnesses in soapy water to remove dirt; rinse them with clean water. Air-dry at room temperature. Don't use cleaning solvents; solvents can damage synthetic material.
- Don't lubricate moving parts unless the manufacturer requires it; lubricants attract dirt.
- Don't remove information labels and warnings; make sure they're still legible after cleaning.
- Follow manufacturer's instruction for storing equipment.
- Store equipment in an area that is clean, dry, and moisture-free; avoid excessive heat, light, oil, and corrosive chemicals.

[More information](#) on cleaning and inspection of fall protection equipment.

## Module 8 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. When should you inspect the components of personal fall-arrest, restraint, or positioning-device systems for damage or excessive wear?**
  - a. Once a week
  - b. Once a day
  - c. Before and after each use
  - d. As needed or directed
  
- 2. Do not use a personal fall-arrest system that has arrested a fall unless a competent person has determined that the system is safe to use.**
  - a. True
  - b. False
  
- 3. Which of the following should be looked for when inspecting harness webbing?**
  - a. Frayed edges
  - b. Cracks, breaks, rough or sharp edges
  - c. Loose, bent or broken grommets
  - d. Stiffness and cracking
  
- 4. When inspecting snap-hooks, which of the following defects should be looked for?**
  - a. Cracks, excessive wear, and corrosion
  - b. Broken fibers and pulled stitches
  - c. Chemical damage
  - d. Cuts and burns

- 5. According to the text, which of the following need not be looked at while inspecting scaffolds?**
- a. Platform
  - b. Guardrails
  - c. Foundation
  - d. Warning zone

## Module 9: Rescue at Height

### Prompt Rescue Required

The best strategy for protecting workers from falls is to eliminate the hazards that cause them. When you can't eliminate the hazards, you must protect workers with an appropriate fall-protection system or method. If a worker is suspended in a personal fall-arrest system, you must provide for a prompt rescue.

"Prompt" means without delay. A worker suspended in a harness after a fall can lose consciousness if the harness puts too much pressure on arteries. A worker suspended in a body harness must be rescued in time to prevent serious injury. If a fall-related emergency could happen at your work site, you should have a plan for responding to it promptly. Workers who use personal fall-arrest systems must know how to promptly rescue themselves after a fall or they must be promptly rescued.

### Developing an Emergency-Response Plan

The following guidelines will help you develop a plan for responding promptly to falls and other emergencies.

- Effective plans don't need to be elaborate. Your plan should show you've thought about how to eliminate and control hazards and workers know how to respond promptly if something goes wrong.
- Get others involved in planning. When other workers participate, they'll contribute valuable information, take the plan seriously, and be more likely to respond effectively during an emergency. Key objectives for an effective emergency-response plan include:
  - Identify the emergencies that could affect your site.
  - Establish a chain of command.
  - Establish procedures for responding to the emergencies.
  - Identify critical resources and rescue equipment.
  - Train on-site responders.
- Identify emergencies that could affect your workplace. Identify any event that could threaten worker safety or health. Two examples:

- A worker suspended in a full-body harness after a fall.
- A worker on a scaffold who contacts an overhead power line.
- Identify critical resources and rescue equipment. Prompt rescue won't happen without trained responders, appropriate medical supplies, and the right equipment for the emergency.
  - First-aid supplies: Every work site needs medical supplies for common injuries. Does your site have a first-aid kit for injuries that are likely to occur? Store the supplies in clearly marked, protective containers and make them available to all shifts.
  - Rescue equipment: Identify on-site equipment that responders can use to rescue a suspended worker. Extension ladders and mobile lifts are useful and available at most sites. Determine where and how each type of equipment would be most effective during a rescue. Make sure the equipment will permit rescuers to reach a fall victim, that it's available when rescuers need it, and that rescuers know how to use it.

Will your longest ladder reach a suspended worker? If not, what equipment will reach the worker? When equipment is needed for a rescue, will workers know where it is and how to use it? Think about seasonal and environmental conditions and how they may affect rescue equipment and those who use it. Equipment that works for summer rescues may not work for winter rescues.

- Train on-site responders: An effective emergency-response plan ensures that on-site responders know emergency procedures, know how to use available rescue equipment, and - if necessary - know how to contact off-site responders. Workers who use personal fall-arrest systems and who work alone must know how to rescue themselves. Those who work at a remote site may need a higher level of emergency training than those who work near a trauma center or a fire department.
- Establish a chain of command. All workers must know their roles and responsibilities during an emergency. A chain of command links one person with overall responsibility for managing an emergency to those responsible for carrying out specific emergency-response tasks. Make sure that back-up personnel can take over when primary responders aren't available.

- Establish procedures for responding to emergencies. Procedures are instructions for accomplishing specific tasks. Emergency procedures are important because they tell workers exactly what to do to ensure their safety during an emergency. Your emergency-response plan should include the following procedures—preferably in writing—that describe what people must know and do to ensure that a fallen worker receives prompt attention:
  - How to report an emergency.
  - How to rescue a suspended worker.
  - How to provide first aid.

After an emergency, review the procedures; determine if they should be changed to prevent similar events and revise them accordingly.

### **Summary: Responding to falls**

Before on-site work begins

- Identify emergencies that could affect your work site.
- Establish a chain of command.
- Document procedures for responding to emergencies and make sure they're available at the site.
- Post emergency-responder phone numbers and addresses at the work site.
- Identify critical resources and rescue equipment.
- Train on-site responders.
- Identify off-site responders and inform them about any conditions at the site that may hinder a rescue effort.
- Identify emergency entry and exit routes.
- Make sure responders have quick access to rescue and retrieval equipment, such as lifts and ladders.

### During on-site work

- Identify on-site equipment that can be used for rescue and retrieval, such as extension ladders and mobile lifts.
- Maintain a current rescue-equipment inventory at the site. Equipment may change frequently as the job progresses.
- Re-evaluate and update the emergency-response plan when on-site work tasks change.

### When an emergency occurs

- First responders should clear a path to the victim. Others should direct emergency personnel to the scene. You can use 911 for ambulance service; however, most 911 responders are not trained to rescue a worker suspended in a personal fall-arrest system. Make sure only trained responders attempt a technical rescue.
- Prohibit all nonessential personnel from the rescue site.
- Talk to the victim; determine the victim's condition, if possible.
- If you can reach the victim, check for vital signs, administer CPR, attempt to stop bleeding, and make the victim comfortable.

### After an emergency

- Report fatalities and catastrophes to OSHA within eight hours.
- Report injuries requiring overnight hospitalization and medical treatment (other than first aid) to OSHA within 24 hours.
- Identify equipment that may have contributed to the emergency and put it out of service. Have a competent person examine equipment. If the equipment is damaged, repair or replace it. If the equipment caused the accident, determine how and why.
- Document in detail the cause of the emergency.
- Review emergency procedures. Determine how the procedures could be changed to prevent similar events; revise the procedures accordingly.

## Module 9 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. If a worker is suspended in a personal fall-arrest system, you must provide for a prompt rescue. "Prompt" means \_\_\_\_\_.**
  - a. within 15 minutes
  - b. as soon as possible
  - c. without delay
  - d. when emergency services arrive
  
- 2. Which of the following is a key planning objective in an effective emergency-response plan?**
  - a. A chain of command
  - b. Response procedures
  - c. On-site responder training
  - d. Each of the above
  
- 3. According to the text, to ensure a fallen worker receives prompt attention, your emergency-response plan should include all of the following, EXCEPT:**
  - a. How to provide first aid
  - b. How to rescue a suspended worker
  - c. How to report an emergency
  - d. How to discipline for non-compliance
  
- 4. You can use 911 for ambulance service because most 911 responders are trained to rescue a worker suspended in a personal fall-arrest system.**
  - a. True
  - b. False

- 5. An effective fallen worker emergency-response strategy primarily relies on \_\_\_\_\_.**
- a. fire department responders
  - b. emergency medical services
  - c. on-site responders
  - d. air rescue services