SAFETY SERVICES COMPANY®

INSTRUCTOR EDITION



DO-IT-YOURSELF

FALL PROTECTION

TRAINING AND CERTIFICATION PROGRAM

Contents

Training Instructions

Before starting to train and certify your students, you should familiarize yourself with the contents and layout of the program. This will make the whole process run more smoothly.
This kit serves two purposes, it will help in the process of training your students, but it will also serve to “train the trainer”. Three years of actual work experience in fall protection would help. If you are not already, this program will take you through the steps.

To train yourself on the materials go through the entire training program, review the OSHA codes included and set up a company fall protection policy based on the included sample policy documentation.

Once you have reviewed the course you are now ready to start the training process for the employees. This process will take part in three phases, they are: **Classroom Training, Hands on Instruction, and Evaluation.**

Classroom Training: The CD included with this program contains interactive training software. If the trainees sit through this, taking the quiz at the end, it will save you the time of doing actual classroom training. If you need to certify more than one employee, then you can use a projector, or large monitor to view the course. This way all of the trainees will be able to see the presentation as you walk them through it.

The CD also includes digital copies of the material in the training software and the quiz they will take. Feel free to print a training manual for each of the students so they may take notes and follow along.

Also, you could use this booklet to lead your own training session, if computer access on the job is going to be an issue. You can use this material to lead the classroom portion. You do not need to prepare any material yourself for this part of the training process.

Hands on Instruction: After the students have done the classroom training, it is time to take them around the work site. During this time you will go over the duties they will perform for the company. This is when they learn about how to use the fall protection equipment your company uses, the different responsibilities of employees in your organization regarding fall protection and about your company’s fall protection programs and policies.

Evaluation: Once you feel that the students are ready to start, you can begin the evaluation phase. Here you can quiz them on the fall protection equipment in the workplace and ask them what they would do in certain situations. You will grade them on their performance here and decide whether they may safely work in and around your work area.

Certification of training

Once the training is complete students will be issued certificates of completion. You should keep records of these certificates of completion. You must

The written certification record must contain the name or other identity of the employee trained, the date(s) of the training, and the signature of the person who conducted the training or the signature of the employer.

If the employer relies on training conducted by another employer or completed prior to the effective date of this section, the certification record is required to indicate the date the employer determined the prior training was adequate rather than the date of actual training.

The latest training certification must be maintained.

Retraining

When the employer has reason to believe that any affected employee who has already been trained does not have the understanding and skill required by the training program, the employer is required to retrain each such employee.

Circumstances where retraining is required include, but are not limited to, situations where:

- Changes in the workplace render previous training obsolete; or
- Changes in the types of fall protection systems or equipment to be used render previous training obsolete; or
- Inadequacies in an affected employee's knowledge or use of fall protection systems or equipment indicate that the employee has not retained the requisite understanding or skill.

Establish a training program

Everyone covered by a fall-protection plan must be trained by a competent person. Be sure to document the names of those who receive fall-protection training and their training dates.

Additional Resources

To help in compliance with the fall protection standard the CD includes OSHA's fall protection regulation, a printable fall protection check list, sample policy manual, training logs, and wallet cards.

Be sure to use these materials to guide your company's Fall Protection policies. If you need further help with policy development please call 877-201-8923

Section 1 Introduction

A. What is fall protection?

Fall protection is the backup system planned for a worker who could lose his or her balance at height, in order to control or eliminate injury potential.

B. Why needed?

Many employees view fall protection as a hindrance to their work. However, fall protection saves hundreds of lives each year.

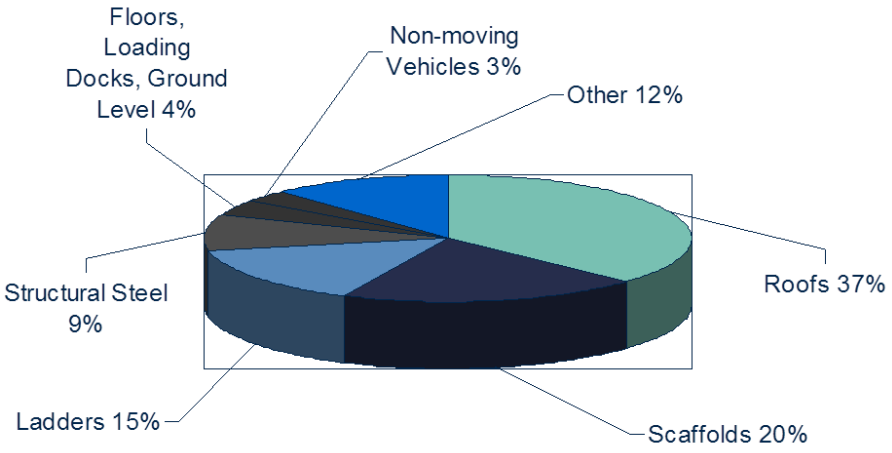
One great example of the power of fall protection comes from the renovation of Lambeau field several decades ago. A construction worker working on the stadium slipped from a steel beam six stories up; however, thanks to his use of full fall protection, the worker was back at work shortly after his rescue. Less than 2 months later, a second worker slipped from a beam on that project and also escaped injury because of his fall protection equipment and training.

C. When is Fall Protection Required?

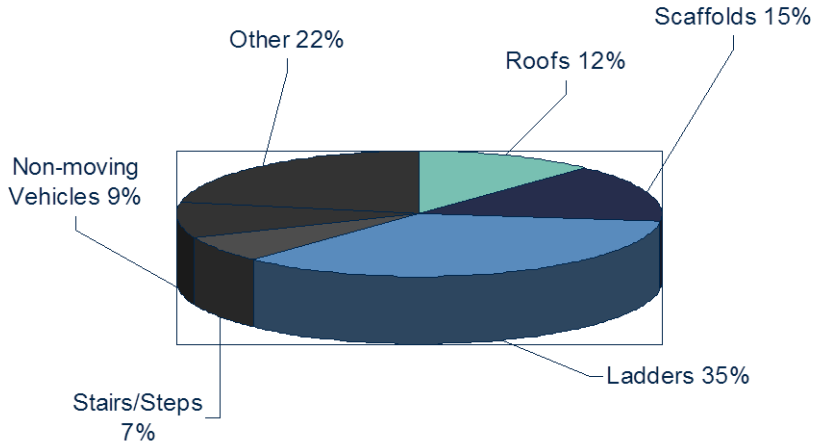
Fall protection must be used in the following situations:

- When working above dangerous equipment, regardless of the height;
- When working on forms or steel reinforcing over 6’ in height;
- When working on scaffolding over 10’ in height;
- When on walking / working surfaces over 4’ in height in general industry;
- When on walking / working surfaces over 6’ in height in construction;
- When using vertical ladders without cages over 24 feet; and
- Whenever working in an articulating and/or telescoping boom lifts and bucket trucks.
- When steel erection employees are on a walking/working surface with an unprotected edge more than 15 feet above a lower level.

D. Where do fatal falls occur?



Where do non-fatal falls occur?



E. Anatomy of a fall

Many people don't use fall protection because they think they can catch themselves if the fall or like a cat, they will always land on their feet. Before you decide not to strap on the harness consider the following.

- The average person doesn't have the strength to stop a fall greater than two feet.
- It takes most people about $^{1}/_{3}$ of a second to become aware they are falling.
- It takes another $^{1}/_{3}$ of a second for the body to react.
- In $^{2}/_{3}$ of a second a body will fall 7 feet.
- A body falling 6.5 feet hits the floor at a force of 15 mph.

F. Quiz

1) Where do most nonfatal falls occur?
   - **a. Ladders**
   - b. Roofs
   - c. Scaffolds
   - d. Non-moving vehicles
   - e. Stairs

2) Where do most fatal falls occur?
   - a. Ladders
   - **b. Roofs**
   - c. Scaffolds
   - d. Non-moving vehicles
   - e. Stairs

3) Fall protection is required above _ feet in general and _ feet in construction.
   - **a. 4, 6**
   - b. 6, 4
   - c. 6, 10
   - d. 4, 10

4) When using vertical ladders without cages over 24’ you don’t need fall protection.
   - a. True
   - **b. False**

5) The average person does not have the strength to stop a fall greater than two feet.
   - **a. True**
   - **b.** False

Section 2 Fall Protection Systems

A. What is a fall-protection system?

A fall-protection system is designed to prevent falls or control them so that someone who does fall doesn't die. The below table describes the basic types of fall protection and what they do.

Fall Protection Systems	
Type of fall-protection system	**What it does**
Personal fall-arrest system	Controls a fall
Personal fall-restraint system	Prevents a fall
Positioning-device system	Positions and limits fall to 2 feet
Guardrail system	Prevents a fall
Safety-net system	Controls (arrests) a fall
Warning line	Warns of fall hazard
Slide-guard system	Prevents sliding down a slopped roof

Other fall-protection methods: The following methods also may be appropriate for preventing falls:

- **Safety monitoring:** 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 Subdivision M, catch platforms, which consist of a stable platform and an attached standard guardrail, can protect workers when other systems or methods are not feasible.

- **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.

B. Selecting fall-protection system

Appropriate fall-protection systems have the following characteristics:

- Affordable.

- Offer the least interference with your tasks or activities.

- Prevent falls or protect workers who do fall.

Evaluating hazards: 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 easily be 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?

C. Personal fall restraint

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 by a qualified person and have a safety factor of at least two — twice the impact force of a worker free-falling six feet.

D. 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 two feet; a personal fall arrest system provides no support and must limit free-fall distance to six 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 but 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.

E. Personal Fall Arrest

A full body harness is the most common type of personal fall arrest. This system stops a fall in progress and minimizes the force of the fall to your body. Waist belts are not allowed because a fall will usually result in injury.

Such a system must include 4 elements referred to as ABCDs of Fall Arrest:

Anchorage – a fixed structure or structural adaptation, often including an anchorage connector, to which the other components of the PFAS are rigged.

Body Wear – a full body harness worn by the worker.

Connector – a subsystem component connecting the harness to the anchorage, such as a lanyard.

Deceleration Device – a subsystem component designed to dissipate the forces associated with a fall arrest event.

Anchorage

An anchorage is a secure point of attachment for lifelines, lanyards, or deceleration devices. 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. 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.

In addition to anchor strength consider:

- **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 the connector is compatible with the lanyard or lifeline and appropriate for the 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.

Body Wear (Harness)

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. Before you purchase harnesses, make sure that 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. Never use a body belt as part of a personal fall-arrest system.

Keep the following in mind when you buy a full-body harness:

- 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 and CSA standards and the manufacturer should have ISO 9001 certification, which shows the manufacturer meets international standards for product design, development, production, installation, and service.

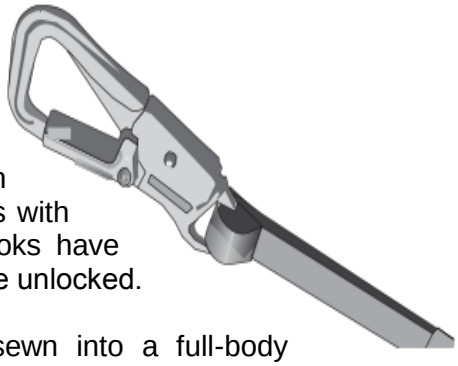
Harness Classifications

- **Class I:** A Class I fall protection harness consists of a simple belt with one or more D-rings for lanyard attachments. This type of restraint is useful only when there is no real danger of a fall, but where climbing or maneuvering is clumsy and needs support.
- **Class II:** A Class II fall protection harness is a complete chest harness that wraps the upper body. This type of harness is not for use where fear of free fall is imminent. It is best for situations where a person must lower into an enclosure or area, and be lifted out at a controlled speed.
- **Class III:** A Class III fall protection harness is the standard free-fall type of harness used whenever the possibility of an uncontrolled fall at a distance greater than 25 feet is possible. It consists of a system of straps and buckles completely wrapping the upper and lower torso.
- **Class IV:** Class IV fall protection consists of devices used to support people working in difficult areas. These devices include boatswain's chairs and suspension belts. Suspension belts differ from Class I belts in that they are used to raise and lower people as well as support them in unbalanced situations.

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.

Deceleration Devices

Any mechanism with a maximum length of 3.5 feet, such as a rope grab, rip stitch lanyard, tearing or deforming lanyards, self-retracting lifelines, etc. which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limit the energy imposed on an employee during fall arrest.

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.

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

Types of Deceleration Devices

- **Shock absorbing lanyards:** Shock-absorbing lanyards extend deceleration distance during a fall, significantly reducing fall arresting forces by 65 to 80 percent, below the threshold of injury (as specified by OSHA & ANSI). Once a shock absorbing lanyard is deployed, it must be taken out of service.

- **Self-retracting lanyards:** Self-retracting lanyards 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 two 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.

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.

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

Vertical lifeline: A vertical lifeline is attached to an overhead anchorage and must be connected directly to a worker's full-body harness, lanyard, retractable device, or rope grab; it must have a minimum breaking strength of 5,000 pounds. When a worker needs to move horizontally, however, a vertical lifeline can be hazardous due to the potential for a swing fall — the pendulum motion that results when the worker swings back under the anchor point. A swing fall increases a worker's risk of striking an object or a lower level during the pendulum motion.

Horizontal lifeline: Unlike a vertical lifeline, the horizontal lifeline stretches between two anchorages. When you connect a lanyard or rope grab to a horizontal lifeline, you can move about freely, thus reducing the risk of a swing fall. However, horizontal lifelines are subject to much greater loads than vertical lifelines. Horizontal lifelines can fail at the anchorage points if they're not installed correctly. For this reason, horizontal lifelines must be designed, installed, and used under the supervision of a qualified person.

Horizontal lifelines and sag angles: Any load on a horizontal lifeline will cause it to deflect or sag. The sag angle is a horizontal lifeline's angle of deflection when it's subjected to a load, such as a falling worker. Reducing the sag angle (making a horizontal lifeline too tight) actually increases the force on the line during a fall. As you tighten a horizontal lifeline, you increase the impact load dramatically!

For example, when the sag angle is 15 degrees, the force on the lifeline and anchorages subjected to a load is about 2:1. However, if you decrease the sag angle to five degrees, the force increases to about 6:1.

- **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.

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

Fall Arrest Rules

When using personal fall arrest systems:

- If you fall, the impact force to the body has to be less than 1800 pounds, achieved by using shock absorbing lanyards and a harness.
- Minimize fall distance; the maximum free fall distance can only be 6 feet.
- There cannot be any structures below in your fall distance.
- Maximum weight of an individual w/tools is 310 pounds.

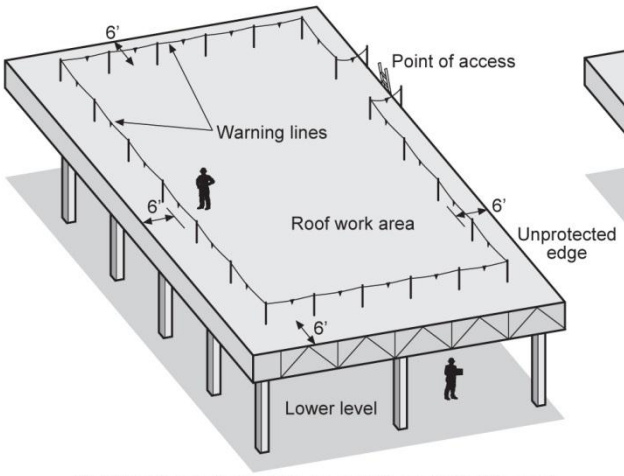
F. Guardrail systems

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.

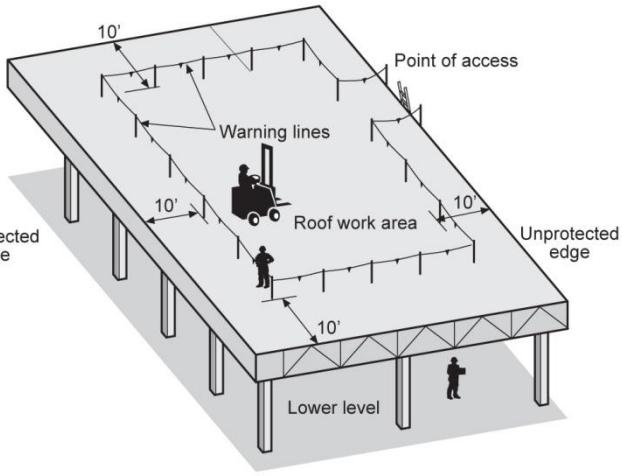
Guardrail systems must be free of anything that might cut a worker or snag a worker's clothing. Top rails and midrails must be at least $^{1}/_{4}$-inch thick to reduce the risk of hand lacerations; steel and plastic banding cannot be used for top rails and midrails.

Other requirements for guardrails:

- Wire rope used for a top rail must be marked at least every six feet with high-visibility material.
- The top rail of a guardrail must be 42 inches (plus or minus three 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 two inches of its top edge in any outward or downward direction.
- Midrails, screens, and intermediate structural members must withstand at least 150 pounds of force applied in any downward or outward direction.



Warning-line system where no mobile equipment is used



Warning-line system where mobile equipment is used

G. Warning Line System

- Wire rope used for a top rail must be marked at least every six feet with high-visibility material.
- Line is flagged every six feet. Work outside the safe area requires a safety monitor
- Equipment cannot be used or stored outside safe area
- The warning line cannot be just caution tape or ribbon
- It must be strong enough to withstand a force of 200 pounds
- Warning lines are not required if the roof is less than 50-feet wide, but if not used, there must be a safety monitor present
- You must either wear fall protection or have a safety monitor when working outside the warning line
- You must wear high-visibility garment outside the line and take it off inside the line
- The work surface should be relatively flat with a slope of 2:12 or less

H. Slide-guard systems

A slide-guard system prevents workers from sliding down a sloped roof. The system, which consists of a slide guard (typically nominal 2 x 6 inch lumber) and at least two roof brackets, must be installed under the supervision of a competent person. Roof brackets are available from roofing equipment suppliers. A slide-guard system can also be made at the work site without manufactured roof brackets. Slide-guard systems by themselves are not an acceptable form of fall protection.

I. Safety-net systems

- Safety-net systems consist of mesh nets and connecting components.
- Safety-net openings can't be more than six inches on a side, center to center.
- Safety nets must not be installed more than 30 feet below the working surface.
- An installed net must be able to withstand a drop test consisting of a 400-pound sandbag, 30 inches in diameter, dropped from the working surface.
- Inspect safety nets regularly and remove debris from them no later than the start of the next work shift.
- The minimum horizontal distance to the net's outer edge depends on how far below the working surface the net is placed, as shown in the table.

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

J. Catch platforms

A catch platform is a stable platform with attached standard guardrails that can "catch" a falling worker or materials. You can use a catch platform to prevent workers from falling when other systems or methods are not feasible. Because a catch platform is a scaffold it must be able to support its own weight and at least four times the maximum intended load applied or transmitted to it. The maximum intended load includes workers and materials, and the impact force of the fall.

K. Quiz

1) A slide rail is an acceptable form of fall protection.

True
False

2) A warning line where no heavy equipment is used is installed __ feet from the roof edge at a height of 36-42 inches

4
5
6
7
8

3) Match

Anchorage	a subsystem component designed to dissipate the forces associated with a fall arrest event.
Body Wear	a subsystem component connecting the harness to the anchorage - such as a lanyard.
Connector	fixed structure or structural adaptation, often including an anchorage connector, to which the other components of the PFAS are rigged.
Deceleration Device	a full body harness worn by the worker

4) What are the two types of life lines?

Lanyards and shock absorbers
Vertical and horizontal
Rope grabs and self-retracting
Self-retracting and shock absorbing

5) An anchorage is a secure point of attachment for lifelines, lanyards, or deceleration devices. An anchorage for a personal fall-arrest system must support at least _____ pounds.

3000
5000
8000

Section 3 Planning and Using Fall Protection

A. Planning and preparation

Before beginning a project, think about the methods, systems, and procedures to control your exposure to fall hazards. Careful planning and preparation lay the groundwork for an accident-free workplace. If you are an employer, you are responsible for anticipating fall hazards at your worksite and including fall-protection measures in your project plans.

The nature and scope of the planning effort depend on the complexity of the project. Larger projects involving multiple contractors and hundreds of workers obviously require more extensive planning than a single project.

At a minimum, the planning process should identify fall hazards, and systems and methods to control the hazards. Effective planning reduces risks for workers during a project and for others after the project is finished. (E.g. anchor points used by construction workers on a building project might also be used to protect window cleaners or other maintenance personnel.)

The planning process:

- Identify fall hazards workers are likely to encounter during the project. Identify tasks that expose workers to fall hazards.
- Describe how workers will reach the worksite (e.g. by ladders, or stairs).
- Describe how workers will keep tools and materials from dropping to lower levels. Establish procedures for inspecting, maintaining, and storing fall-protection equipment. Make sure workers use appropriate fall-protection systems.
- Identify anchor point locations.
- Describe the methods for setting anchors and securing lifelines.
- Identify areas where workers may be exposed to falling objects and how they will be protected. Describe emergency-response procedures for workers who fall.
- Post emergency responders' phone numbers and make sure workers know them.
- Describe equipment that will be available for rescuing workers who fall.

B. Roof openings and holes

Roof Openings are fall hazards and must either be covered or surrounded by a guardrail. Skylights will usually break unless guarded or screened.

Hole covers are required regardless of the fall distance. A floor hole has an opening between 1" and 12" in the smallest dimension. A person could trip, twist an ankle, or fall partially into a hole or materials could fall to a lower level. A floor opening is larger than 12 inches in its smallest dimension. A person could fall through an opening. If the attendant could fall through the hole that is more than 10 ft above the ground or lower surface, then the attendant must be wearing fall protection. Hole covers must be:

- Designed to support a minimum load of 200 lbs,
- Secured with cleats or hinges,
- Marked "Hole" or "Cover",
- Hole must be attended if the cover is removed.

C. Low-slope and steep roofs

A roof (and that means any roof) is the exterior surface on the top of a building. Concrete form work or a floor that temporarily becomes the top surface of a building under construction is not a roof.

Low-slope roofs are roofs with slopes less than or equal to 4:12 (vertical to horizontal). If you do roofing work on a low-slope roof with unprotected sides and edges and you are six feet or more above a lower level, you must be protected from falling by guardrail systems; safety net systems; personal fall arrest systems; or a combination of warning line system and guardrail system, warning line system and safety net system; warning line system and personal fall arrest system; or warning line system and safety monitoring system.

Steep roofs are roofs with slopes greater than 4:12. If you do roofing work on a steep roof with unprotected sides and edges, and you are six feet or more above a lower level, you must be protected from falling by guardrail systems with toeboards, safety net systems, or personal fall arrest systems.

Flat roofs are roofs re roofs with a slope of less than 2:12 vertical to horizontal. Types of fall protection used on these roofs include guard rails, personal fall arrest systems, catch platforms, safety monitors and others.

D. Calculating Fall Distance

Knowing how to calculate Total Fall Distance is just as important as selecting the proper harness, lanyard, anchorage connector and anchorage point for the specific task to be performed. Total Fall Distance (TFD) is defined as the sum of Freefall Distance (FFD), Deceleration Distance (DD), Harness Effects (HEFF), and Vertical Elongation (VEL). It is also wise to include a Safety Factor (SF) of at least one foot in the formula.

Total Fall Distance can be calculated using the following formula:

TFD = FFD + DD + HEFF +VEL + SF

Before we can begin to calculate Total Fall Distance, we first need to define the variables in the formula above.

- **Freefall Distance (FFD):** The vertical distance a worker travels between the onset of a fall until just prior to the point where the Fall Arrest System begins to arrest the fall. Federal OSHA limits this distance to 6’ or less. To keep FFD to a minimum, you should always try to keep your anchor point as far above the back D-ring of the harness as possible.
- **Deceleration Distance (DD):** The vertical distance a worker travels between the activation of the Fall Arrest System and final fall arrest. Federal OSHA limits this distance to 3.5’ or less. The DD that each shock-absorbing fall arrest device will permit is typically stated on the product label.
- **Harness Effects (HEFF):** The stretch of a harness during fall arrest. This is typically one foot or less for a properly-fitted harness. However, some harnesses use elastic-type webbing that can increase the harness effects to two feet or more.

- **Vertical Elongation (VEL):** The stretch in the lifeline of the Personal Fall Arrest System. Vertical Elongation is measured on the part of the lifeline that is under tension during deceleration and final fall arrest. This variable will change drastically depending upon the type of Fall Arrest System you are using. For example, most shock-absorbing lanyards are designed to have a maximum deceleration distance of 3.5', which includes the vertical elongation of the lanyard. However, if you are using a rope grab system or a horizontal lifeline, vertical elongation must be calculated based on the stretch of the vertical or horizontal lifelines in those systems. You will need to check the manufactures' product for exact stretch percentages.
- **Safety Factor (SF):** An additional factor of safety to ensure that you have the required clearance below your working surface. This variable should be at least one foot, but can reflect any number with which you feel comfortable.

Example: In figure 1 we see a worker wearing a 6' shock-absorbing lanyard on an elevated platform. His attachment point is 2' above the back D-ring of the harness. For every 1' the lanyard attachment point is above the harness back D-ring, 1' is deducted from the freefall distance. (For every 1' that the lanyard attachment point is below the harness back 1' is added to the freefall distance).

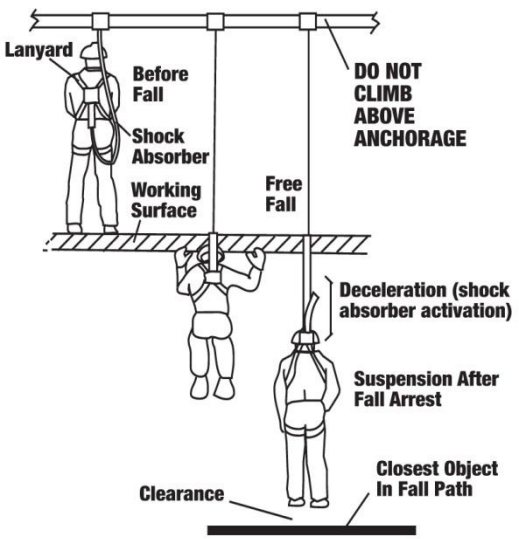


FIGURE 1

In this scenario, if the worker falls, the Freefall Distance (FFD) will equal 4' since the lanyard attachment point is 2' above the back D-ring of the harness. So, our formula looks like this:

$$TFD = 4' + \mathrm{DD} + HEFF + VEL + SF$$

The next variable to consider is Deceleration Distance (DD). OSHA requires this distance not exceed 3.5'. Since all manufacturers' products are slightly different, you should read the label to determine maximum deceleration distance. In our example, the maximum deceleration distance would be 3.5'.

$$TFD = 4' + 3.5' + HEFF + VEL + SF$$

The Harness Effects (HEFF) variable is relatively constant at less than one foot. This will vary slightly because of the adjustment of the harness, so we generally use one foot to account for these slight differences. However, elastic-type harnesses can have more than one foot of stretch. In our example, using a non-elastic harness keeps Total Fall Distance to a minimum.

$$TFD = 4' + 3.5' + 1' + VEL + SF$$

Most manufacturers design shock-absorbing lanyards so the vertical elongation of the lanyard is included in the OSHA mandated 3.5' maximum deceleration distance. However, if we were using a rope grab or horizontal lifeline, or if you were attaching to a non-rigid anchorage

connector, VEL would need to be calculated based on the specifications of those components in your Fall Arrest System. Since we are using a 6' Shock Absorbing Lanyard in our example and the VEL is already considered in the lanyard design, we will enter a "0" for the VEL variable.

$$TFD = 4' + 3.5' + 1' + 0 + SF$$

The final variable of the formula is the Safety Factor. It is always a good idea to include at least a 1' safety factor; however, the safety factor could reflect any number that makes you comfortable with your calculation.

Now we can solve our Total Fall Distance

$$TFD = 4' + 3.5' + 1' + 0 + 1' = \mathbf{9.5'}$$

Now we know that if the worker in Figure 1 would happen to fall, his Total Fall Distance will be 9.5'. But what does this number really mean? It means that the clearance between the working surface and the next closest object in the fall path must be at least 9.5'. If the distance is not 9.5' you will need to modify the system to arrest the fall sooner or look at other types of fall protection.

E. Steps to using a fall arrest system

1. Inspect all equipment

See Section 5 of this training program.

2. Put on the harness

This demonstration is to help instruct you on how to don a harness. Due to the multiple styles of harnesses in the workplace have your instructor show you how to properly wear your harness.

Step 1: Hold harness by back D-ring. Shake harness to allow straps to fall in place.

Step 2: If chest, leg and/or waist straps are buckled, release straps and unbuckle.

Step 3: Slip straps over shoulders so D-ring is located between shoulder blades.

Step 4: Pull leg strap between legs and connect to opposite end. Repeat with second leg strap. If belted harness, connect waist strap after leg straps.

Step 5: Connect chest strap and position in midchest area. Tighten to keep shoulder straps taut.

Step 6: After all straps have been buckled, tighten all buckles so that harness fits snugly but allows full range of movement. Pass excess strap through loop keepers.

Mating buckle connection:

Check that the straps are not twisted. The loose end of webbing is for adjustment and must always be located on the outside, away from the user.

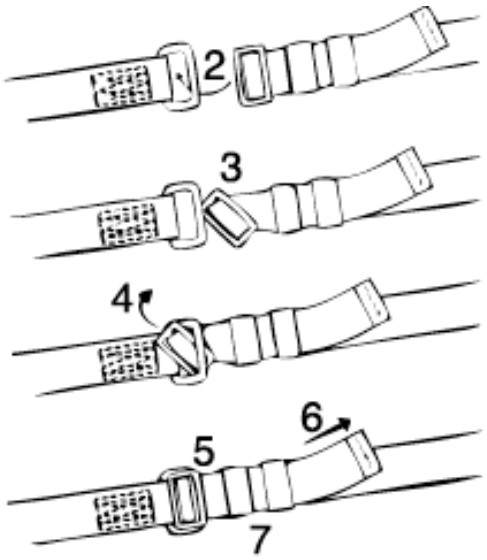
The buckle with the center bar must pass under the square link.

Turn the center bar buckle so that the narrow side can pass under and through the square link. Pull the center bar buckle completely through the square link.

Allow the center bar buckle to fall into place on top of the square link. Pull loose end of strap to tighten adjustment of the harness.

Slide keepers to hold any excess webbing.

To remove, reverse procedure.



3. Install Anchor

Plan anchor points. Try to anticipate anchor locations before construction work begins. Because a personal fall-arrest system doesn't prevent a fall, the anchorage must be high enough above a worker so that the arrest system, rather than a 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. Let's look at how to install some common types of anchors.

4. Connect the lifeline

After the anchor is secure, connect the lifeline to the anchor using the lifeline snap hook. When connecting, ensure the snap hook closes completely and locks. Pull a few times to ensure a solid connection.

5. Connect lanyard

Finally, connect the lanyard to the D-ring on the harness. Ensure the snap hook completely closes and locks.

Wood Roof Anchors: Wood anchors are available in a wide of layouts. These include anchors that can be used on the pitch of a roof, flat anchors and others. Typically these types

of anchors are designed for a single person and have a maximum capacity of 310 pounds. Be sure to read the manufactures instructions to ensure that you are using the proper anchor. Here is a look at the basic steps of installing a wood roof anchor.

1. Before installation and before each use, inspect the structure and roof members (i.e., studs, joists, rafters, trusses), where the roof anchor is installed or will be installed for deteriorated wood, rot, decay, defects, or any other questionable conditions. Ensure that the condition of the support structure will support the anticipated loads.
2. Locate and mark solid roof members/support structures under roof sheathing at the location where the anchor will be installed.
3. Lay the brackets of the anchor against the solid member and fasten with the required number of screws/nails. It is important to only use nails or screws, do not mix the two. It is important when fastening to structure to ensure that all nails/screws pass through the sheathing and into a support structure. If this warning is not followed, the anchorage connection will be weakened and serious injury or death could occur in the event of a fall.

Concrete Anchors: A concrete anchor is mounted in a concrete wall by drilling a hole and inserting the device. These types of anchors are rated at 5,000 lbs. in all directions. Concrete must have a compressive strength of at least 3,000 PSI (20.7MPa) and you cannot anchor in uncured/wet concrete. The following steps describe the installation of a standard concrete anchor. Have your trainer show you how to install these types of devices if used at your workplace.

1. Drill a hole the same diameter as the anchor and at least 3” deep.
2. Drill hole straight into substrate.
3. Don’t drill the hole closer than 6” to any edge or corner.
4. Blow hole clean with compressed air.
5. When reusing a previously drilled hole, always inspect the hole carefully. The previously drilled hole must be free of deformation.
6. Drill another proper hole if needed.
7. Insert unit 3 inches deep into hole.
8. Set the device with a slight tug on the anchor loop, the stop sleeve must always be partially inserted into the hole.
9. Remove device at the end of each day. Never leave inserted in a hole overnight.
10. Inspect the anchorage connector for damage each time you use it. If damage has occurred, dispose of device properly.

Rules for placement of concrete anchors:

- If a hole is 6” from an edge or corner, the concrete substrate must be 12” thick and 12” wide (example: a 12” x 12” column).
- If a hole is 8” from an edge or corner, the concrete substrate must be 10” thick and 16” wide (example: a 10” x 16” column).
- If a hole is 10” from an edge or corner, the concrete substrate must be 8” thick and 20” wide (example: a 8” x 20” column).
- If a hole is 12” or more from any edge or corner, the concrete substrate must be 5” thick.

Beam Clamps: A beam clamp is an anchor used to secure employees working on steel erection. The basic steps for use are as follows. Have your supervisor demonstrate the use of a beam clamp.

1. Locate and identify a compatible structural beam, capable of withstanding a 5,000 lb. static load, or that meets OSHA 1926.502 requirements for a safety factor of two.
2. Open the jaws of the adjustable clamp by either removing a pin or releasing pressure on the ratchet device.
3. Place the anchor over the top of the beam and tighten the clamp in place. This tightening will involve the reinsertion of pin or reactivation of other locking device.
4. Grab onto opposite ends of the beam anchor and make certain it can’t be removed from the beam by twisting or rocking.

Warning! Do not mount beam anchors to open ended beams.

Tie Offs, Clips or Ropes: Clip or tie-off anchors are quick and easy to use devices. To use these devices you typically clip to a rebar or wrap around a support beam. Ensure the member you are attaching these devices to can support a minimum of 5,000 lbs. or two times the intended load.

Knots: A knot can be used to secure a lifeline to an anchor point only when you know the breaking strength of the lifeline and the knot does not decrease the strength of the lifeline below 5000 lbs.

F. Mobile Fall Protection

Read and understand the installation and maintenance requirements that are in the manufacturer's instructions. Systems are designed to be used on flat roofs. All workers need to be trained in the proper use of the mobile fall protection system. Inspect the lifelines, harnesses, and D-rings.

Always inspect the system for cracks, defects, splits, bends, and damage before using. Repair or replace immediately. Check for rust and corrosion. Replace immediately. Do not throw or drop any part of the system when loading, unloading, or moving the system.

Set up operations: Make sure the position of the utility cart is parallel to the leading edge with the pivot arms pointing toward the edge.

Place the base assembly onto the utility roof cart and then tighten it down to the utility cart. Slide the extension arms into the base assembly; tighten down to secure the arms into place. Make sure the ballast basket slides into the extension arms and is secured with tighteners to hold the basket in place.

Insert the pivot arms onto the opposite side of the base assembly and insert joining bolts. Place the weight into the ballast basket.

Decking: Mobile fall protection must not be used for fall arrest on leading edge work where the parapet is higher than 30 inches.

Make sure workers are properly trained for rescue and self-rescue operations. If a worker falls over the edge, the life line will pull on the top of the mast, pulling on the cross member that is welded to the pivot arms, pushing on the lower cross member, driving the pivot arm plates into the roofing membrane. Workers should know the proper procedure for getting back up over the edge.

When there is no existing roofing membrane, an accessory plate must be bolted to the pivot arm plates.

These are mechanically fastened to the roof deck with wedge anchors embedded into concrete. Check manufacturer's specifications for size and embedment distance (e.g. (4) $^{3}/_{8}$ x 2" wedge anchors) (1-$^{1}/_{2}$" embedment).

On wood decks where there is no existing membrane, turn the handle of the wheel on the wheel jack to lift the ballast weight until the pivot points depress the wood. **On steel fluted decks** where the flutes are running parallel to the leading edge, lift the ballast weight until the pivot points set into the bottom of the flute. **On steel decks** where the flutes run perpendicular to the leading edge, an accessory plate must be bolted to the pivot arm plates. The accessory plate must be fastened to the steel deck with a self-tapping sheet metal screw (e.g. minimum $^{5}/_{16}$ x 1-$^{1}/_{2}$").

Remember … Reset the ballast after moving the mobile fall protection system.

G. Quiz

1) Low-slope roofs are roofs with slopes less than or equal to ____.
   4:12
   4:10
   4:14

2) Hole covers are required regardless of the fall distance
   True
   False

3) You need to consider the _____ before installing an anchor
   Fall Distance
   Time of Day
   Nail strength

4) Most wood roof anchors have a maximum capacity of
   250 lbbs
   310 lbs
   430 lbd
   410 lbs

5) Prior using a fall protection system you should.
   Inspect equipment
   Check your weight
   Install an anchor
   Measure distance of fall

6) A person is working 12 feet above ground level. They are wearing a 6' shock absorbing lanyard that is hooked to a D-ring 3' feet above the back of the connecting D-ring on the harness. The lanyard features a 3 foot deceleration device and the harness has no elasticity. What is the total fall distance of this set up? Be sure to include foot of distance for elasticity of harness and a foot of distance for safety factor?

   8 feet
   10 feet
   12 feet
   14 feet

Section 4 Inspection and Maintenance

OSHA requires you to regularly inspect and properly maintain fall protection equipment. This section of the training program will examine how to inspect and maintain common types of fall protection equipment.

A. Lanyard Inspections

Hardware

Snaps
Inspect closely for hook and eye distortions, cracks, corrosion, or pitted surfaces. The keeper (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 locks must prevent the keeper from opening when the keeper closes.

Thimbles
The thimble 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 must be free of sharp edges, distortion, or cracks.

Lanyards

Wire Rope (Steel) Lanyard
Always wear gloves when inspecting a wire rope lanyard because broken strands can cause injury. To inspect, rotate the wire rope lanyard while watching for cuts, frayed areas or unusual wearing patterns on the wire. Broken strands will separate from the body of the lanyard.

Web Lanyard
While bending webbing over a pipe, observe each side of the webbed lanyard. This will reveal any cuts, snags or breaks. Swelling, discoloration, cracks and charring are obvious signs of chemical or heat damage. Observe closely for any breaks in stitching.

Rope Lanyard
Rotate the rope lanyard while inspecting from end-to-end for 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.

Shock Absorber Pack
The outer portion of the pack should be examined for burn holes and tears. Stitching on areas where the pack is sewn to D-rings, belts or lanyards should be examined for loose strands, rips, deterioration or other signs of activation.

Shock-Absorbing Lanyard
Shock-absorbing lanyards should be examined as a web lanyard. However, also look for the warning flag or signs of deployment. If the flag has been activated, remove this shock-absorbing lanyard from service.

B. Common Types of Damage to Webbing and 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.

C. Self-Retracting Lines

Check Housing
Before every use, inspect the unit's housing for loose fasteners and bent, cracked, distorted, worn, malfunctioning or damaged parts.

Lifeline
Test the lifeline retraction and tension by pulling out several feet of the lifeline and allow it to retract back into the unit. Maintain a light tension on the lifeline as it retracts. The lifeline should pull out freely and retract all the way back into the unit. Do not use the unit if the lifeline does not retract. Also check for signs of damage. Inspect for cuts, burns, corrosion, kinks, frays or worn areas. Inspect any sewing (web lifelines) for loose, broken or damaged stitching.

Braking Mechanism
Test the braking mechanism by grasping the lifeline above the load indicator and applying a sharp steady pull downward to engage the brake. There should be no slippage of the lifeline while the brake is engaged. Once tension is released, the brake should disengage and the unit should to the retractable mode. Do not use the unit if the brake does not engage.

Snap Hook
Check the snap hook to be sure it operates freely, locks, and the swivel operates smoothly. Inspect the snap hook for any signs of damage to the keepers and any bent, cracked, or distorted components.

Anchorage Connection
Make sure the carabiner is properly seated and in the locked position between the attachment swivel/point on the device and the anchor point

D. Harness Inspection

Webbing
Grasp the webbing with your hands 6 inches (152 mm) to 8 inches (203mm) apart. Bend the webbing in an inverted “U”. The surface tension resulting makes damaged fibers or cuts easier to detect. Follow this procedure the entire length of the webbing, inspecting both sides of each strap. Look for frayed edges, broken fibers, pulled stitches, cuts, burns and chemical damage.

D-Rings/Back Pads
Check D-rings for distortion, cracks, breaks, and rough or sharp edges. The D-ring should pivot freely. Inspect for any unusual wear, frayed or cut fibers, or broken stitching of the D-ring attachments. Pads should also be inspected for cracks, excessive wear, or other signs of damage.

Buckles
Inspect for any unusual wear, frayed or cut fibers, or broken stitching of buckle attachments.

Tongue Buckles/Grommets
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. Roller should turn freely on frame. Check for distortion or sharp edges. Inspect for loose, distorted or broken grommets. Webbing should not have additional punched holes.

Friction and Mating Buckles
Inspect the buckle for distortion. The outer bars and center bars must be straight. Pay special attention to corners and attachment points at the center bar.

Quick-Connect Buckles
Inspect the buckle for distortion. The outer bars and center bars must be straight. Make sure buckles engage properly.

Harness Fall Arrest Indicators
Inspect fall arrest indicators (located on the back D-ring pad) for signs of activation. Remove from service if broken or stretched between any of the four pairs of arrows.

E. Cleaning of Equipment

Basic care for fall protection safety equipment will prolong the life of the equipment and contribute to its safety performance. Proper storage and maintenance after use is as important as cleaning the equipment of dirt, corrosives or contaminants. The storage area should be clean, dry, and free of exposure to fumes or corrosive elements.

Nylon and Polyester
Wipe off all surface dirt with a sponge dampened in plain water. Squeeze the sponge dry. Dip the sponge in a mild solution of water and commercial soap or detergent. Work up a thick lather with a vigorous back and forth motion. Then wipe the belt dry with a clean cloth. Hang freely to dry but away from excessive heat.

Housing
Periodically clean the unit using a damp cloth and mild detergent. Towel dry.

Drying
Harness, belts, and other equipment should be dried thoroughly without exposure to heat, steam, or long periods of sunlight.

F. Quiz

1) OSHA requires you to regularly inspect and properly maintain all fall protection equipment.
   True
   False

2) You should always wear gloves when inspecting a shock absorber pack.
   True
   False

3) Select 3 common causes of damage to webbing and lanyards
   Flame
   Chemical Contact
   Paint
   Rain

4) The braking mechanism on a self-retracting line should have no slippage when the brake is engaged.
   True
   False

5) Harness, belts, and other equipment should be dried thoroughly with exposure to heat, steam, or long periods of sunlight.
   True
   False

Section 4 Fall Response

A. Preparing for emergencies

Fall-protection systems are designed to minimize your exposure to fall hazards and to reduce risk of injury if you do fall.

This portion of the training program will examine common emergency response. Have your supervisor discuss with you the company's emergency response plan and identify on-site equipment that can be used for rescue and retrieval.

B. If an emergency occurs:

Call 911 or other emergency numbers in the emergency-response plan. First responders should clear a path to the victim. Others should direct emergency personnel to the scene.

Make sure only qualified personnel attempt a technical rescue. Prohibit all nonessential personnel from the fall-rescue site. Talk to the fall victim; determine the victim's condition, if possible. If the victim is accessible, make the victim comfortable and check vital signs. If necessary, administer CPR and attempt to stop bleeding.

C. Fall Protection Emergency Rescues

If a fall leaves you suspended in a personal fall arrest system, you must know how to rescue yourself or someone else must know how to rescue you promptly. The pressure that results from hanging in a body harness can constrict blood flow between your lower extremities and your heart. If you cannot reduce the pressure promptly, you could lose consciousness within minutes. A prompt rescue can mean the difference between life and death. Let's look at how to perform some basic rescues.

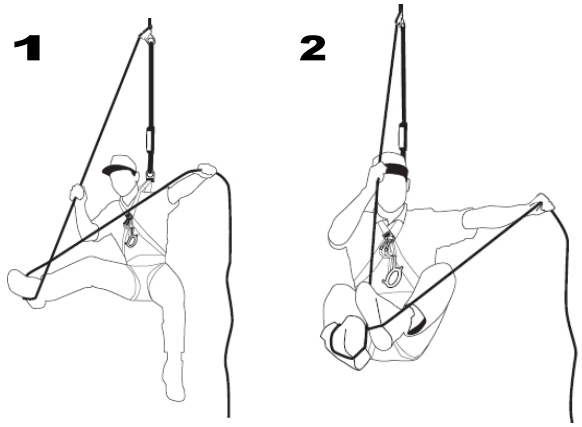
D. Foot Wrap

The harness will put excessive pressure on the body if you fall. By learning the feet wrap technique you will relieve the pressure and be able climb up or down for short distances. This self-rescue technique is valuable for workers who use a personal fall-arrest system and if fall would be suspended more than 35 feet above a lower level.

<u>How To:</u>

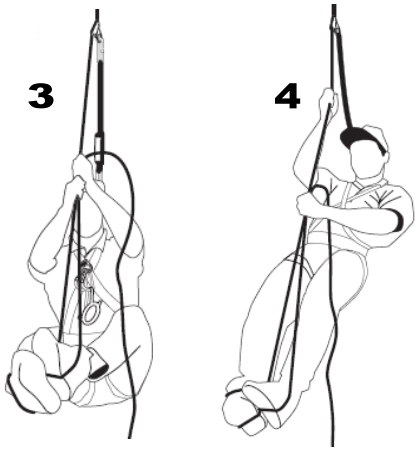
1. Grasp the lifeline hanging below you (that is the trailing end).
   Wrap it once under your right foot starting from the inside, and then loop it over the top of the foot.

2. Stretch the lifeline out horizontally and step into it with your left foot.



3. Raise the trailing end of the lifeline and bring both parts together. You have now created a loop that will allow you to stand.

4. Hold on to the lifeline with both hands and stand up to relieve the pressure on your upper legs. When you get tired, shift back to a sitting position. You can also distribute weight between your feet and the harness. To climb up or down short distances, slide the rope grab up (to climb up) or down (to climb down).



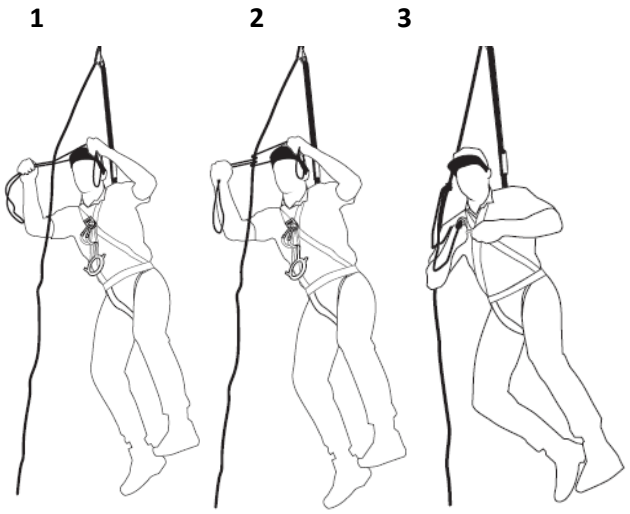
E. Rappel

How To:

1. Take one of the two prussic loops and spread it horizontally across the lifeline.

2. Make a three-wrap prussic knot as follows: Take the end of the loop in your right hand and push it through the eye of the loop in your left hand. Do this three more times, and then pull the tail of the loop down firmly to tighten the knot.

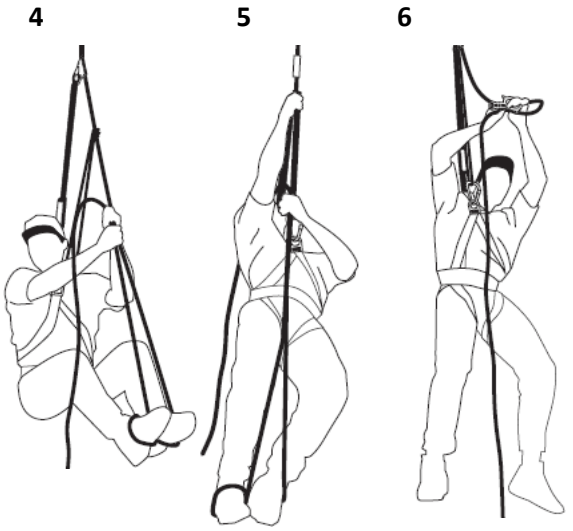
3. Clip a carabineer into the tail of the prussic loop and into the rappelling attachment on your harness. Slide the prussic knot up the lifeline toward the rope grab to remove any slack in the prussic loop.



4. Grasp the lifeline hanging below you (the trailing end) and do a foot wrap.

5. Stand up in the lifeline. Slide the prussic knot up the lifeline so that it touches the rope grab. If the knot does not reach the rope grab, you will have to sit down in the harness, do another foot wrap, and then stand up again so that you are closer to the rope grab.

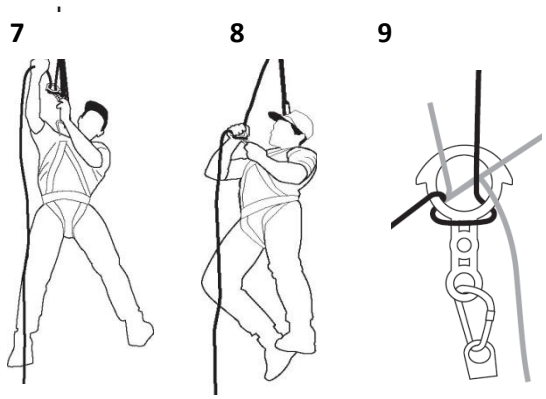
6. When you have reached the rope grab, attach your descender to the lifeline. Grab the lifeline and bring it together so that it forms a loop at approximately shoulder level. Feed the lifeline loop through the larger eye of the descender.



7. Slip the loop over the smaller eye of the descender. (Make sure the smaller eye is pointing toward the ground.) The loop will ride up against the base of the larger eye.

8. Clip a carabineer to your rappel attachment and through the small eye of your descender. Lock off the descender.

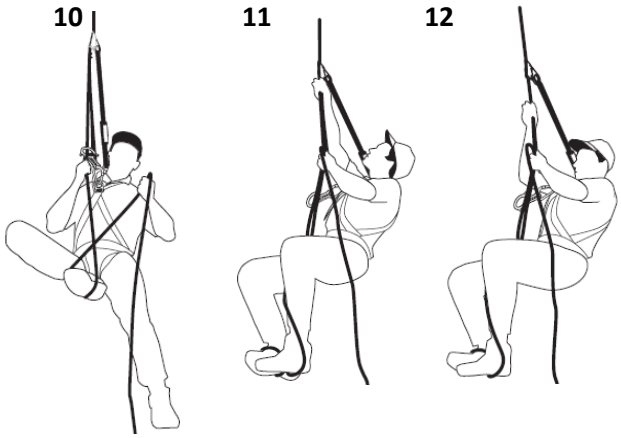
9. Lock off the descender by grasping the trailing end of the rope and sliding it between the leading end of the rope and the large eye of the descender.



10. Do a foot wrap.

11. Stand up in the lifeline and grasp the prussic knot (you will be transferring your body weight to the descender).

12. Slide the prussic knot down the lifeline to the top of the descender.

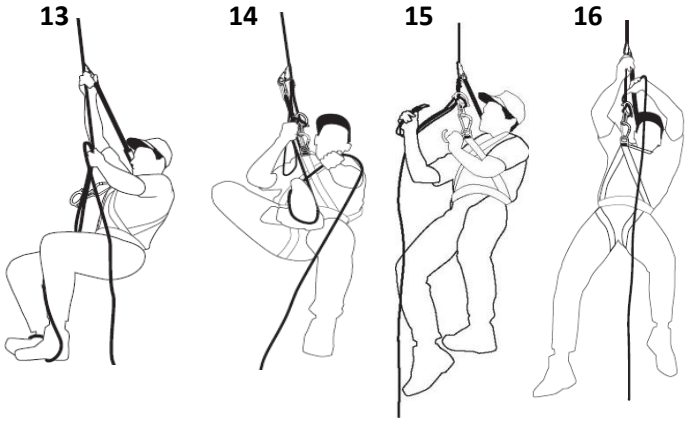


13. Slide the rope grab down to the top of the descender. Sit down again. Your weight will be off the prussic loop. Unclip the prussic loop and remove it.

14. The full weight of your body is now transferred to the descender. Undo the foot wrap.

15. Remove the prussic loop from the lifeline.

16. Unlock the descender. Descend to a safe area, sliding the rope grab down the lifeline with you.



F. Pulley System Rescue

Pulley systems have been used for centuries to move heavy loads. A properly rigged 4:1 system takes about 60 pounds of force to raise a 200-pound person; a task that one adult can accomplish easily. Pulley systems are safe, inexpensive, and easy to rig; and can raise or lower a suspended worker from any height. You will need a long rope to make the system an efficient one. Lowering a person 50 feet with a 4:1 system requires a 240-foot rope (four times 50 feet plus 40 feet as a safety margin).

Pulley system equipment: Use a large pad to protect the rope and to reduce friction over an unprotected edge, two pulleys, two carabineers, a rope long enough to accomplish the rescue, plus additional length as a safety factor.

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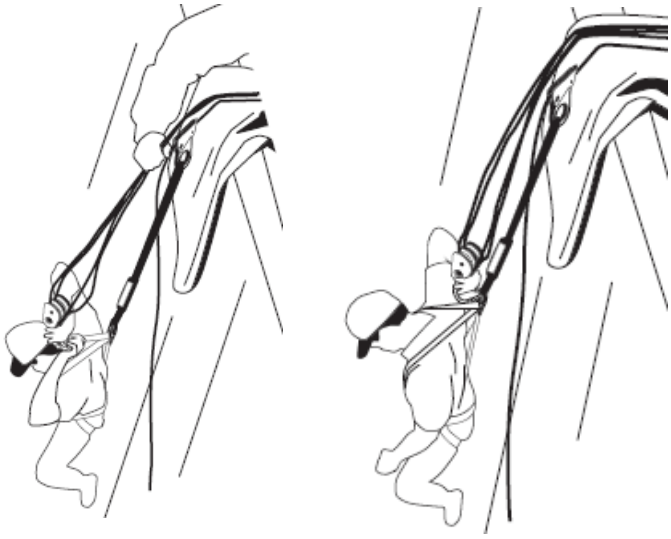
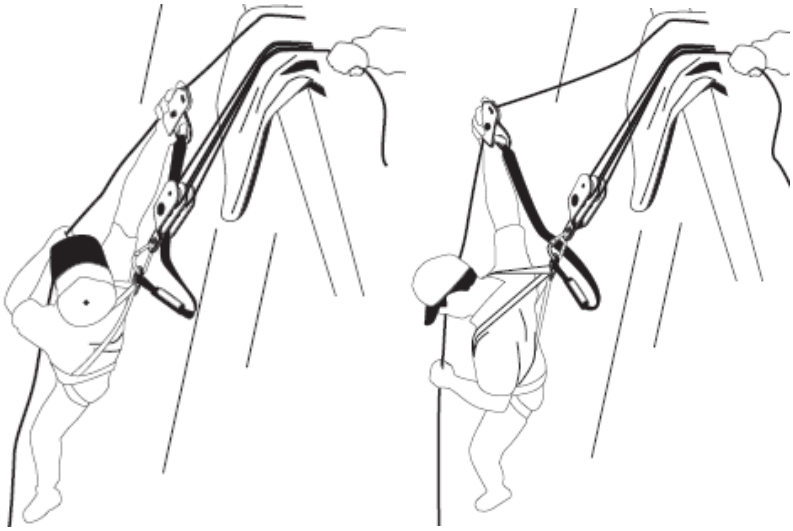
1. Connect the leading end of the pulley system to an anchor with at least a 5,000-pound load capacity. Be sure to place the rope pad under the ropes; the pad protects the ropes and reduces friction. Lower the trailing end of the system to the suspended worker.

2. Attach the pulley carabineer on the trailing end of the system to the D-ring on the body harness. (Here the worker attaches it to the D-ring connector on his back. You can also attach the trailing end to the rappel attachment on the front of a body harness.)



3. Begin raising the worker until he can reach and unlock the rope grab on the fall-arrest system.

4. After the worker has unlocked the rope grab, lower or raise the worker to a safe landing area.



G. Emergency Response

If a suspended worker cannot perform a self-rescue, call the on-site emergency-response team and get the appropriate rescue equipment. First responders should clear a path to the victim. Others should direct emergency personnel to the scene.

- Prohibit all nonessential personnel from the rescue scene.
- Talk to the worker and try to determine the worker's condition.
- If the worker is accessible, provide comfort and check vital signs.
- If necessary, administer CPR (if trained to do so) and attempt to stop bleeding.
- If the worker's injuries are minor, proceed with the rescue. Only trained responders should attempt a technical rescue.
- If the worker has severe injuries, contact emergency medical responders. Remember, 911 responders may not be able to accomplish prompt rescues.

H. Post Emergency

After an emergency, always report all injuries requiring overnight hospitalization and medical treatment, other than first aid, to OSHA, within 24 hours. Report fatalities and catastrophes to OSHA within eight hours. Document what went wrong step by step.

Identify all equipment that may have contributed to the emergency. Let a qualified person - one who has the knowledge, the experience, and the demonstrated ability to resolve fall protection and rescue problems - examine the equipment. If the equipment was damaged, repair or replace it. If the equipment contributed to the emergency, determine why and how. Most equipment must be discarded after a fall.

Determine what caused the emergency. Be as specific as possible. Include dates, times, environmental conditions, work processes, and persons involved.
Review the emergency-response plan. Determine what procedures should be added or changed to prevent similar emergencies. Revise the plan accordingly.

I. Quiz

1) Only qualified persons should attempt to make a fall rescue.

   True
   False

2) A harness can put excessive pressure on the body.

   True
   False

3) A person who falls should not try to rescue themselves.

   False
   True

4) The pressure from remaining in a harness can cause a person to lose consciousness.

   True
   False

5) OSHA needs to be notified of any catastrophes or fatalities within 48 hours of the incident

   False
   True

Section 6 Hazard Identification

A. What is a fall hazard?

A fall hazard is a workplace hazard that could cause worker's loss of balance or physical support. Fall hazards cause accidents such as the following:

- A worker walking near an unprotected leading edge trips over a protruding board
- A worker slips while climbing an icy stairway
- A makeshift scaffold collapses under the weight of four workers and their equipment
- A worker carrying a sheet of plywood on a flat roof steps into a skylight opening

B. How to evaluate fall hazards

Involve others. You may need others to help you evaluate fall hazards. Ask workers who may be exposed to fall hazards and their supervisors. Involving others also strengthens your safety program.

Determine how workers will access elevated surfaces to do their jobs. Will workers be using portable ladders, supported scaffolds, aerial lifts, or suspension platforms to reach work areas? Which ones will they use? How and where will they use the equipment?

Identify jobs that could expose workers to falls. Using a set of worksite plans, review the entire construction project. Evaluate each phase of the project from the ground up. Ensure that all walking/working surfaces have the strength to support workers and their equipment. Then identify jobs that could expose workers to falls.

C. Common Fall Hazards

- Holes in walking/working surfaces that they could step into or fall through
- Elevated walking/working surfaces 10 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 are not readily seen and 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 six 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

D. Ways to eliminate fall hazards:

- Perform construction work on the ground before lifting or tilting it to an elevated position.
- Install permanent stairs early in the project so workers don't need to use ladders between floors.
- Use tool extensions to perform work from the ground.

If you can't eliminate fall hazards, you must ensure that someone who does fall doesn't die. There are two ways:

- Prevent falls with covers, guardrails, handrails, perimeter safety cables, and personal fall-restraint systems.
- Control falls with personal fall-arrest systems, positioning-device systems, and safety-net systems. Use these fall- protection systems only when you can't eliminate fall hazards or prevent falls from occurring.

E. Name the Hazards

1. Workers are exposed to a fall hazard greater than 6 feet, while working near stairwell opening.

2. Worker wearing no fall protection.

3. Workers are installing a new metal roof without fall protection.

4. Lack of fall protection for workers on fabricated frame scaffolds.

5. Workers working on balcony of a structure exposed to fall hazard due to unprotected side/edge.

6. Worker on an 8:12 pitch roof with only the lifeline tied to his waist as fall protection. Employer must provide full body harnesses.

Section 7 Final Exam

1. Select when fall protection must be used
    a) At heights greater than 4 feet in construction
    b) When working under a boom lift
    c) When working above dangerous equipment
2. In ____ of a second your body will fall 7 feet.
    a) 1/3
    b) 2/3
    c) ½
3. Most fatal falls are off of roofs.
    a) True
    b) False
4. A personal fall arrest system prevents a fall
    a) True
    b) False
5. A personal fall restraint system prevents a person from hitting the ground after they have fallen from a roof.
    a) True
    b) False
6. Fall protection should be affordable, interfere with a person's work and capable of preventing a fall.
    a) True
    b) False
7. Select the four parts of a fall arrest system
    a) Net
    b) Anchorage
    c) Harness
    d) Connector
    e) Deceleration device
8. An anchor must support at least
    a) 2,500 lbs.
    b) 3,500 lbs.
    c) 5,000 lbs.
    d) 6,000 lbs.

9. Body belts are acceptable forms of fall protection.
    a) True
    b) False
10. Carabineers, snap hooks and D-rings all must have a capacity of 4,000 lbs.
    a) True
    b) False

11. The maximum length of a deceleration device is
    a) 3 feet
    b) 3.5 feet
    c) 4 feet
    d) 4.5 feet

12. Self-retracting lanyards and lifelines that limit free-fall distance to two feet or less must be able to hold at least _____ pounds with the lanyard (or lifeline) fully extended.
    a) 3,000
    b) 4,000
    c) 5,000
    d) 6,000

13. Self-retracting lanyards that don't limit free-fall distance to two feet must be able to hold at least _____ pounds with the lanyard (or lifeline) fully extended.
    a) 3,000
    b) 4,000
    c) 5,000
    d) 6,000

14. Guardrail systems must be free of anything that might cut a worker or snag a worker's clothing.
    a. True
    b. False

15. A slide rail is an acceptable form of fall protection.

    a) True
    b) False

16. A warning line where no heavy equipment is used is installed __ feet from the roof edge at a height of 36-42 inches

    a) 4
    b) 5
    c) 6
    d) 7
    e) 8

17. What are the two types of life lines?

    a) Lanyards and shock absorbers
    b) Vertical and horizontal
    c) Rope grabs and self-retracting
    d) Self-retracting and shock absorbing

18. Roof Openings are fall hazards and must either be covered or surrounded by a guardrail. Skylights will usually break unless guarded or screened.
    a. True
    b. False

19. Total Fall Distance can be calculated using the following formula: $TFD = \mathrm{FFD} + DD + HEFF + VEL + SF$
    a. True
    b. False

20. Order the steps of using a personal fall arrest system
    a. Inspect equipment
    b. Put on harness
    c. Install anchor
    d. Connect Lifeline
    e. Connect lanyard

21. You need to consider the _____ before installing an anchor

    a. Fall Distance
    b. Time of Day
    c. Nail strength

22. You should always wear gloves when inspecting a shock absorber pack.
    a. True
    b. False

23. Harness, belts, and other equipment should be dried thoroughly with exposure to heat, steam, or long periods of sunlight.

    a. True
    b. False

24. A harness can put excessive pressure on the body.

    a. True
    b. False

25. The pressure from remaining in a harness can cause a person to lose consciousness.

    a. True
    b. False