

Fall Protection Training

- **Reference:**

OSHA 29CFR 1910

OSHA 29CFR 1926

ANSI Z359.1-1992
(R1999)



Introduction

- Deaths occurring from falls during 1996 increased five percent over 1995 figures. This accounts for 11 percent of all fatal work injuries. Half of all fatal falls took place in the construction industry.
- The chances of dying from a fall of 11 feet are 85%.

Source: U.S. Bureau of Labor Statistics

Fall Protection Basics

- The first goal of any Fall Protection Program is:
To identify fall hazards, minimize exposure to those hazards, and determine which equipment will best safeguard the individual working on that system.
- The ultimate goal of any fall arrest system is:
To limit the fall distance.

Traditional Fall Protection

- **Guardrail Systems:**

The top edge of guardrail systems shall be 42 inches, plus or minus 3 inches above the walking/working level.

- **Fall Protection System:**

Each employee on a walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet (1.8m) or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems.

There are two types of fall protection systems:

- **Fall restraint**
- **Fall arrest**
- **The fall protection system minimizes chances for injury, should a fall occur.**

There are four components of a fall protection system:

- a) **Anchor system**: A combination of the anchorage and anchorage connector(s).
- b) **Connecting means**: The device or a combination of devices between the anchor system and body holding device.
- c) **Body support**: The harness or belt worn by the worker.
- d) **Rescue and/or escape**: A comprehensive fall protection program will always include provisions for rescue.

Fall Restraint System:

A fall restraint system is one that prevents a worker from approaching a fall hazard

- Fall Restraint System Components:

- a) Anchor system
- b) Connecting Means
- c) Body Holding Devices
- d) Rescue and/or escape

Fall Arrest System:

A fall arrest system is made up of a series of components that function together to prevent a worker from free falling to the ground.

- Fall Arrest System Components:

- a) Anchor system
- b) Connecting means
- c) Body support
- d) Rescue and/or escape

Considerations for the Fall Arrest System:

- Systems Compatibility: System compatibility refers to the harmonious operation of the various fall protection system components.
- Impact Force: The force generated on a fall arrest system and person during a fall is referred to as impact force. While anchorages for a vertical system must be able to withstand a minimum force of 22.2kN(5000lbs.), a fall of even a few short feet can create substantial shock to the entire system.

- Swing Fall Hazard: Swing fall is a pendulum-like motion that can occur when a worker moves in a horizontal direction away from a fixed anchorage, and then falls, While the force generated in a swing fall is the same as the force in a vertical fall, there is the potential hazard of colliding with a structure such as a building or platform.
- Total Fall Distance: Total fall distance is the maximum vertical change in distance from the bottom of the individual's feet at the onset of a fall, to the position of the feet after the fall is arrested—including free fall distance and deceleration distance. Total fall distance can be affected by many factors.

- Free Fall Distance: Another factor to keep in mind is free fall distance. This is the distance an individual free falls before activation of the fall arrest system. Depending upon governing body regulations, maximum free fall distance generally ranges between 4 and 6 feet.

Overview of the Five Classes of Fall Protection:

Introduction:

Where a hazard cannot be eliminated altogether, the worker avoids falling by use of a “Primary” system such as working platform or the structure he/she is climbing on. Fall Protection is recognized as a “Secondary” system that prevents or arrests a fall if the worker makes a mistake or if the primary system fails.

1. Hazard Elimination: In this form of fall protection, the process has usually been re-designed to eliminate (Engineer Out) the worker's exposure to a fall hazard. This is often not recognized as fall protection because the solution leaves no visible hazard or need for a "secondary" system to protect the worker.
2. Traditional Fall Protection: The "Secondary" system passively barricades workers from reaching the hazard. No special training is required to know how to work safely in the vicinity of the fall hazard.
3. Fall Restraint: The "Secondary" system is attached to workers to keep them from reaching the fall hazard. Workers need training to recognize the hazard and to know how to correctly establish or use the system.

4. Fall Arrest Systems: This “Secondary” system is used to “catch” the worker when the possibility of a fall cannot be prevented. Workers need training to recognize the hazards, to know how to correctly set up and use the system, and how to respond should a fall occur.
5. Fall Protection Procedures: Used only when it is clearly “infeasible” to provide 100% fall protection using any of the above methods. Advanced planning and training is needed for workers to recognize the hazards and to know how to undertake the work as safely as possible. Fall Protection Procedures use warning systems and special work methods.

Anchorage

- The anchorage is a secure structure that safely withstands forces exerted by fall protection and rescue equipment. This structure can be in the form of a beam, girder, column, or floor. Anything attached directly to the anchorage is considered the anchorage connector. Anchorages are either engineered or non-engineered. Occupational Safety and Health Administration (OSHA) states any anchorage used for attachment of personal fall arrest equipment must be capable of withstanding a minimum of 5000lbs (22.2kN).

Anchorage Connector

- The anchorage connector (also anchor point or anchor) is the means by which the fall protection system is secured to the anchorage. This could be a load rated eye-bolt, a steel cable sling, tripod, davit arm or any other device designed to suspend human loads and capable to withstanding the forces of fall.

The anchor system is the term used to describe the combination of the anchorage and anchorage connector(s). All equipment should be used exclusively for fall protection.



Eye-Bolt



Steel Cable Sling



Tripod



David Arm

Snap Hook

- The snap hook is a connector comprised of a hook-shaped body with a normally closed gate or similar arrangement which may be opened to permit the hook to receive an object and, when released, automatically closes to retain the objects. The self-locking snap hook has a self-closing, self-locking gate which remains closed and locked until intentionally unlocked and opened for connection or disconnection. All snap hooks, carabiners, D-rings and O-rings shall withstand a force of 5000 lbs. In order to meet current ANSI requirements, the snap hook must be self-locking. Effective January 1, 1998, only locking snap hooks will be accepted for use. (OSHA).

Carabiner

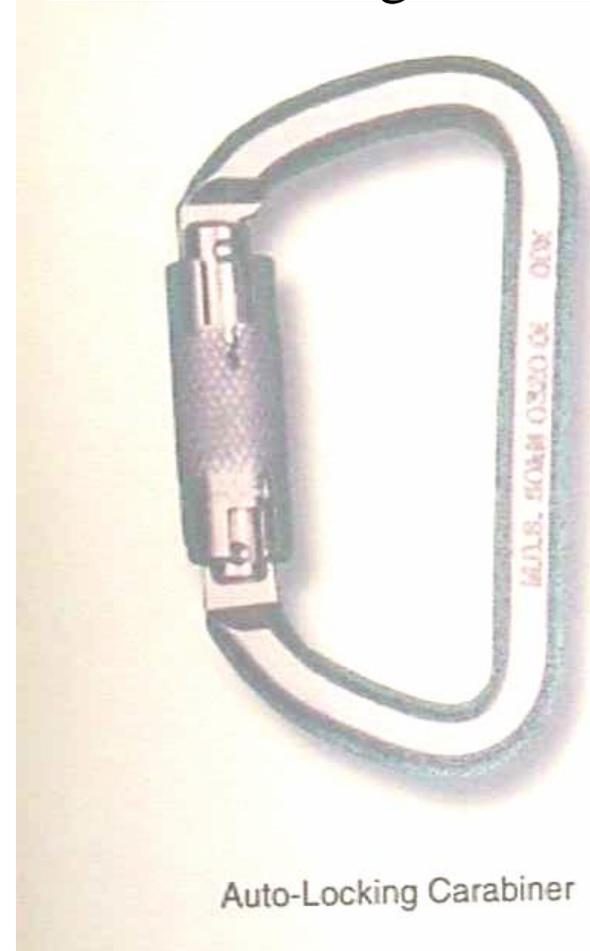
- The carabiner is a connector component generally comprised of a trapezoidal or oval shaped body with a normally closed gate or similar arrangement that can be opened to permit the body to receive an object and, when released, automatically closes to retain the object. Like the snap hook, the carabiner should be self-locking and capable of withstanding 22.2 kN or 5000 lbs. (ANSI Z359.1-1992)(R 1999). All snap hooks, carabiners, D-rings and O-rings shall be subjected to proof of load testing at 16kN or 3600 lbs. (OSHA)

Self-Locking Snap Hook



Self-Locking Snap Hook

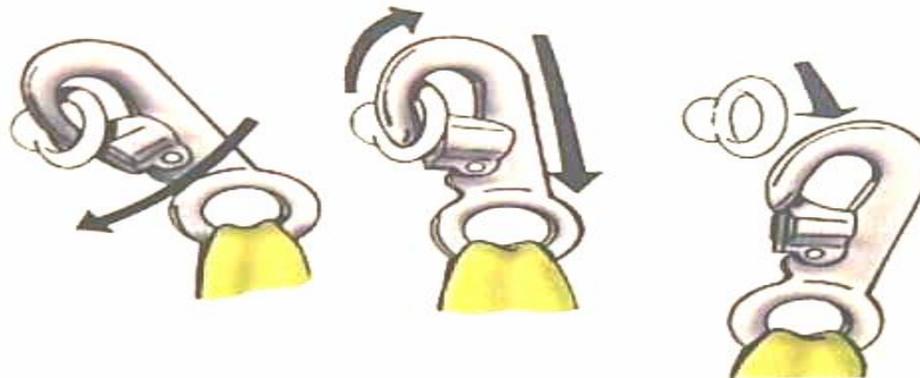
Auto-Locking Carabiner



Auto-Locking Carabiner

Roll-Out

- Roll-out is the accidental disengagement of paired connectors which can occur when there is interference between a hook and pair connector thus causing the hooks' gate to accidentally open and release connection.



Roll-Out

Lanyard

- A component consisting of a flexible line of rope, wire rope, or strap which generally has a connector at each end for connecting the body support to a fall arrester, energy absorber, anchorage connector, or anchorage. The lanyard is the most commonly used connecting means for fall arrest and fall restraint. The minimum diameter for synthetic rope lanyards according to the ANSI standard is 1/2 inch or 13 mm. Lanyards typically vary in lengths of 3 to 6 feet (0.9 – 1.8 m).

Lanyard



Inspection, Care and Maintenance

- In keeping with any fall protection equipment, refer to manufacturer's recommendations. Routine inspection and care is important. Check for signs of wear, corrosion, rust, or any abnormalities. If any signs of wear or dysfunction are present, remove the device from service.

Fall Arrester (Rope Grab)

- A device that travels on a lifeline and will automatically engage the lifeline and lock so as to arrest the accidental fall of a person.
- The fall arrester, also referred to as the 'rope grab' is a unit designed to slide along a rope in one direction, and grasp it in the other direction. These units are usually composed of a metal shell and toothed cam or other device that works apply friction to a rope sliding in one direction.

Energy Absorber (EA)

- The energy absorber is a component whose primary function is to dissipate energy and limit deceleration forces that the system imposes on the body during fall arrest. The personal energy absorber (PEA) is an energy absorber which is attached to the harness.
- A fall of just a few feet will create tremendously high impact forces to both the fallen worker and entire fall protection system. High impact forces could cause significant injury, even if a worker is in a full body harness.

Fall Arrester (Rope Grab)



Lanyard with Shock Absorber



Self Retracting Device

- All self retracting devices perform a tethering function which allows unrestricted vertical movement to the device while arresting the user's fall. These devices have a housing normally attached to the anchorage of a fall arrest system containing a drum-wound lifeline. The retracting end of the lifeline will unwind from the drum under slight tension during normal movement below the device. When tension is removed, the drum will automatically retract the lifeline. Quick movement, which is typically applied at the onset of a fall, will lock the drum and arrest the user's motion. The self retracting device is designed to arrest a fall while minimizing fall distance and impact forces.

Self Retracting Device



Body Support (BSU)

- The body support is a component comprised of a strap or straps suitably arranged and assembled to support the human body during and after fall arrest. It generally includes adjustable means for fastening it about the body and means for attaching it to other components or subsystems of the PFAS.

Body Belt (Waist Belt)

- A body support component comprised of a strap with means for securing it about the waist and for attaching it to the other components or subsystems.
- Note: As of January 1, 1998, the use of a body belt for fall arrest is prohibited.

Body Harness

- A component with a design of straps which is fastened about the person in a manner so as to contain the torso and distribute the fall arrest forces over at least the upper thighs, pelvis, chest and shoulders with means for attaching it to other components or subsystems. OSHA states, “Personal fall arrest systems, when stopping a fall, shall limit maximum arresting force on an employee to 1,800 lbs. (8 kN) when used with a body harness.”

Body Belt (Waist Belt)

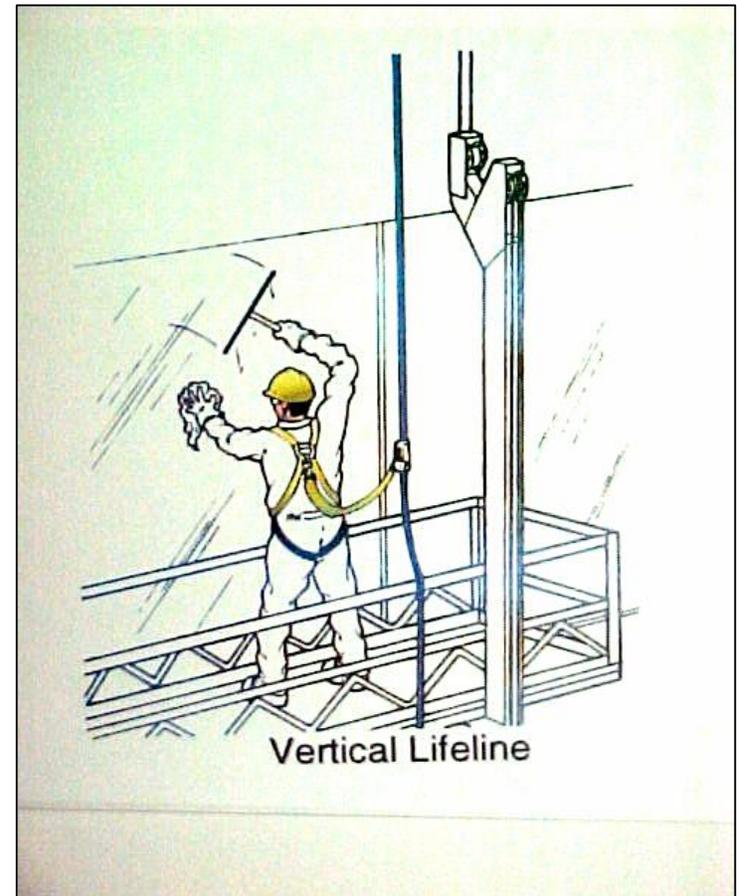


Full Body Harness



Vertical Lifeline

- A component, element, or constituent of a lifeline subsystem, which consists of, a vertically suspended flexible line with a connector at the upper end for fastening it to an overhead anchorage or anchorage connector and along which a fall arrester travels.



Rope

- Any cordage, synthetic or natural, with an external diameter greater than 4mm (3/16 inch). The length may be twist balanced, as in a “laid” rope, or may have an external sheath surrounding a load bearing core as in a kernmantle rope. Each rope is manufactured to demonstrate a variety of purposes including strength, abrasion resistance, handling, long term sustained loading, elongation, elasticity, shock loading and resistance to heat, acids and chemicals – to name a few.
- Rope used for vertical lifelines is typically 5/8” (16 mm), and made of polyester. Rope used for rescue is usually 7/16” (11 mm) and made of nylon.

Introduction to Rescue

- Saving lives is the primary function of any rescue. However, the most effective approach to rescue is prevention. In the event of an emergency, several skills are necessary for affecting a safe and efficient rescue. This requires significant time not only for training, but practice. Rope work, knots, and belaying are some of the skills involved with rescue. It will cover some of the principles involved in rescue.

Team Development

- The most important aspect of any rescue team is the people. Dedication, capability and quick thinking are all qualities that contribute to an effective team. A portion of this group should be strong leaders. Others should do well in a hands-on role, taking direction and carrying out assigned tasks. Often the most successful rescue teams are made up of volunteers – these individuals have made a conscious choice to be a part of a team and tend to be very motivated.

Raising / Lowering Devices

- These units enable the raising and lowering of an individual using mechanical advantage. While they can be used in work situations, they are most effective for rescue.
- All raising / lowering devices are intended strictly for persons properly trained in correct application and use.

Descent Control Device

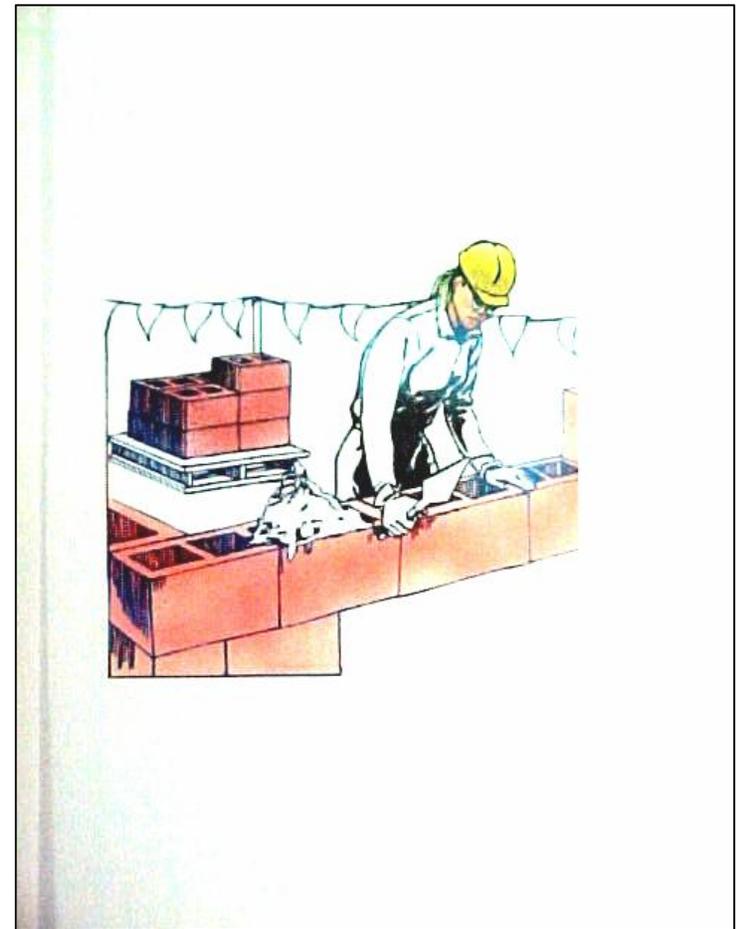
- The descent control device is used to lower an individual from height at a controlled rate. This device can be either manual or automatic.
- Descent control devices operate by creating friction in the lifeline system. They are generally used as a means of escape or egress. Training is crucial for any individual required to use these devices either routinely or in an emergency.

Fall Protection Plan

- A fall protection plan can be used if an employer can prove that it is not feasible or may create an even greater hazard to use a conventional fall protection system. This option is limited to those working in leading edge, pre-cast concrete erection or residential construction.

Controlled Access Zone (CAZ)

- CAZ restrict entry to overhand bricklaying and leading edge work areas to Authorized personnel when conventional fall protection systems such as guardrails, personal fall arrest devices, or safety nets cannot be used, or may create a greater hazard.



Safety Monitoring Systems

- Safety monitoring systems protect workers on low-sloped roofs, in leading edge operations.
- A safety monitoring system consists of a competent person who is responsible for recognizing fall hazards and ensuring workers are aware of them. A competent person understands the hazards and has the authority to take actions to eliminate them.

Warning Line Systems

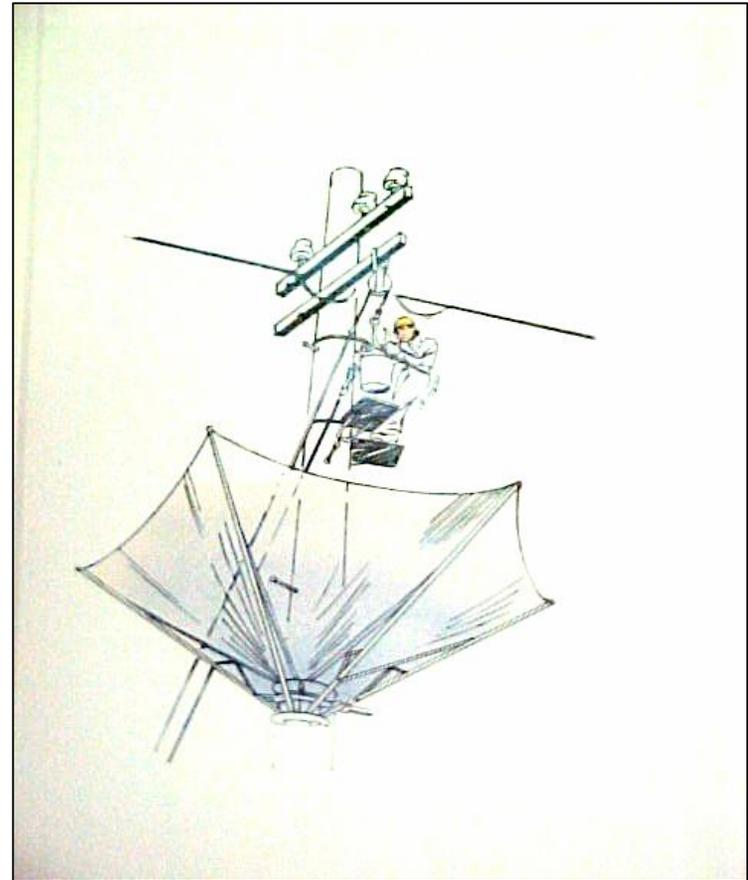
- A warning line system is a barrier erected on a roof to warn workers that they are approaching an unprotected roof side or edge. This system is used in areas where greater hazard would be created with other means of fall protection such as guardrails, body belts or safety nets. It is very important that the barrier be erected in such a manner that any type of accidental fall within this area would not result in a fall over a roof side or edge.

Guardrail Systems

- Guardrails are one form of traditional fall protection. This system is designed to protect a worker from falling by use of a physical barrier. The guardrail system must be used on unprotected sides or edges of a ramp or runway, side or edge of a hole, edge of a roof, or to prevent access to a hoist area when is is not in use.

Safety Net Systems

- Safety net systems are designed to catch people, tools, material or equipment that could fall from an elevated construction site.



Covers

- Covers are designed to prevent workers from falling through holes in floors, roofs or other working surfaces.



Quiz Time



Passing score is 80% or more. If the employee fails the test, please have him/her review the contents of training and retake a test until he/she passes the test.

Name: _____ Command/Code: _____ Job Title: _____

Phone Number: _____ E-mail Address: _____

FALL PROTECTION

1. According to U.S. Bureau of Labor Statistics, “Deaths occurring from falls during 1996 increased five percent over 1995 figures.”
True or False
2. The ultimate goal of any fall arrest system is to limit the fall distance.
True or False
3. Each employee on walking working surface with an unprotected side or edge which is ___ feet or more above a lower level shall be protected from falling.
a--4 b--6 c--8 d--10
4. There are two types of fall protection systems, Fall Restraint and Fall Arrest.
True or False
5. A fall restraint system is one that prevents a worker from free falling to the ground.
True or False
6. While anchorages for vertical system must be able to withstand a minimum force of 22.2 kN (5000 lbs).
True or False
7. As of January 1, 1998, the use of a body belt for fall arrest is prohibited.
True or False
8. Personal fall arrest systems, when stopping a fall, shall limit maximum arresting force on an employee to 1800 lbs (8 kN) when used with a body harness.
True or False
9. Rope used for vertical lifeline is typically 7/16” (11 mm) and made of nylon.
True or False
10. The top edge of guardrail shall be 42 inches, plus or minus 3 inches above the walking/working level.
True or False