



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.

Quiz Instructions

After each section, there is a quiz question. Make sure to read the material in each section to discover the correct answer to these questions. Circle the correct answer. When you are finished go online to take the final exam. This exam is open book, so you can use this study guide.

1. Which of the following industries experience the highest frequency of fall-related deaths?

- a. Agriculture
- b. Construction
- c. Healthcare
- d. Transportation

When Fall Protection is Needed

OSHA's general industry standards require employers to identify the potential for falls in the workplace and establish appropriate fall protection when they identify hazards. Four feet above the ground or a lower level is widely understood among general industry employers as the "trigger height" that requires you to take action to protect your employees from falls.

Did you know that some trigger heights in general industry differ from four feet? Working above or adjacent to dangerous equipment requires action to protect employees from falls onto that equipment, regardless of height, and many types of scaffolds have trigger heights above four feet.

Understanding OSHA's fall protection trigger heights and the types of fall protection allowed in general industry will help you protect employees.

The tables in this section identify trigger heights for a variety of general industry situations employees may encounter.

Fall protection trigger heights are rule specific. Some trigger heights are activated when the height is met while others are activated when the height is exceeded. When this occurs, you must take action to protect your employees from the associated fall hazards.

Selecting, installing, maintaining, and using fall protection can be challenging. Browse through any safety supply website today and you will see a wide variety of fall protection systems; however, not all systems provide equivalent levels of worker protection. Furthermore, one fall protection system may not be appropriate for every workplace situation.

The rules referenced in the tables in this section will help you select appropriate fall protection systems when your employees work at heights that require you to take action to protect them.

2. What is widely understood among general industry employers as the "trigger height" that requires you to take action to protect your employees from falls?

- a. Three feet above the lowest surface
- b. Four feet above the ground or a lower level
- c. Six feet above any walking-working surface
- d. Eight feet above a lower level

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

3. Most fall injuries are caused by falls _____.

- a. down stairs
- b. from scaffolds
- c. from ladders
- d. from roofs

Why Fall Protection Program (FPP) is Important

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.

4. What should you do to help make sure the Fall Protection Program is effective?

- a. Discipline every time there is a fall
- b. Report all falls to OSHA
- c. Threaten employees with termination
- d. Identify and evaluate fall hazards

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.

5. Who is responsible for making sure fall protection equipment is used properly?

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

Real-World Falls

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.

Module 2: Fall Protection Program Elements

A **program** is a planned, coordinated group of activities or procedures that have a specific purpose. It helps to think of the company's Fall Protection Program as one of the "subsystems" within the company's Safety Management System (SMS). It's a subsystem because, like any system, it contains interrelated elements that work toward a common goal. To help understand how systems work, let's take a short look the nature of systems in general.

A **system** is a group of interacting, interrelated, or interdependent elements forming a complex whole. All systems have structure, inputs, processes, and outputs. In terms of structure, the best systems are designed with formal (written) policies, plans, programs, processes, procedures and practices that produce intended results. However, systems may be structured in a very informal manner, and most likely result in inefficient and ineffective outputs. Either way, systems will produce only what they are designed to produce: they can't produce anything else.

To better understand systems, let's take a look at the image of "Sysie" the cow. You're probably wondering what a cow has to do with safety management system: just read on.

Sysie the cow is actually a very complicated system that, like all systems, has:

- **Structure** - She is built to function as a cow.
- **Inputs** - She eats, drinks, and breathes.
- **Processes** - She thinks, feels, circulates oxygen and nutrients, digests food, and eliminates waste.
- **Outputs** - She produces milk, waste products, and other cows (results). Her behaviors reflect wellness or illness.

Like Sysie, a safety management system has:

- **Structure** - Formal or informal, responsibilities, assignments, and teams.
- **Inputs** - Funding, commitment, leadership, staffing, and equipment.
- **Processes** - Procedures, tasks, and best practices.
- **Outputs** - Low/high accident rates, low/high direct and indirect costs, morale, and reputation.

The bottom line: There are two important things to remember about systems:

1. Your company cannot NOT have a safety management system: what does yours look like?
2. Your safety management system can only produce what it is designed to produce.

The challenge is to design, develop and deploy your system so that it is both efficient and effective.

1. Funding, commitment, leadership, staffing, and equipment are example of safety management system ____.

- a. inputs
- b. predictions
- c. processes
- d. outputs

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.

2. The purpose of employee involvement in the Fall Protection Program is to make it more likely that employees will ____.

- a. use fall protection when not being supervised
- b. not complain about having to use fall protection
- c. comply and enforce safety rules
- d. not need permission to climb without fall protection

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](#).

3. Which element of the Fall Protection Program is an OSHA accident investigation most likely to focus on first if a fall accident occurs?

- a. Commitment
- b. Accident investigation
- c. Training
- d. Hazard identification

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.

Business Policy. Our company is committed to achieving and maintaining a safe, healthful workplace for all its employees. We base our commitment on a safety and health program that involves all employees in the effort to eliminate or control workplace hazards. All employees, including managers and supervisors, will be held accountable for following this policy.

Management Responsibilities. Managers are responsible for preventing workplace injuries and illnesses and will consider all employee suggestions for achieving a safe, healthful workplace. Managers will stay informed about workplace hazards and will review the safety and health program at least once a year.

Supervisor Responsibilities. Supervisors are responsible for supervising and training employees to work safely. Supervisors must enforce safe work practices and correct hazardous conditions.

Safety committee responsibilities. The safety committee includes managers and other employees who are responsible for identifying hazardous conditions and unsafe conditions, and recommending how to eliminate, prevent, or control them. The committee is also responsible for helping managers review the safety and health program's strengths and weaknesses.

Employees' responsibilities. Our safety and health program achieves success through our employees. All employees are responsible for identifying and reporting hazards immediately to their supervisors or safety committee representatives, for following safe work practices, and for using required personal protective equipment.

4. Which of the following allows managers, supervisors, and employees to make decisions about work without having to check with the employer?

- a. Plans
- b. Processes
- c. Programs
- d. Policies

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.

5. Which of the following is a person who, by extensive knowledge, training, and experience, has successfully demonstrated his or her ability to solve or resolve problems relating to the subject matter, the work, or the project?

- a. Certified professional
- b. Competent person
- c. Qualified person
- d. Designated professional

Real-World Falls

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

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.

1. Most workplace fall hazards are _____.

- a. unforeseeable
- b. foreseeable
- c. mostly unknown
- d. unknowable

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.

2. One of the best procedures to identify fall hazards in general industry is to ____.

- a. conduct a Job Hazard Analysis (JHA)
- b. conduct a table-top exercise
- c. conduct a walkaround inspection
- d. discuss the topic in training

Identify Hazardous Tasks

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

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?

3. Which question assesses for the causes of most falls from elevation?

- a. "Will they be working extended shifts?"
- b. "Will they be exposed to slip, trip, or fall hazards?"
- c. "Will they have issues working at height?"
- d. "Will they be using a buddy system?"

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

4. Elevated walking-working surfaces in construction must be guarded if they are ____.

- a. four feet or more above a lower level for construction work
- b. six feet or more above a lower level for construction work
- c. six feet or more above a lower level for general industry work
- d. four feet or more for all industry categories

Determine How Frequently Workers Will Do Tasks

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-Working 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.

5. Which statement is true regarding walking-working surfaces?

- a. There's no way to make a totally hazard-free walking-working surface in the workplace
- b. Hazard-free walking-working surfaces only occur at floor level
- c. Hazard-free walking-working surfaces are possible using administrative controls
- d. It's possible to remove all hazards on a working surface through sound engineering

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.

6. What is the LEAST important factor that determines the severity of injury from a fall?

- a. The distance of the fall
- b. The origin of the fall
- c. The nature of the surface at impact
- d. The orientation of the body at impact

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.

7. For fall protection, the "four-foot rule" applies to _____.

- a. mining operations
- b. agriculture
- c. general industry
- d. construction

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.

8. Which of the following would totally eliminate exposure to a fall-to-below hazard?

- a. Place guard rails around the elevated surface
- b. Lower the work surface to ground level
- c. Substitute fall arrest with fall restraint equipment
- d. Enforce safety rules at all times

Module 4: Supported and Suspended Access

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 safety. The Bureau of Labor and Statistics reports that most injuries from falls occur from a height that is less than 10 feet, 20 percent of fatal falls at work occur from heights less than 15 feet (4.5 m), and 50 percent of fatal falls are from a height less than 35 feet (10.6 m).

Step Ladders

Common stepladder hazards include the following:

- Damaged stepladder
- Ladders on slippery or unstable surface
- Unlocked ladder spreaders
- Standing on the top step or top cap
- Loading ladder beyond rated load
- Ladders in high-traffic location
- Reaching outside ladder side rails



- Ladders in close proximity to electrical wiring/equipment

1. Each year, most workers are injured when they fall from ladders from a height that is

_____.

- a. more than 10 feet
- b. less than 10 feet
- c. less than 2 feet
- d. more than 15 feet

Straight or Single Ladders

The most common type of portable ladder is a straight or single ladder. It is a non-self-supporting portable ladder that is non-adjustable in length, consisting of one section. Unlike a stepladder that requires level support for all four of its side rails, the Single Ladder requires only two-level ground support points in addition to a top support. Ladder levelers may be used to achieve equal rail support on uneven surfaces. ([American Ladder Institute](#))

- It is intended for use by one person.
- The length cannot exceed 30 feet.
- It is available in wood, metal and reinforced fiberglass.
- It supports only one worker.
- The top support allows tie off the top of the ladder to increase stability.

Extension 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. Characteristics of extension ladders include:

- They 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.
- They are made of wood, metal, or fiberglass.

- The maximum length of extension depends on material
- They support only one worker.

It's important to choose the right ladder for the right job. Using a ladder for a task that it was not designed for may increase the risk of falling.

2. How many workers will a standard straight ladder support?

- a. 1
- b. 2
- c. 3
- d. 4

Preventing Falls from Ladders

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 before each use.
- Match work tasks to appropriate ladders.
- Set up ladders correctly. Use the 1 to 4 rule. One foot out from wall for every four feet of height.
- Climb and descend ladders properly. Both hands should be free.
- Face the ladder when climbing and use the three-point rule. "Two feet - One hand" or "Two hands - One foot" making contact at all times.
- Protect the base of a ladder to prevent others from accidentally striking it. If the ladder could be displaced by work activities, secure it.
- Select a ladder that will extend at least 36 inches (2 rungs) above the access area, or provide a grab rail so that workers can steady themselves as they get on or off.

- 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.

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; and
- OSHA's 29 CFR 1910.23-28 requirements for the ladders.

3. Most workers fall from ladders when _____.

- a. the ladders become unstable and shift or tilt
- b. the ladders sink into unstable ground
- c. the ladders are placed on uneven ground
- d. the ladders are not inspected by workers before use

Supported Scaffolds

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.

If you work on a supported scaffold more than 10 feet above a lower level, you must be protected from falling. Supported scaffolds must meet the following requirements:

- 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.
- 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.
- Scaffold components made by different manufacturers may be mixed, provided they fit together without force and maintain structural integrity.
- 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.

4. At what height above a lower level must workers be protected from falling when working on a supported scaffold?

- a. Four feet
- b. Six feet
- c. Ten feet
- d. Twelve feet

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.

- 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.
- 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.
- 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

5. What is the minimum clearance distance from an uninsulated power line while working on a scaffold?

- a. 3 feet
- b. 10 feet
- c. 15 feet
- d. 20 feet

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 in [ANSI/SAIA A92.22-2018, Safe Use of Mobile Elevating Work Platforms \(MEWPs\)](#).

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.

6. What are most aerial lift accidents caused by?

- a. Inadequate training
- b. Defective equipment
- c. Lack of common sense
- d. Engaging in horseplay

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.

7. How far must aerial lifts stay away from overhead powerlines?

- a. At least three feet
- b. Five feet
- c. Ten feet or more
- d. At least 13 feet

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.

8. Most fatalities involving adjustable-suspension scaffolds happen because _____.

- a. platforms snag on building structures
- b. of failure to use fall protection
- c. primary suspension ropes break
- d. failure of hoist motors

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.

9. Most suspended scaffold falls result from _____.

- a. a failure of friction stops
- b. a failure of the descent device

- c. a failure of the support rope or anchor
- d. a failure of fall protection systems

Crane- and Derrick-Suspended Personnel Platforms

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.

10. Most crane-related fatalities happen when _____.

- a. the boom fails due to an excessive load
- b. platform loads are not properly rigged
- c. the crane is located on unstable ground
- d. the crane boom or another part contacts a power line

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

1. A fall-arrest system _____ the fall and the fall-restraint system _____ the fall.

- a. limits, prevents
- b. limits, limits
- c. allows, prevents
- d. holds, limits

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.

2. On construction sites, fall protection safety monitors must be _____.

- a. qualified engineers
- b. competent persons
- c. experienced workers
- d. safety personnel

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?

3. What should be your first priority when identifying and evaluating fall hazards in the workplace?

- a. How to select proper fall protection
- b. How to mitigate fall hazards
- c. How to eliminate fall hazards
- d. How to limit exposure to fall hazards

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.

4. Personal fall-arrest system components work together to _____ and _____.

- a. restrain movement, ensure adequate arrest forces
- b. limit a fall, cancel arrest forces
- c. stop a fall, minimize arrest forces
- d. hold the fall to six feet, limit forces to 100 ft/lb

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.

5. Which of the following is a high-tensile alloy steel connector that has a locking gate?

- a. Snap hook
- b. Carabiner
- c. Anchorage
- d. D-ring

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.

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.

6. Where must the D-ring be located on a full-body harness?

- a. At the front of the harness at belt level
- b. At the center of the back at about shoulder level
- c. At the side about mid-level between belt and shoulder
- d. At the front at chest level

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

A deceleration device is a mechanism (e.g., tearing or deforming lanyards) that serves to dissipate energy during a fall to limit the energy and stress imposed on a worker during a fall. Deceleration occurs over a maximum distance of 3.5 feet. Deceleration devices vary widely. Examples include:

- **Self-retracting lanyard.** A self-retracting lanyard/lifeline contains a drum-wound line which can be slowly extracted or retracted. The lanyard extends as necessary to allow the worker to move about the work area, but retracts as necessary to maintain slight tension, preventing the line from becoming slack. The drum is under slight tension during normal worker movement and automatically locks the drum when the line is extracted too rapidly.
 - Self-retracting lanyards and lifelines that limit free fall to two feet or less need to sustain, at a minimum, 3,000 pounds applied to the device with the lanyard in the fully extended position.
 - Self-retracting lanyards that do not limit free fall to two feet or less need to sustain, at a minimum, 5,000 pounds applied to the device with the lanyard in the fully extended position.
 - Some retractable lifelines provide a deceleration (energy-absorbing) function. These lifelines can include a feature that slows the fall over a distance of up to 3.5 feet.
- **Rip-stitch lanyards.** A rip-stitch lanyard has extra webbing incorporated into the lanyard. The extra webbing is stitched into place and folded lengthwise along the lanyard. During a fall, the weaker stitching allows the folded webbing to pull away at a controlled speed, slowing the fall.
- **Shock-absorbing lanyards.** The webbing in a shock-absorbing lanyard is designed to stretch as it receives the worker's falling weight. The stretching action breaks the fall in a controlled manner.

This is not an all-inclusive list of lanyards. OSHA expects that emerging lanyard technology will continue to improve safety in the workplace.

7. Which statement is true regarding lanyards?

- a. They have a snap hook at each end
- b. It is okay to combine lanyards
- c. Minimum breaking strength is 2000 pounds
- d. Tie knots to make lanyards longer

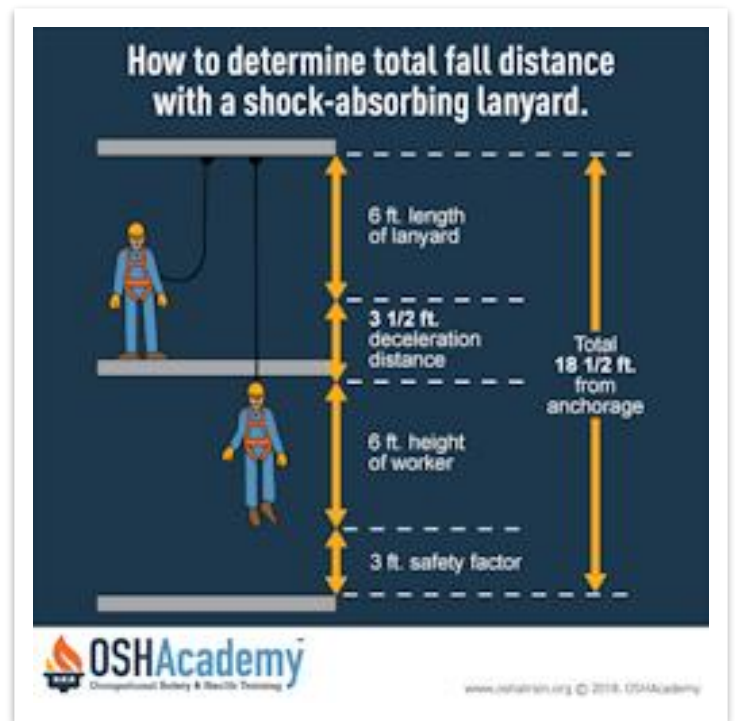
Shock-Absorbing Lanyard

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 (6 feet) + deceleration distance (3.5 feet) + worker's height (6 feet) + safety margin (3 feet) = 18.5 vertical feet from anchorage to lower level.

Never use a shock-absorbing lanyard if the shock absorber is even partially extended or if the lanyard has arrested a fall.



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.



8. A shock absorber reduces the impact force on a worker during fall arrest by extending up to ____.

- a. 2 feet
- b. 3.5 feet
- c. 4.5 feet
- d. 6 feet

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.

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.

9. If a worker is working directly below an anchorage point and falls, a self-retracting lanyard reduces free-fall distance to about ____.

- a. 2 feet
- b. 3.5 feet
- c. 4 feet
- d. 4.5 feet

Lifelines

Lifelines function as an extension of an anchorage system, allowing employees to move up and down (vertical lifeline) or back and forth (horizontal lifeline) across a work area. A sliding fitting (rope grab or shuttle) connects to the line and a lanyard connects the harness to the sliding fitting.

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.

As we know, when a worker needs to move horizontally, a vertical lifeline can be hazardous due to the potential for a swing fall

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 from side to side, 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, lifeline material, spring, and anchorage all influence impact force. Click to enlarge.

Sag angle is the angle of horizontal lifeline sag when a fall occurs. If the lifeline is tight, it won't sag much when a fall occurs, but the impact force on the lifeline will be higher.

Impact force, as used in this context, is the force or "shock" imparted to a lifeline by the attached lanyard. If the lifeline is not so tight, it will sag more and the impact force on the lifeline will actually be less.

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.

Example: If the sag angle is 15 degrees, the impact force, or force amplification, imparted to the lifeline is only about 2:1. However, when the sag angle is decreased to only 5 degrees, it's tighter, and the impact force imparted to the lifeline increases to about 6:1.

Remember, lifeline anchorages must be strengthened as impact forces increase. To reduce loads on a horizontal lifeline, increase the sag angle or connect to the lifeline with a shock-absorbing lanyard.

10. Which of the following are the two types of lifelines used in personal fall-arrest system (PFAS) design to provide fall protection?

- a. primary, secondary
- b. vertical, horizontal
- c. shock absorbing, self-retracting
- d. fixed, flexible

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).

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. Body belts should be used for positioning only.

11. What is the result if you tie knots in rope lanyards and lifelines?

- a. Rope strength increases by twice
- b. Nothing that affects safety
- c. Knots can reduce strength by 50 percent
- d. Each knot increases rope strength by 10 percent

Real-World Falls

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 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. All connectors must have locking features to avoid unclipping.

1. Which of the following systems makes it easier to work with both hands free on a vertical surface such as a wall or concrete form?

- a. Personal fall-arrest system (PFAS)
- b. Positioning-device system
- c. Safety net system
- d. Full-body harness system

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.

2. The top rail or a guardrail must be _____ inches plus or minus _____ inches above the walking/working surface.

- a. 42, 3
- b. 42, 5
- c. 39, 9
- d. 49, 3

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.

<http://www.westernsafety.com/dbisala/dbisala9.html>

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

3. Safety nets must not be installed more than _____ below the working surface.

- a. 10 feet
- b. 20 feet
- c. 30 feet
- d. 40 feet

Warning-Line Systems

A warning-line system consist of ropes, wires or chains, and supporting stanchions that mark off an area within which 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.

4. While roofing work is taking place the warning line must be at least _____ from an unprotected edge.

- a. 6 feet
- b. 10 feet
- c. 20 feet
- d. 30 feet

Residential Roof Construction

Employees engaged in residential construction activities 6 feet (1.8 m) or more above lower levels must be protected by guardrail systems, safety net system, or personal fall arrest system unless another provision in 1926.501(b) provides for an alternative fall protection measure.

Exception: When employers can prove that it is infeasible or creates a greater hazard to use these systems, the following applies:

- Employers and residential contractors are permitted to use alternative methods of fall protection where it is infeasible to use conventional means. Where infeasibility is proven, the contractors can implement a fall protection plan, as specified in section 1926.502(k).
- There is a presumption that it is feasible and will not create a greater hazard to implement at least one of the three fall protection systems mentioned above.
- Employers have the burden of establishing that it is appropriate to implement a fall protection plan for a particular workplace situation, in lieu of implementing guardrail, safety net systems, or fall arrest systems.

5. To use alternative methods for fall protection during residential construction activities, employers and contractors must do each of the following EXCEPT _____.

- a. prove that primary fall protection methods are infeasible
- b. develop a written fall protection plan
- c. verify that the work will be less than 10 feet above the ground
- d. prove that using primary systems will create a greater hazard

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.

6. The safety monitor used during roofing work must be a _____.

- a. qualified person
- b. competent person
- c. member of the AGC
- d. registered engineer

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.

7. Hole covers will support at least _____ times the maximum expected weight of workers, equipment, and materials.

- a. 2
- b. 3
- c. 4
- d. 5

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.

8. Each of the following is a way to protect workers from falling objects EXCEPT _____.

- a. canopies
- b. toeboards
- c. safety nets
- d. barricades

Module 7: Fall Protection Training

Why Fall Protection Training

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.

Employers: Your Responsibility

Workers who could be exposed to fall hazards must be trained to recognize the hazards and to know the procedures that minimize the hazards. All employees must prove they understand and can properly use, care for, and detect defects in fall protection equipment. The only way to do that is to demonstrate adequate knowledge, skills, and abilities (KSAs) to a competent person.

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.

A Word About Qualifications

Don't assume an OSHA 10- or 30-Hour training card somehow magically qualifies an employee to do anything, especially to work at elevation or train fall protection: OSHA will tell you it doesn't. Make sure you require each new employee to prove they can use fall protection correctly by demonstrating adequate knowledge and skills before allowing them to work above heights requiring fall protection.

1. What must the employer do before allowing a new employee to use fall protection equipment on the job?

- a. Require the employee to provide an OSHA 10-hour card
- b. Have the employee prove adequate knowledge and skills
- c. Ask for a course completion certificate
- d. Make sure the employee has previous experience

<http://4safetytraining.dotarrowsite.com/Default.aspx>

Training Must Be How-To and Hands-On

Employers may assume that they can complete fall protection training simply by providing a classroom lecture, showing a video, or having employees complete an online course. However, lectures, videos, or online training do not completely satisfy OSHA requirements for employers to prove their employees have adequate knowledge, skills, and abilities (SKAs) to use fall protection equipment. Although employers may satisfy the how-to instructional component, they cannot prove adequate knowledge and skills unless they provide employees an opportunity to practice hands-on to develop the necessary skills and abilities.

Blended Learning

Blended learning is an effective educational strategy for conducting fall protection training that helps employers meet OSHA requirements and ensures employees gain adequate knowledge, skills, and abilities. We call it "blended learning" because it blends multiple educational strategies to provide both the how-to and hands-on components through instruction, practice, and performance evaluation.

For instance, using the blended learning strategy, you might follow these steps:

1. Employees complete an online course or video presentation on general fall protection principles and equipment before participating in classroom instruction;
2. The trainer follows up with more complete instruction on the specific equipment that will be used after training.
3. Employees complete written exams to verify they have gained adequate knowledge.
4. Employees next practice using the equipment in a safe training environment.
5. After practice, the trainer requires employees to demonstrate how to use the equipment in the training environment.
6. The trainer evaluates employee skills during the demonstrations and, if appropriate, certifies employees as initially qualified.
7. When employees return to work, a supervisor or competent person evaluates the ability of employees to use equipment safely while performing tasks and certifies them as fully qualified.

2. OSHA considers an employee as fully qualified in the use of fall protection equipment

_____.

- a. when a trainer certifies the employee demonstrates adequate KSAs during practice
- b. when practice indicates the employee has adequate KSAs
- c. when KSAs are verified by scoring at least 70% on the course written exam
- d. when a competent person certifies adequate KSAs on the job

Trainer Criteria

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. Remember: A competent person is one who can identify work site hazards and who has management authority to control them.

The fall protection 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
- 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

3. The fall protection trainer, as a competent person, should be able to explain each of the following EXCEPT _____.

- a. how to use fall-protection systems
- b. company policies and procedures
- c. how to repair harnesses on the job
- d. the nature of fall hazards on site

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 do not appear to know how to correctly use fall protection,
- 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](#).

4. When should an employee be trained on how they may be exposed to fall hazards?

- a. The day after being hired
- b. Within one week after being hired
- c. Before being exposed to fall hazards
- d. After any fall accident occurs

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 of knowledge, skills, and abilities occurs throughout the OJT process while keeping the employee safe from injury while learning.

1. **Introduction.** The instructor tells the trainee about the fall protection training emphasizing why it's importance of properly use it whenever required. The instructor also asks questions and reviews company policies regarding employee accountability.
2. **Instructor informs.** Next, the instructor explains important fall protection topics and demonstrates how to properly use, maintain, and store fall protection. The instructor also stresses the natural consequences (the injury/illness) and system consequences (reward/discipline) related to performance. The trainee becomes familiar with using fall protection equipment and why it is important to use safe procedures.
3. **Instructor shows.** Think of this step as a test. In this step, roles are reversed: the trainee attempts to teach the instructor how to use the equipment. The instructor follows the trainee's instructions and asks "why" certain points are important. It's important to include this step especially if injury is possible. There is an opportunity for the instructor to discover if there were any misunderstandings while protecting the trainee from possible injury.
4. **Trainee shows.** Now it's the trainee's turn to perform. The trainee describes each step before performing it. If a step might expose the trainee to a serious hazard, the instructor may require employees to get permission prior to performing a hazardous step.
5. **Evaluation.** After the trainee successfully completes the procedure, the instructor evaluates employee performance in the training environment. After training, a

supervisor or competent person will evaluate employee performance in the work environment.

6. **Documentation.** The trainer documents initial qualification and a supervisor or competent person documents full qualification. Use the [sample certification](#) to document the training. OSHA will love it!

5. According to the text, what is the best method for training specific on-the-job fall protection safety procedures?

- a. Group exercise
- b. Guided discussion
- c. Show and tell
- d. Lecture

Real-World Falls

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.

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!

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

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.

2. What should you look for when inspecting harness D-Rings?

- a. Frayed edges, broken fibers, cuts, burns, chemical damage
- b. Wear or deterioration
- c. Loose, bent or broken grommets
- d. Cracks, breaks, rough or sharp edges

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.

3. Why should you bend lanyard webbing over a piece of pipe and observe each side of the webbing?

- e. To make the webbing more flexible
- f. To properly shape the webbing
- g. To reveal cuts or breaks
- h. To get dirt and grime out of the webbing

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.

4. What is the likely problem when you see webbing with shiny spots or a hard and brittle feel?

- a. Exposure to molten metal or flame
- b. Exposure to ultraviolet rays
- c. Exposure to paint and solvents
- d. Exposure to heat

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.

5. Inspect safety nets for damage or deterioration at least ____.

- a. weekly
- b. daily
- c. monthly
- d. annually

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.

6. It is important to inspect the rope on ____ to make sure it is not worn, rotted, or defective.

- a. mobile ladders
- b. extension ladders
- c. fixed ladders
- d. step ladders

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 midrails frequently to ensure that it meets the minimum strength and rail height requirements. [See 1926.502(b)].

7. Scaffolds are required to be inspected _____.

- a. prior to an approaching storm, accident or other event
- b. after erection, before the work shift, and after an event
- c. before erection, after a work shift, and prior to an event
- d. at least daily, weekly and monthly

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.

8. If equipment looks like it needs repair, what should be done immediately?

- a. Contact supervisor
- b. Wait until the end of shift to examine completely
- c. Remove from service
- d. Keep using equipment

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.

1. If a worker is suspended in a personal fall-arrest system, you must provide for a prompt rescue. The word "prompt" means _____.

- a. within 15 minutes
- b. without delay
- c. as soon as possible
- d. when emergency services arrive

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.

2. Each of the following is a key objective of a Fall Protection Emergency Response Plan EXCEPT _____.

- a. identifying OSHA reporting procedures
- b. establishing a chain of command
- c. training on-site emergency responders
- d. establishing procedures for responding to emergencies

- 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.

3. What is an important question to ask about rescue equipment if it's needed after a fall?

- e. Is the equipment color code appropriate?
- f. Will the equipment be comfortable?
- g. Does the equipment meet ANSI requirements?
- h. Will the equipment reach the victim?

- 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.

4. Which of the following links one person with overall responsibility for managing a fall emergency to those responsible for carrying out specific emergency-response tasks?

- a. A team priority system
- b. A communication strategy
- c. The safety committee
- d. The chain of command

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.

5. At what point should you identify on-site equipment that can be used for rescue and retrieval?

- a. When an emergency occurs
- b. During on-site work
- c. Everyday
- d. After an emergency

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.

6. At what point should you prohibit all non-essential personnel from the rescue site?

- a. When an emergency occurs
- b. During on-site work
- c. Everyday
- d. After an emergency