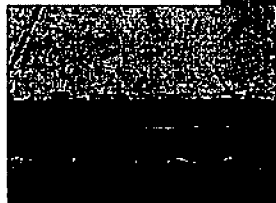
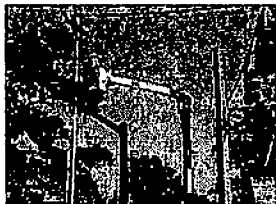


UF EH&S Training Fall Protection



Fall Protection Class Goals

- Recognize fall hazards
- Review UF requirements (OSHA and UF Policy)
- Review fall protection systems
- Practical demonstration
- Quiz



Why Fall Protection?

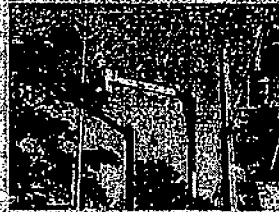
- Over 100,000 injuries and deaths annually
- An OSHA study of 99 fatalities suggests that **ALL** the deaths could have been prevented



Fall Protection Requirements

■ UF Policy and OSHA regulations, some form of fall protection is required when:

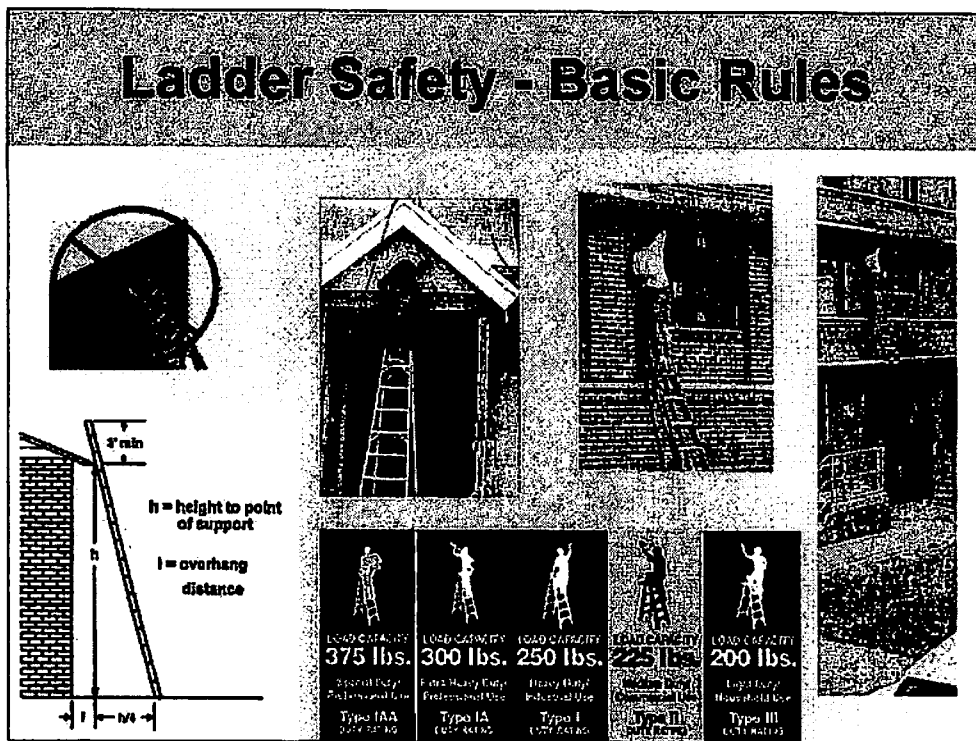
- working 6 feet or more above a lower level (e.g. roof)
- on an articulating boom platform
- in-place systems are compromised
- Exception -- limited duration and exposure where greater hazard would exist



For a general rule of thumb, remember that fall protection is required for any employee working 6 feet or more above a lower level. A lower level is considered an surface onto which an employee can fall and includes, but is not limited to, ground levels, floors, platforms, ramps, excavations, pits, tanks, water, equipment, and structures.

Exception: limited duration and limited exposure, and the hazards involved in rigging and installing the safety devices equal or exceed the hazards involved in the actual activity.

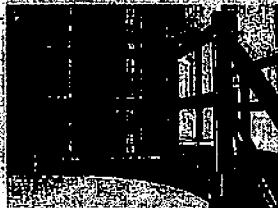
Ladder Safety - Basic Rules



- Ladders must be used only for the purpose for which they were designed.
- When portable ladders are used for access the side rails must extend at least 3 feet (.9 m) above the upper landing surface.
- Ladders must not be loaded beyond the manufacturer's rated capacity.
- Ladders must be used only on stable and level surfaces unless secured to prevent accidental movement.
- Ladders placed in areas such as passageways, doorways, or driveways, must be secured to prevent accidental movement or a barricade must be used.
- Ladders must have nonconductive side rails if they are used where the worker or the ladder could contact exposed energized electrical equipment.
- The top or top step of a stepladder must not be used as a step.
- Ladders must be inspected by a competent person for visible defects on a periodic basis and after any incident that could affect their safe use.
- When ascending or descending a ladder, the worker must face the ladder.
- Each worker must use at least one hand to grasp the ladder when climbing.
- A worker on a ladder must not carry any object or load that could cause him/her to lose balance and fall.

Guardrails

- Barrier along an open edge.
- Top rail between 39 and 45 high with middle rail halfway up.
- Toeboard or kick plate.
- Withstand 200 lbs. force.
- Additional protection may be required.



Top edge height of top rails must be between 39 and 45 inches above the walking/working level.

Midrails must be midway between the top edge of the guardrail system and the walking/working level.

Guardrail systems must be able to withstand at least 200 pounds of force applied in any direction without causing the top edge of the guardrail to deflect downward 2 inches

Midrails, screens, mesh, and other intermediate members must be capable of withstanding at least 150 pounds of force applied in any direction at any point along the midrail or other member.

Must use additional fall protection if protection provided by rail is compromised (e.g. working from a ladder near a guardrail, having to lean over a guardrail to perform work)

Other Fall Protection Systems

- Personal fall arrest systems
- Warning line systems (at least 6 ft from edge)
- Controlled access zones
- Safety monitoring



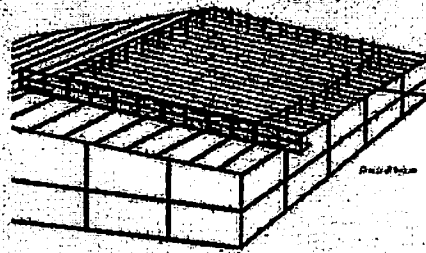
Controlled access zones are areas in which certain work may take place without the use of guardrails, fall protection, or safety net systems. Access to this work area is limited to specific workers that are doing specific construction jobs (i.e., overhand bricklaying).

Warning line systems are barriers erected to warn employees that they are approaching an unprotected edge. As long as employees do not cross the warning line, they may work without the use of a guardrail, harness, or a safety net system.

Safety monitoring is a system in which a competent person is responsible for recognizing and warning employees of fall hazards. This person keeps workers away from open edges.

Roof Work - Warning Line System

- **The Warning Line must:**
 - Be at least 6 feet from the edge.
 - Have wooden or metal posts with wire or nylon rope and "Caution" tape strung from post to post. It must be able to withstand 16 pounds of force.
 - Must surround the work being performed.



Roof Work – Safety Monitoring System

- A fall protection system where a competent person monitors workers and warns when they are working in an unsafe manner or appear to be unaware of fall hazards.
- This system can be used as an exclusive fall protection system on roofs 50 feet or less in width. It can also be used in conjunction with a warning line system where workers must move closer to the edge.

Positioning/Restraint Devices

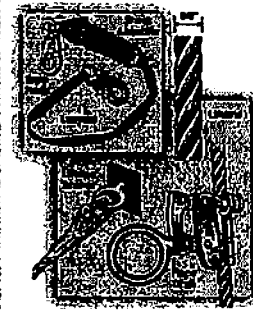
Positioning devices allow one to get up to the edge but never go over.



Work restraint actually prevents a worker from getting to the open or leading edge of a roof or other work surface. The worker is tied off with a short lanyard so that the open edge cannot even be reached. A worker in a manlift can be tied off with a short lanyard so that he cannot climb out of the manlift.

Personal Fall Arrest System

- Worker tied to fixed object
- Full Body Harness
- Lanyard, lifeline, deceleration device
- Never used to hoist workers or objects



A personal fall arrest system is one in which the worker is tied, or anchored, to a fixed object.

The worker is wearing a full body harness.

A lanyard, lifeline, or deceleration device connects harness to the fixed object.

A personal fall arrest system is never to be used as a hoist for workers or objects. This may cause damage to the integrity of the personal fall arrest system.

Anchorage

- Located directly above you
 - Avoid swinging
 - Clear drop zone
- Can withstand 5,000 pounds of force
- Don't use guardrail, window frame or other structure that may fail
- Ask a supervisor or EH&S if unsure about proper anchor points
- Proper anchor points may not always exist –
 - If it can't be done safely, it can't be done



The location of your anchor, or tie-off point, is critical. In case of a fall, you do not want to swing and potentially crash into something—so you tie off directly above you. You do not want to fall very far, so you tie off at shoulder height or above. You also want to make sure the fall space, or drop zone, is clear, so do not tie off to an anchor that will result in your falling onto something such as machinery.

The maximum free-fall distance is 6 feet. Remember, the farther the fall, the larger the arresting forces.

The anchor point must be able to withstand 5,000 pounds of force. The construction industry will use special anchors or create horizontal tie-off lines that are safe to tie onto.

General industry must be careful not to tie to electrical conduit, water lines, guardrails, etc. Remember, there is no point in tying off at all if you plan to tie off to an anchor that will not withstand your fall arresting forces.

Harness

- **Arresting forces on thighs, pelvis, waist, chest and shoulders**
 - Protects internal organs
 - Tolerable suspension time of 15 minutes
- **D-rings**
 - Upper back for fall arrest
 - Sides for positioning
 - Front for rescue or suspension



The harness will provide the greatest protection for your body in a fall situation because all the arresting forces will be applied to the structural components of your skeletal system.

The harness is rated for a maximum of 1,800 pounds of arresting forces.

The harness has a tolerable suspension time of 15 minutes, which allows plenty of time for rescue in most situations.

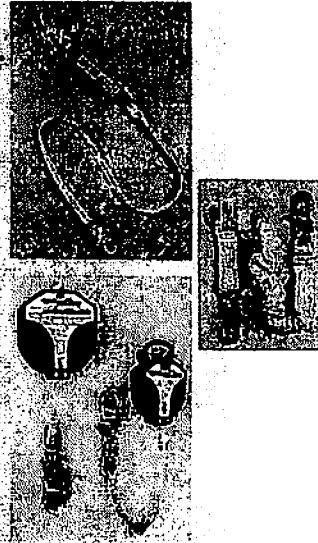
The D-ring on your upper back is for fall arrest; make sure your anchor point is always above this location to limit the height of your fall.

Use the side D-rings for positioning.

The front D-ring is used for rescue or suspension.

Lanyard and Self-Retracting Lifelines (SRL)

- Connects harness to lifeline or anchor
- Stretching or tearing system absorbs shock, prevents bouncing to reduce arresting forces
- No knots or wrapping around sharp objects
- SLR limits fall to inches



A lanyard is a flexible line of rope or strap that generally has a connector at each end for connecting the harness to a deceleration device, lifeline, or anchorage.

The lanyard often has its own deceleration device that greatly reduces the arresting forces. Depending on the brand, lanyards may use technologies such as tearing or stretching.

Using just a steel cable lanyard would exert the most arresting forces on the fallen worker. The steel cable would not give or stretch to absorb any falling forces, so all the forces would be absorbed by the worker.

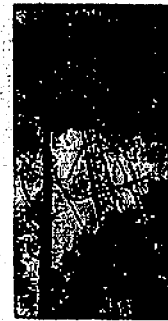
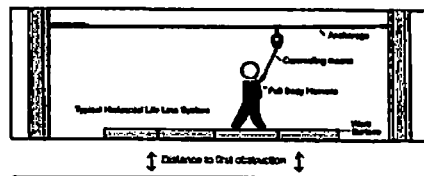
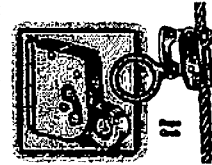
Nylon rope will give and stretch, so some of the arresting forces are absorbed by the rope. However, nylon rope also has a tendency to spring or bounce back, which would cause the fallen worker to undergo numerous small falls after the initial fall.

The deceleration device will reduce arresting forces by both giving and preventing bouncing. The lanyard will absorb most of the forces to protect the worker from potential jarring forces.

Lanyards must not have any knots or be wrapped around or over any sharp objects.

Horizontal Line or Rope Grab

- Rope or webbed material
- Means to connect personal fall arrest system to an anchor
- Stretches horizontally between two anchors
- Hangs vertically from one anchor point



The lifeline is used to connect a personal fall arrest system (consisting of a harness and deceleration lanyard) to an anchor point that cannot be reached by the short lanyard. The lanyard/lifeline connection point in a sense becomes the anchor point. The lifeline is not intended to stretch to add to the length of a fall.

The lifeline can be made of a flexible line such as a rope or cable, or it can be made of a strap or webbing material.

The lifeline can hang vertically from one anchor point to which the lanyard must be connected at the end of the vertical lifeline.

The lifeline can also hang horizontally between two anchor points to which the lanyard can be connected at any point along the horizontal line.

Connectors



- Connectors are vital
- Self-locking snap hooks only
- Non-locking snap hooks may not be used
- Do not link similar connectors together
- Knots may only be used in specific circumstances (e.g. rescue) and only specific knots (e.g. figure eight)

Connectors include snaphooks and rings that are used to attach the lifeline, lanyard, etc., to the anchor and the harness.

Self-locking snaphooks will automatically lock shut after they have been hooked. They require the worker to manually unlock the snap hook in order to release it.

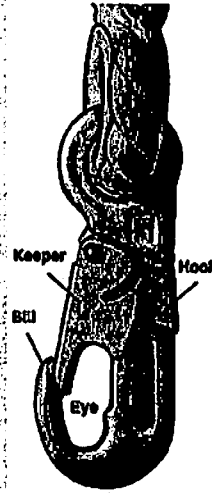
Non-locking snaphooks, which may disconnect themselves, cannot be used as part of a personal fall arrest system. Rings have been known to roll out of nonlocking snaphooks.

Do not attach similar connectors together. For example, do not attach a self-locking snaphook to another self-locking snaphook. The keepers are only rated to several hundred pounds. Attach a snaphook to a ring connector.

Never use a knot to tie a lifeline, lanyard, etc., to a harness or anchor.

Equipment Inspection

- Inspect before every use.
- Cuts, tears, abrasions, stitches coming out.
- Cracks or burrs.
- Parts move freely.
- No alterations.
- Appropriate labels.
- Record inspection in a log.



Inspect the equipment before every use. If it fails when you most need it, you could die. If it has been shock-loaded it should be removed from service.

Check the ropes and straps for cuts, tears, abrasions, loose stitches, etc.

Do the metal components (i.e., snaphooks and rings) have any cracks or burrs?

Do all the parts move freely as designed? Do the snaphooks work easily and then lock correctly? Check the rope grab device or the retracting lifelines to make sure they work correctly.

Inspect the equipment for alterations.

Does the harness and associated equipment contain the appropriate labels?

Any deficiencies noted on the equipment should result in that equipment being tagged as out of service. The equipment should then be sent to the manufacturer for repair or recertification.

Record the inspection on the appropriate inspection log.

Rescue Plan

- Each area must have a rescue plan
- Employees must be trained on the plan
- Objective- getting people down safely while limiting hanging/suspension time

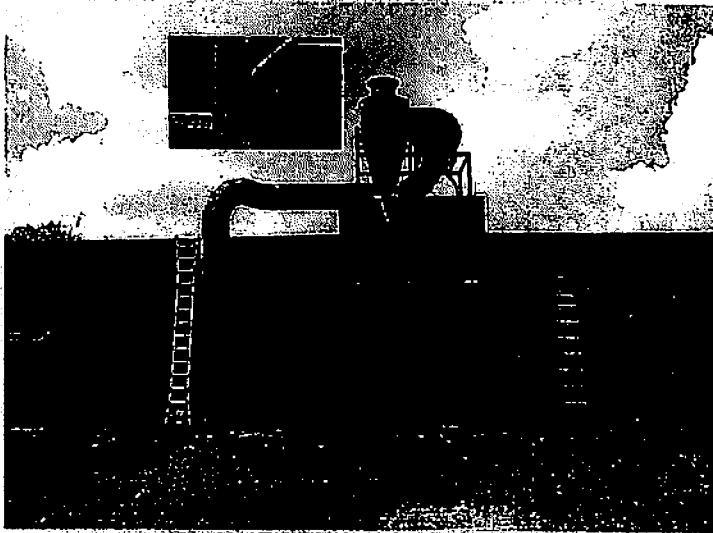


There should be rescue plans in place for each work area in which personal fall protection devices are used.

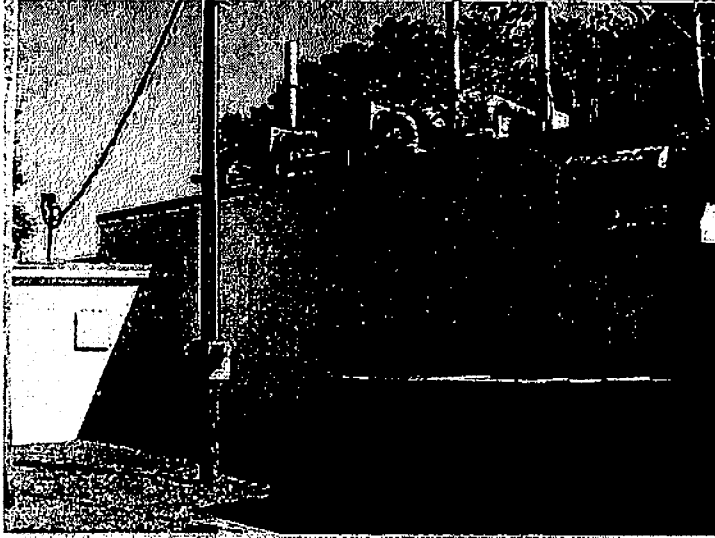
Rescuers need to be aware of the rescue plan.

The goal of any rescue is to limit the hanging/suspension time of the fallen employee.

Concerns?



Concerns?



Summary

- Understand and recognize potential hazards.
- Use the right equipment.
- Inspect your equipment prior to each use.
- Reduce arresting forces by limiting fall distance.
- Use appropriate anchorages.
- Don't take shortcuts.

EH&S FALL PROTECTION POLICY
UFEHS-SAFE1-01/03/2002
Environmental Health and Safety
Finance and Administration
University of Florida

- OBJECTIVE:** To establish minimum requirements for practices and procedures to protect employees from hazards of falls when working in elevated work areas such as rooftops, platforms and aerial lifts.
- AUTHORITY:** OSHA 29CFR 1926 Subpart M, OSHA 29CFR 1910.23, OSHA 29CFR 1910.66, OSHA 29CFR 1910.132, OSHA 29CFR 1910.269, Governors Executive Order 2000-292.
- POLICY:** All employees, students, volunteers, and contractors working under direct UF supervision shall comply with all elements of the UF Fall Protection Program (see Procedures Section).
- RESPONSIBILITIES:**
- EHS – Develop, maintain, distribute, and provide oversight in accordance with all applicable federal and state regulations, and best industry practices. EH&S staff, supervisors and PIs have the responsibility and authority to halt any unsafe practices not in accordance with this policy. Environmental Health and Safety (EH&S) has the responsibility for assisting departments in developing appropriate fall protection plans, providing technical guidance and assisting with employee training.
- Departments – Comply with all policy and program elements.
- PROCEDURES:** All work performed in elevated areas such as aerial lifts, roofs, elevated platforms, on top of industrial equipment, building ledges, etc. shall be in accordance with this policy and the referenced fall protection program.

UF Fall Protection Program

General

Each year over 100,000 injuries and deaths are attributable to work-related falls. The Bureau of Labor Statistics show falls as one of the leading causes of occupational death. An OSHA study involving 99 fall-related fatalities suggests that all of the deaths could have been prevented by the use of fall protection. Fall protection can be in the form of guardrails, personal fall arrest systems, or under specific conditions, warning line systems.

An employee must be protected from falling when working on a surface that has an unprotected side or edge, which is 6 feet or more above an adjacent lower level, or when working from bucket trucks or other personnel lifts with articulating booms.

In each of these cases, the fall hazards must be evaluated to determine the preferable method to protect the employee.

Responsibilities

Supervisors have the primary responsibility for the implementation of the Fall Protection Program in their work area. The supervisor should be a competent person, as defined by OSHA, or ensure that responsibility for the competent person is assigned to a qualified individual within the work group. OSHA defines a competent person as:

- 1) A person who is capable of identifying existing and predictable hazards in the surroundings or identifying working conditions which are hazardous or dangerous to employees and
- 2) Who has authorization to take prompt corrective measures to eliminate them.

Supervisors must assure that only trained individuals are assigned work that requires use of fall protection systems (other than guardrails).

Employees have the primary responsibility for proper care, use and inspection of their assigned fall protection equipment.

Departments have the primary responsibility for providing fall protection systems and appropriate training.

Environmental Health and Safety (EH&S) has the responsibility for assisting departments in developing appropriate fall protection plans, providing technical guidance and assisting with employee training.

Training

Each employee who may be exposed to fall hazards will be trained to recognize the hazards and the procedures to follow to minimize the hazards. A competent person will provide the training.

The competent person must train employees in the following areas:

- fall hazards in the work area
- correct procedures for erecting, maintaining, disassembling and inspecting the fall protection systems used
- use and operation of the fall protection systems used
- role of employees in fall protection plans
- what rescue procedures to follow in case of a fall
- overview of the OSHA fall protection standards

A training record will be maintained for each employee. The record will contain the name of the employee trained, date of training and the signature of the person who conducted the training. Retraining should be done if there is a change in the fall protection system being used or if an employee's actions demonstrate that the employee has not retained the understanding or skills important to fall protection.

Fall Protection Systems

One of the following systems should be in place whenever an employee is exposed to a fall of greater than six feet.

Guardrail systems

Guardrails are needed at the edge of work areas 6 feet or more in height to protect employees from falling. This includes the edge of excavations greater than six feet in depth. Guardrail systems need to meet the following criteria:

- Toprail is 42 inches, +/- 3 inches above the walking/working level
- Midrail is located midway between the top rail and the walking/working level
* It is important to remember that the working level is that level where the work is being done. Someone working on a stepladder next to an edge may raise his/her working surface well above the walking surface.
- Both top and midrails should be constructed of materials at least one-quarter inch in thickness or diameter. If wire rope is used for toprails, it needs to be flagged with a high-visibility material at least every 6 feet and can have no more than 3" of deflection
- The toprail needs to withstand a force of 200 pounds when applied in any downward or outward direction.
- The midrail needs to withstand a force of 150 pounds applied in any downward or outward direction
- The system should be smooth to prevent punctures, lacerations or snagging of clothing
- The ends of the top rail should not overhang the terminal posts, except when such overhang does not present a projection hazard

- When a hoisting area is needed, a chain, gate or removable guardrail section must be placed across the access opening when hoisting operations are not taking place.

Personal Fall Arrest Systems

Personnel requiring the use of personal fall protection equipment shall employ the "Buddy System" or have an observer to render assistance when and if required.

There are three main components to the personal fall arrest system. This includes the personal protective equipment the employee wears, the connecting devices and the anchorage point. Prior to tying off to perform the work a means of rescue in the event of a fall must be immediately available. The system needs to meet the following criteria for each component:

Personal Protective Equipment

- **Full body harnesses are required.** The use of body belts is prohibited.
- The attachment point of the body harness is the center D-ring on the back.
- Employees must **always** tie off at or above the D ring of the harness except when using lanyards 3 feet or less in length.
- Harnesses or lanyards that have been subjected to an impact load shall be destroyed.
- Load testing shall not be performed on fall protection equipment.

Connecting devices

This device can be a rope or web lanyard, rope grab or retractable lifeline.

- Only locking snaphooks may be used.
- Horizontal lifelines will be designed by a qualified person and installed in accordance with the design requirements.
- Lanyards and vertical lifelines need a minimum breaking strength of 5,000 pounds.
- Lanyards may not be clipped back to itself (e.g. around an anchor point) unless specifically designed to do so.
- If vertical lifelines are used, each employee will be attached to a separate lifeline.
- Lifelines need to be protected against being cut or abraded

Anchorage

Secure anchor points are the most critical component when employees must use fall arrest equipment. UF buildings may have existing structures (e.g., steel beams that may meet the criteria for a secure anchor point). Other work locations and assignments may require the installation of a temporary or permanent anchor. As a minimum, the following criteria must be considered for each type of anchor point:

- Structure must be sound and capable of withstanding a 5000 lb. static load/person attached.

- Structure/anchor must be easily accessible to avoid fall hazards during hook up.
- Direct tying off around sharp edged structures can reduce breaking strength by 70% therefore; chafing pads or abrasion resistant straps must be used around sharp edged structures to prevent cutting action against safety lanyards or lifelines.
- Structures used as anchor points must be at the worker's shoulder level or higher to limit free fall to 6 feet or less and prevent contact with any lower level (exception – when self retracting lifelines and or 3 foot lanyards are used)
- Choose structures for anchor points that will prevent swing fall hazards. Potentially dangerous "pendulum" like swing falls can result when a worker moves horizontally away from a fixed anchor point and falls. The arc of the swing produces as much energy as a vertical free fall and the hazard of swinging into an obstruction becomes a major factor. Raising the height of the anchor point can reduce the angle of the arc and the force of the swing. Horizontal lifelines can help maintain the attachment point overhead and limit the fall vertically. A qualified person must design a horizontal lifeline.

Permanent Anchor Requirements

In addition to all the criteria listed above, the following points must be considered:

- Environmental factors and dissimilarity of materials can degrade exposed anchors.
- Compatibility of permanent anchors with employee's fall arrest equipment.
- Inclusion of permanent anchors into a Preventive Maintenance Program with scheduled annual re-certification.
- Visibly label permanent anchors.
- Anchors must be immediately removed from service and re-certified if subjected to fall arrest forces.

Reusable Temporary Anchors:

- Reusable temporary roof anchors must be installed and used following the manufacturer's installation guidelines.
- Roof anchors must be compatible with employee's fall arrest equipment.
- Roof anchors must be removed from service at the completion of the job and inspected prior to reuse following the manufacturer's inspection guidelines.
- Roof anchors must be immediately removed from service and disposed of if subjected to fall arrest forces.

Complete system

- If a fall occurs, the employee should not be able to free fall more than 6 feet nor contact a lower level.
To ensure this, add the height of the worker, the lanyard length and an elongation length of 3.5 feet. Using this formula, a six-foot worker with a six-foot lanyard would require a tie-off point at least 15.5 feet above the next lower level.
- A personal fall arrest system that was subjected to an impact needs to be removed from service immediately.
- Personal fall arrest systems need to be inspected prior to each use and damaged or deteriorated components removed from service.
- Personal fall arrest systems should not be attached to guardrails nor hoists.

Work from Aerial Lifts and Self Powered Work Platforms

Body harnesses must be worn with a shock-absorbing lanyard (preferably not to exceed 3 feet in length) and must be worn when working from an elevated work platform (exception: scissor lifts and telescoping lifts that can move only vertically do not require the use of a harness and lanyard as long as the work platform is protected by a guardrail system). The point of attachment must be the lift's boom or work platform. Personnel cannot attach lanyards to adjacent poles, structures or equipment while they are working from the aerial lift.

Personnel cannot move an aerial lift while the boom is in an elevated working position and the operator is inside of the lift platform.

Inspection

The employee will inspect the entire personal fall arrest system prior to every use. The competent person will inspect the entire system in use at the initial installation and weekly thereafter. The visual inspection of a personal fall arrest system periodically will follow the manufacturer's recommendations. An example of a complete inspection is in Appendix A.

Warning Line Systems and Controlled Access Zones

Warning line systems and work in controlled access zones must be developed in accordance with OSHA regulation 1926.502 and must be approved by EH&S or their designee before employees are exposed to fall hazards.

Monitoring System

OSHA emphasizes that safety-monitoring systems are a last resort and may only be used when other systems are infeasible or present a greater hazard. Monitoring systems must be developed in accordance with OSHA regulation 1926.502 and must be approved by EH&S or their designee before employees are exposed to fall hazards.

Appendix A

Personal Fall Arrest System Inspection

All fall protection equipment shall be inspected before each use in accordance with the manufacturers instructions. The following is general guidance for the inspection of this equipment.

Harness Inspection Webbing

- Inspect the entire surface of webbing for damage. Beginning at one end, bend the webbing in an inverted “U”. Holding the body side of the belt toward you, grasp the belt with your hands six to eight inches apart. This surface tension makes the damaged fibers or cuts easier to see. Watch 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. “D” ring back pads should also be inspected for damage.

Attachment of Buckles

- Note any unusual wear, frayed or cut fiber, or distortion of the buckles.

Tongue/Grommet

- The tongue receives heavy wear from repeated buckling and unbuckling. Inspect for loose, distorted or broken grommets. The webbing should not have any additional punched holes.

Tongue Buckle

- Buckle tongues should be free of distortion in shape and motion. They should overlap the buckle frame and move freely back and forth in their socket. The roller should turn freely on the frame. Check for distortion or sharp edges.

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 of the center bar.

Lanyard Inspection 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 splice should have no loose or cut strands. The edges of the thimble must be free of sharp edges, distortion, or cracks.

Web Lanyard

- While bending the webbing over a curved surface such as a pipe, observe each side of the webbed lanyard. This will reveal any cuts or breaks. Examine the webbing for swelling, discoloration, cracks, or burns. Observe closely for any breaks in the stitching.

Rope Lanyard

- Rotation of the rope lanyard while inspecting from end to end will bring to light any fuzzy, worn, broken or cut fibers. Weakened areas from extreme loads will appear as a noticeable change from the original diameter. The rope diameter should be uniform throughout, following a short break-in period. Make sure the rope has no knots tied in it. Knots can reduce the strength of the rope by up to 60%.

Shock-absorbing Lanyard

- Shock-absorbing lanyards should be examined as a web lanyard. However, also look for signs of deployment. If the lanyard shows signs of having been put under load (e.g. torn out stitching), remove it from service.

Appendix B Definitions

Fall Protection System - Fall Protection Systems are designed to protect personnel from the risk of falls when working at elevated heights. Recognized systems include:

Fall Prevention - a structural design to limit a fall to the same level (e.g., guardrails, positioning/restraint systems).

Fall Arrest System - an approved full body harness, shock absorbing lanyard or self retractable lifeline, locking snap hooks and anchor points approved for a static load of 5000 pounds or engineered to meet a two to one safety factor.

Aerial Lift - Vehicle mounted elevating work platform (e.g. Boom Lifts, Articulating Telescoping Boom Lifts).

Competent Person - A person who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are hazardous to personnel and who has authorization to quickly correct the situation.

Qualified Person - A person with a recognized degree or professional certificate, (e.g. civil or mechanical engineering profession or Certified Safety Professional) and extensive knowledge and experience in this area, capable of doing design, analysis, evaluation and specifications.

Certification - ANSI (American National Standards Institute) defines certification as documentation that determines criteria meets the requirements of the standard through testing or proven analytical method (e.g. engineering calculations) or both, carried out under the supervision of a Qualified Person..

Preventing Injuries and Deaths from Falls during Construction and Maintenance of Telecommunication Towers

WORKERS should take the following steps to protect themselves from falls during tower construction and maintenance:

- Use 100% fall protection when working on towers at heights above 25 feet.
- Participate in all training programs offered by your employer.
- Follow safe work practices identified by worker training programs.
- Use OSHA-required personal protective equipment and make sure you are trained in its proper use.
- Inspect equipment daily and report any damage or deficiencies to your supervisor immediately.

EMPLOYERS should take the following steps to reduce the risk of worker injuries and deaths from falls during tower construction and maintenance:

- Comply with OSHA Compliance Directive 2-1.29.
- Ensure that hoisting equipment used to lift workers is designed to prevent uncontrolled descent and is properly rated for the intended use.
- Ensure that hoist operators are properly trained.

- Ensure that workers use 100% fall protection when working on towers at heights above 25 feet.
- Provide workers with a 100% fall-protection system compatible with tower components and the tasks to be performed.
- Ensure that gin poles are installed and used according to the specifications of the manufacturer or a registered professional engineer.
- Ensure that tower erectors are adequately trained in proper climbing techniques, including sustaining three-point contact.
- Provide workers with OSHA-required personal protective equipment and training in its proper use.
- Ensure that workers inspect their equipment daily to identify any damage or deficiencies.
- Provide workers with an adequate work-positioning device system. Connectors on positioning systems must be compatible with the tower components to which they are attached.
- Supplement worker training on safe work practices with discussions of FACE case reports.
- Know and comply with child labor laws that prohibit hazardous work by workers under age 18.

7.2 Equipment Rigging and Use- PFAS equipment shall be rigged to prevent a free fall in excess of 6 feet (1.8m) and preclude the presence of vertical and lateral obstructions in the potential fall path. The rigging shall take into consideration the rescue plan and rescue equipment provision for retrieval of the fallen user of the PFAS. The PFAS equipment shall be rigged to prevent its contact with hazardous objects in the workplace which could damage the equipment or prevent its proper functioning.

7.2.1 No knots shall be tied in lanyards, lifelines or anchorage connectors. Sliding hitch knots shall not be used in lieu of fall arrestors.

7.2.2 Snaphooks and carabiners shall be compatibly matched to their associated connector to reduce the possibility of rollout. Snaphooks and carabiners shall be securely closed and locked once coupled to an associated connector. Snaphooks and carabiners shall not be connected to each other.

7.2.3 Anchorages selected for PFAS shall have a strength capable of sustaining static loads, applied in the directions permitted by the PFAS, of at least:

(a) 3,600 pounds (16 kN) when certification exists, or (b) 5,000 pounds (22.2 kN) in the absence of certification. When more than one PFAS is attached to an anchorage, the anchorage strengths set forth in (a) and (b) above shall be multiplied by the number of personal fall arrest systems attached to the anchorage.

E7.2.2 Multiple connections into a single ring are not recommended (i.e. two snaphooks; snaphook and webbing; snaphook and carabiner).

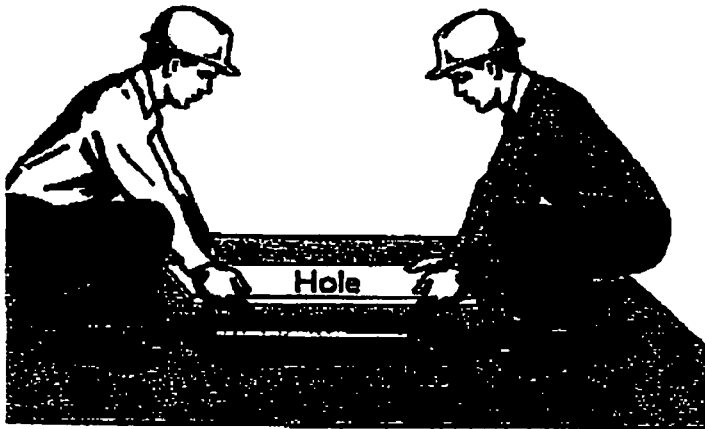
E7.2.3 The 5,000 pound anchorage referred to here is the same as that required by OSHA 1910.66. An assumption is made that the 5,000 pound strength level has been established and, therefore, certification is not required. See 2.13.

7.2.4 Anchorage connections shall be stabilized to prevent unwanted movement or disengagement of the PFAS from the anchorage.

7.2.5 Anchorage connectors shall not be attached to anchorages where such attachment would reduce the anchorage strength below the applicable level set forth in 7.2.3 or reduce the anchorage strength below the allowable level set by applicable structural codes. A suitable anchorage connector shall be used for rigging the connection of lanyards and lifelines to structural members. Lanyards and lifelines shall not be wrapped around structural members and connected back onto themselves unless a suitable anchorage connection means is integral to them.



Any gap or hole larger than 2" must be considered as an opening that needs to be treated one of the following ways; covered and marked, guardrails must be erected around it, or worker must wear personal fall arrest equipment



One of the greater hazards that a roofer faces is falling. As a result it is very important that proper fall protection measures be used. Falls happen very quickly. The best way to avoid a fall is to be using fall protection measures, before an accident occurs.

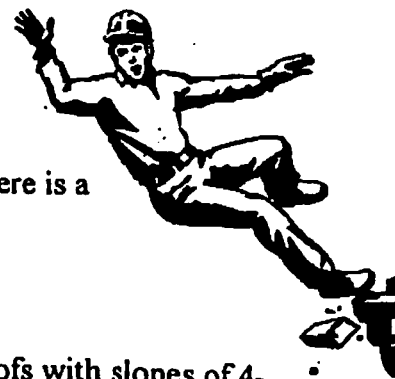
Fall protection is required for both steep-slope and low-slope roofing. A steep-slope roof is one with a slope greater than 4-in-12. A low-slope roof is one with a slope less than or equal to 4-in-12.

OSHA requires that some type of fall protection be used whenever there is a level-to-level distance of 6 feet or more.

WARNING LINES

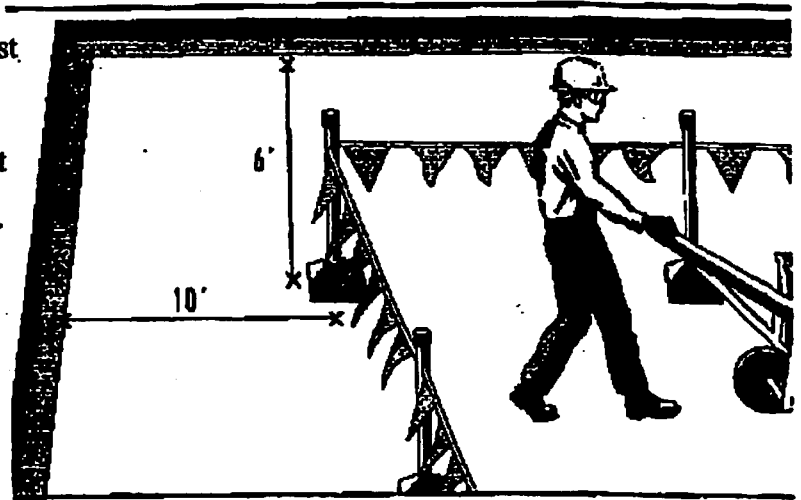
The warning lines system can be used to provide fall protection on roofs with slopes of 4-in-12 or less. The warning line system must be erected on all open sides of the work area and consist of stanchion posts with flagged wire, rope, or chain

Safety material on this page was taken from the National Roofing Contractors Association, Pocket Guide to Safety. For more information on them go to www.nrca.net



When mechanical equipment is not being used, the warning line must be erected at least 6 feet from the roof edge.

If mechanical equipment is being used, the warning line must be erected at least 6 feet from roof edge parallel to the direction of travel and at least 10 feet from the roof edge perpendicular to the direction of travel.



The safety monitoring system is a fall protection system where a competent person monitors workers and warns when they are working in an unsafe manner or appear to be unaware of fall hazards. This system can be used as an exclusive fall protection system on roofs 50 feet or less in width. It can also be used in conjunction with a warning line system, when crew workers are working outside of the warning line. Mechanical equipment cannot be used when using the safety monitoring system.



Safety material on this page was taken from the National Roofing Contractors Association, Pocket Guide to Safety. For more information on them go to www.nrca.net

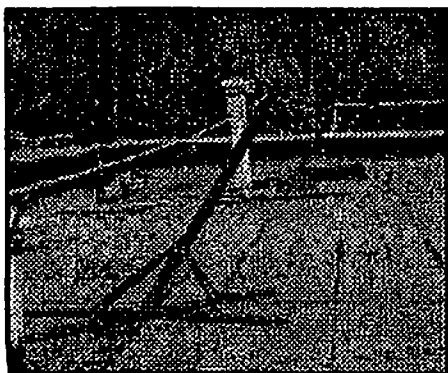
EXAMPLE ONLY

SPEED STAND Warning Line System

The quickest, most efficient
solution for roof safety.



One piece stands set up quickly.



Tilted stand design improves production by keeping the footprint of the stand out of the way. Workers can perform production fieldwork without the interruption of moving the stands.

Speedstand weighs less than ½ the weight of most other stands. This allows one man to lift and move as many

stands as two men could before. Lighter stands also cause less strain. Because roofing projects typically require the stands to be handled 7 times, this adds up to large payroll savings.



Speedreel handles flagline quickly and prevents time lost with tangled line.

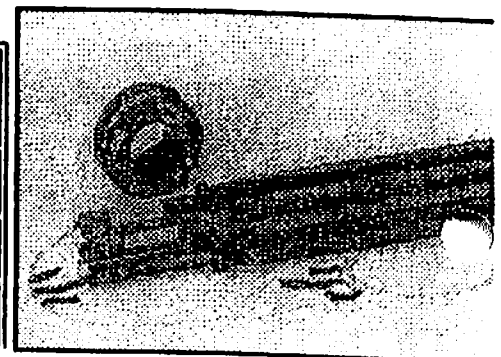
Simple ropelock fastens flagline rapidly with only or hand.

Speedstand offers quick one-piece setup, light, rapidly handled stands, tilted design that improves production, a simple ropelock, speedreel, and durable construction which add substantial payroll savings and grateful employees.

Warning line systems warn workers of fall danger, improving safety, and avoiding expensive OSHA fines.

Speedstand was designed by knowledgeable roofers, roofing contractors, and engineers: flat roofs only. Patented.

	1-4 sets	5-9 sets	10+ sets
Price per Set	\$340	\$310	\$295
	f.o.b. Sutherlin, OR 97479		
Replacement Flagline (160')			





ACCIDENT SUMMARY

Accident Type	Fall from Roof
Weather	Clear
Type of Operation	Construction Roofing
Crew Size	4
Collective Bargaining	Yes
Competent Safety Monitor on Site?	No
Safety and Health Program in Effect?	No
Was the Worksite Inspected Regularly?	No
Training and Education Provided?	No
Employee Job Title	Roofer
Age/Sex	21/M
Experience at this Type of Work	6 months
Time on Project	3 weeks



BRIEF DESCRIPTION OF ACCIDENT

A roofer, handling a piece of fiberboard, backed up and tripped over a 7½ inch parapet. He fell more than 50 feet to ground level and died of severe head injuries.

INSPECTION RESULTS

Inspection of the accident site revealed that there was neither a safety monitoring system/warning lines or a motion-stopping-safety (MSS) system in use during the installation on the roof of the building. Also, there were two unguarded duct openings on the roof.

ACCIDENT PREVENTION RECOMMENDATIONS

1. Provide standard railing for temporary floor opening [29 CFR 1926.500(b)(7)].
2. Provide employees engaged in built-up roofing work on low-pitched roofs with a safety monitoring system on roofs of fifty feet or less in width where mechanical equipment is not being used [29 CFR 1926.500(g)(1)(ii)].
3. Erect warning lines around all sides of the work area during the performance of built-up roofing work on low-pitched roofs where the ground to cave height is greater than 16 feet [29 CFR 1926.500(g)(3)(i)].
4. Assure that employees engaged in built-up roofing work have been trained and instructed in the nature of fall hazards in the work area near a roof edge; the function, use and operation of the MSS system, warning line, and safety monitoring systems to be used; the correct procedures for erecting, maintaining, and disassembling the systems to be used; the role of each employee in the safety monitoring system when this system is used; the limitations on the use of mechanical equipment; and the correct procedures for the handling and storage of equipment and materials [29 CFR 1926.500(g)(5)(i)(a) through (f)].
5. Erect an MSS system along all unprotected roof sides and edges [29 CFR 1926.500 (g)(5)].

SOURCES OF HELP

- OSHA General Industry Standards [29 CFR parts 1900-1910] and OSHA Construction Standards [29 CFR Part 1926] which together include all OSHA job safety and health rules and regulations covering construction.
- OSHA Safety and Health Training Guidelines for Construction (Available from the National Technical Information Service, 526S Port Royal Road, Springfield, VA 22161; 703/467-4650; Order No. PB-239-312/AS): a set of 15 guidelines to help construction employers establish a training program in the safe use of equipment, tools, and machinery on the job

NOTE: The case here described was selected as being representative of fatalities caused by improper work practices. No special emphasis or priority is implied nor is the case necessarily a recent occurrence. The legal aspects of the incident have been

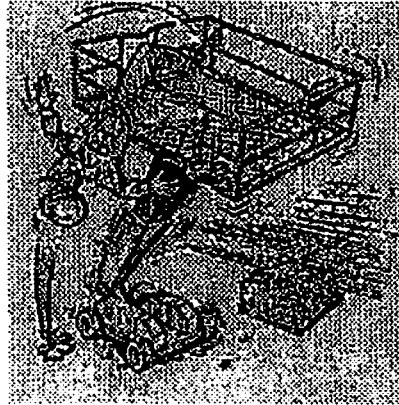
Accident Report FATAL FACTS

U.S. Department of Labor
Occupational Safety
and Health Administration
No. 68



ACCIDENT SUMMARY

Accident Type	Fall (Thrown from)
Weather	Unknown
Type of Operation	Cleaning, Replacing and Caulking Brick
Crew Size	8
Competent Safety Monitor on Site?	No
Safety and Health Program in Effect?	Yes
Was the Worksite Inspected Regularly?	No
Training and Education Provided?	Yes
Employee Job Title	Laborer
Age/Sex	45/M
Experience at this Type of Work	Unknown
Time on Project	3 weeks



BRIEF DESCRIPTION OF ACCIDENT

Employee was operating an aerial lift, with an extendable boom rotating aerial work platform. He was thrown from the basket while moving the machine. The boom was fully extended and the machine apparently ran over some bricks, causing the boom to flex or spring, throwing the employee from the basket. The fall was about 37 feet to a concrete surface. The employee died from severe head and chest injuries.

The foreman was not on the site at the time.

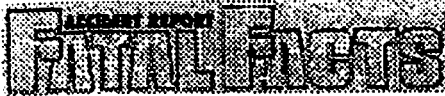
ACCIDENT PREVENTION RECOMMENDATIONS

The employer must:

1. Have a competent person conduct frequent regular inspections of the worksite, in accordance with 29 Code of Federal Regulations (CFR) 1926.20(b)(2).
2. Permit only those employees qualified by training to operate equipment and machinery, in accordance with 1926.20(b)(4).
3. Instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his or her work environment, in accordance with 1926.21 (b)(2).
4. Prohibit unauthorized persons from operating aerial lifts, in accordance with 1926.556(b)(2)(ii).
5. Require the wearing of a body belt and lanyard at all times while in this type of device, in accordance with 1926.556(b)(2)(v).

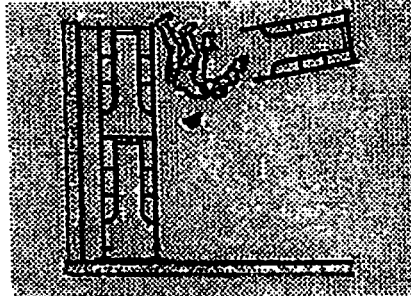
SOURCES OF HELP

- OSHA Construction Standards [29 CFR Part 1926], which include all OSHA job safety and health rules and regulations covering construction, may be purchased from the Government Printing Office, phone (202) 512-1800, fax (202) 512-2250, order number 869-022-00114-1, \$33.
- OSHA-funded free consultation services listed in telephone directories under U.S. Labor Department or under the state government section where states administer their own OSHA programs.
- OSHA Safety and Health Training Guidelines for Construction, Volume III (Available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; phone (703) 487-4650; Order No. PB-239-312/AS, \$25) to help construction employers establish a training program.
- Courses in construction safety are offered by the OSHA Training Institute, 1555 Timos Drive, Des Plaines, IL 60018, 847/297-4810.
- OSHA regulations, documents and technical information also are available on CD-ROM, which may be purchased from the Government Printing Office, phone (202) 512-1800 or fax (202) 512-2250, order number 729-13-00000-5; cost \$79 annually; \$28 quarterly. That information also is on the Internet World Wide Web at <http://www.osha.gov/>



ACCIDENT SUMMARY

Accident Type	Fall From Elevation
Weather	Clear/Cold
Type of Operation	Masonry Contractor
Crew Size	7
Collective Bargaining	No
Competent Safety Monitor on Site?	No
Safety and Health Program in Effect?	No
Was the Worksite Inspected Regularly?	No
Training and Education Provided?	No
Employee Job Title	Brick Mason
Age/Sex	37/M
Experience at this Type of Work	Unknown
Time on Project	1 Month



BRIEF DESCRIPTION OF ACCIDENT

An employee was constructing the third level of a tubular welded frame scaffold while standing on the second level. The scaffold was constructed on a poured concrete floor and had been leveled. Each section of the framework measured 6'5" high. The working surface was solidly planked.

When the employee tried to set the third level frame into the pins of the second level, the frame he was trying to position flipped to one side. The momentum of the frame thrust the employee backward off the second level. He fell to the ground, sustaining a fatal blow to his head.

INSPECTION RESULTS

Following its inspection, OSHA cited the employer for failure to provide specific employee training, failure to implement an effective safety program and failure to report the fatality within 48 hours.

ACCIDENT PREVENTION RECOMMENDATIONS

1. Employers must establish specific site safety rules for erecting and dismantling scaffolding [29 CFR 1926.21(b)(1)].
2. Employers must provide training to employees on the correct procedures to use in erecting and dismantling scaffolding [29 CFR 1926.21(b)(2)].
3. Fatalities must be reported to the nearest OSHA office within 48 hours [29 CFR 1904.8].

SOURCES OF HELP

- OSHA General Industry Standards [CFR parts 1900-1910] and OSHA Construction Standards [CFR Part 1926] which together include all OSHA job safety and health rules and regulations covering construction.
- OSHA-funded free onsite consultation services. Consult your telephone directory for the number of your local OSHA area or regional office for further assistance and advice (list under the U.S. Department of Labor or under the state government section where states administer their own OSHA programs).

ACCIDENT REPORT FATAL FACTS

U.S. Department of Labor
Occupational Safety
and Health Administration
No. 32



ACCIDENT SUMMARY

Accident Type	Falling from Excavator Bucket
Weather	Clear
Type of Operation	Plumbing Contractor
Crew Size	4
Collective Bargaining	Yes
Competent Safety Monitor on Site?	No
Safety and Health Program in Effect?	Yes
Was the Worksite Inspected Regularly?	Yes
Training and Education Provided?	Yes
Employee Job Title	Plumber
Age/Sex	88/M
Experience at this Type of Work	22 years
Time on Project	2 days



BRIEF DESCRIPTION OF ACCIDENT

Two plumbers working in a trench were being hoisted to the street level in the bucket of an excavator. As the excavator operator started to swing the bucket it jerked causing one employee to fall approximately 14 feet striking his head on the pipe in the trench.

INSPECTION RESULTS

As a result of its investigation OSHA issued a citation alleging one serious violation.

ACCIDENT PREVENTION RECOMMENDATIONS

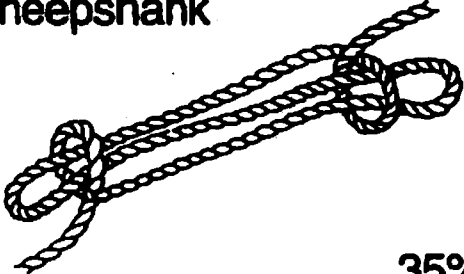

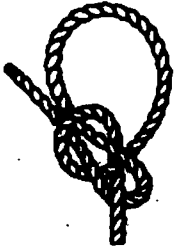

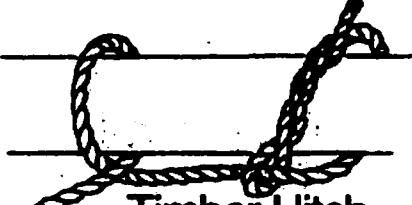

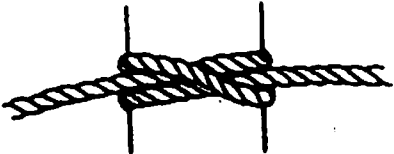

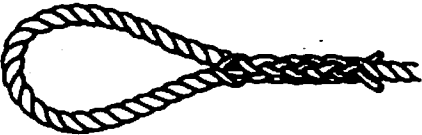
1. A work rule prohibiting employees from riding in the bucket of an excavator should be effectively communicated and enforced.
2. Employees must be instructed in the recognition and avoidance of unsafe conditions and the regulations applicable to their work environment to control or eliminate any hazards or other exposure to illness or injury (29 CFR 1926.21 (b)(2)).
3. When employees are required to be in trenches four feet deep or more, an adequate means of exit such as a ladder or steps, shall be provided (29 CFR 1926.652).

SOURCES OF HELP

- Construction Safety and Health Standards (OSHA 2207) which contains all OSHA job safety and health rules and regulations covering construction.
- OSHA Safety and Health Training Guidelines for Construction (available from the National Technical Information Service - Order No. PB-239-312/AS) comprised of set of 15 guidelines to help construction employers establish a training program in the safe use of equipment, tools and machinery the job.
- OSHA-funded free onsite consultation services. Consult your telephone directory for the number of your local OSHA area or regional office for further assistance and advice (list under the U.S. Department of Labor or under the state government section where states administer the own OSH programs).
- Courses in construction safety are offered by the OSHA Training Institute, 1555 Times Dr., Des Plaines, Ill. 60018 (312) 297-4810.

NOTE: The case here described was selected as being representative of fatalities caused by improper work practices. No special emphasis or priority is implied nor is the case necessarily a recent occurrence. The legal aspects of the incident have been resolved, and the case is now closed.

Approximate Efficiency – Comparison of Manila Rope Knots and Connections to Safe Load on Manila

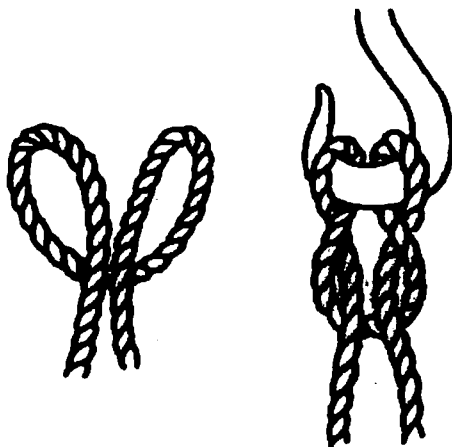
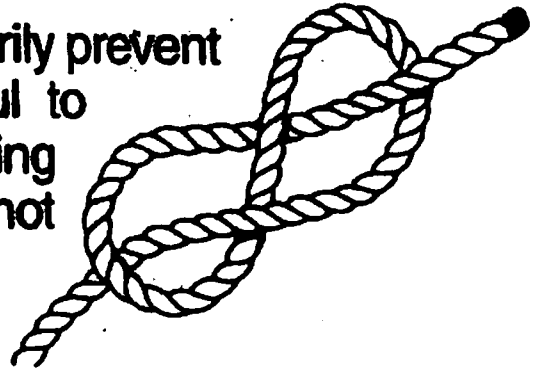
<p>Sheepshank</p>  <p>35%</p>	<p>Square or Reef Knot</p>  <p>43%</p>
<p>Bowline (outside) 50%</p>  <p>Bowline (inside) 53%</p> 	<p>72%</p>  <p>Timber Hitch & Half Hitch</p>
<p>Long Splice</p>  <p>68%</p>	<p>Clove Hitch</p>  <p>75%</p>
<p>Short Splice</p>  <p>85%</p>	<p>Eye Splice</p>  <p>85%</p>

Handbook for Riggers, 1977 Revised Edition

Note: Variations in test equipment, procedures, rope age, condition and construction, etc. may impact test results. The efficiencies shown above are for point of reference only. Rigging methods, rope capacity, etc. should well exceed the weight of the load to be hoisted. Knot efficiencies should not be factored into the lift too closely; err on the side of caution.

Figure Eight Knot

Used in the end of a rope to temporarily prevent the strands from unraveling. Useful to prevent the end of a rope from slipping through a block or an eye, and does not jam as easily as the overhand knot.

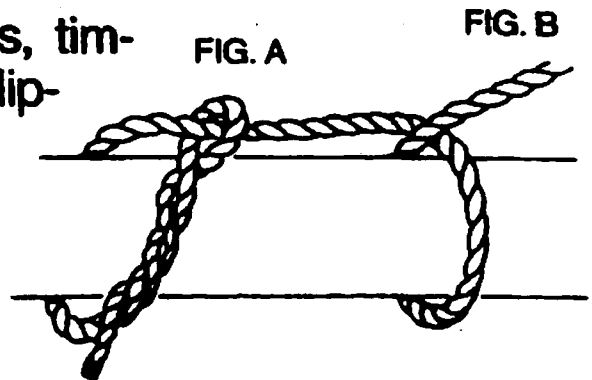


Catspaw

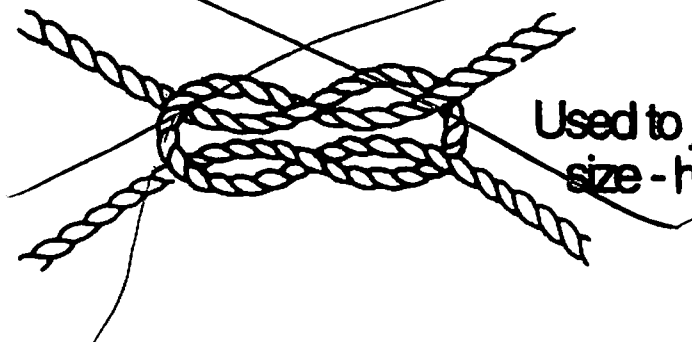
Used to secure the middle of a rope to a hook. Take two bights (loops) in the rope, twist in opposite directions and then bring the loops together and pass over hook.

Timber Hitch

(Fig. A) Used for hoisting planks, timbers and pipe. Holds without slipping and does not jam. A half-hitch is added in (Fig. B). This is done to keep a plank or length of pipe on end, while lifting.

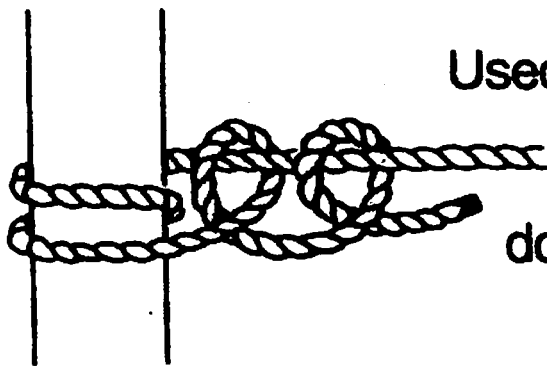


Reef Knot or Square Knot



Used to join two ropes or lines of the same size - holds firmly and is easily untied.

Round Turn and Two Half Hitches



Used to secure a rope to a column or post, and will stand heavy strain without slipping. Easily tied and does not jam.

Figure Eight on a Bight

Provides a secure loop in the end of a rope. Made by doubling a line back on itself and then tying a Figure Eight knot in the double line. This knot may reduce the strength of a rope by 20%. This knot can be used for securing a lifeline to a carabiner. **CAUTION:** Be certain you tie a Figure Eight, not an Overhand on a Bight.

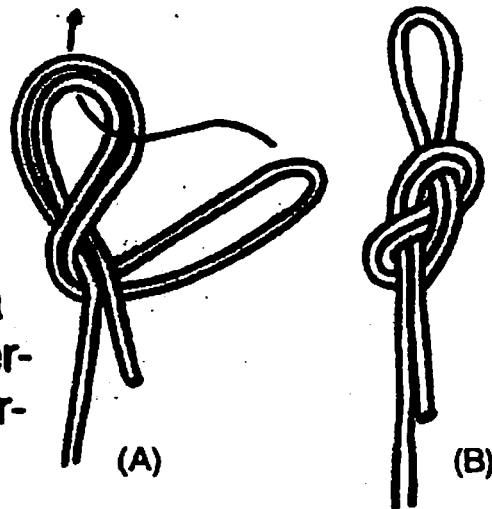
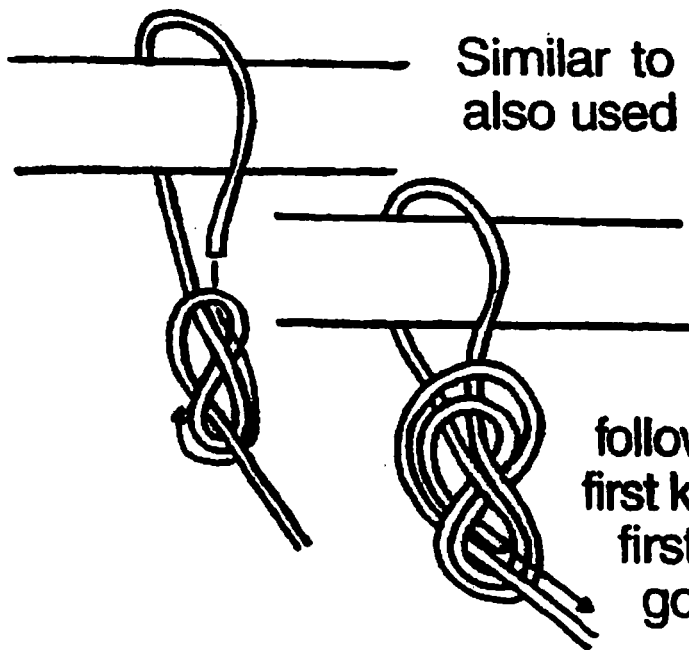


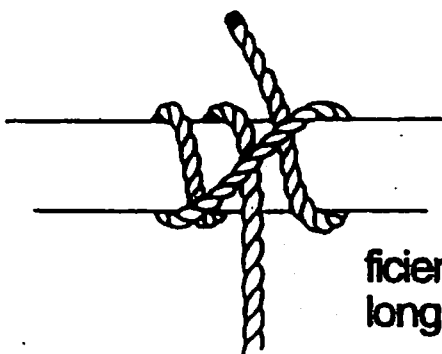
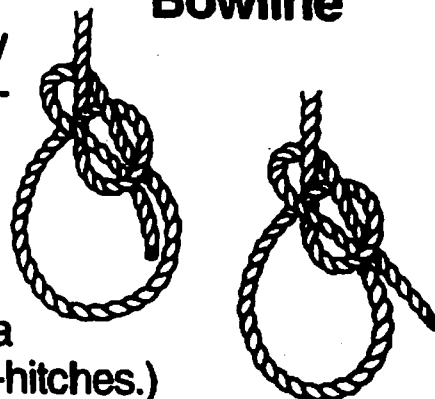
Figure Eight Follow Through



Similar to Figure Eight on a Bight, it is also used for securing lifelines but is tied around the anchor point. Tie a simple Figure Eight well back from the end of the rope. Pass the end of the rope around the anchor point then follow back through parallel to the first knot. Follow every contour of the first knot with both rope ends going in the same direction.

One of the best-known and most-widely used of all knots. A favorite knot with riggers, it is easily constructed and used wherever a hitch is required that will not slip, jam or fail. It can be used for securing lifelines but can reduce the overall strength of a rope by 50 % (Hint: leave a long tail and secure the tail with two half-hitches.)

Bowline

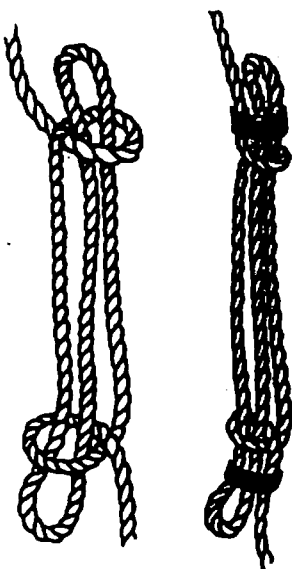
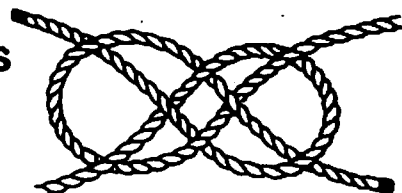


Rolling Hitch

This knot is used for lifting round loads, such as pipe or bar steel. For a more efficient knot, add half-hitch, short end around long end.

Carrick Bend

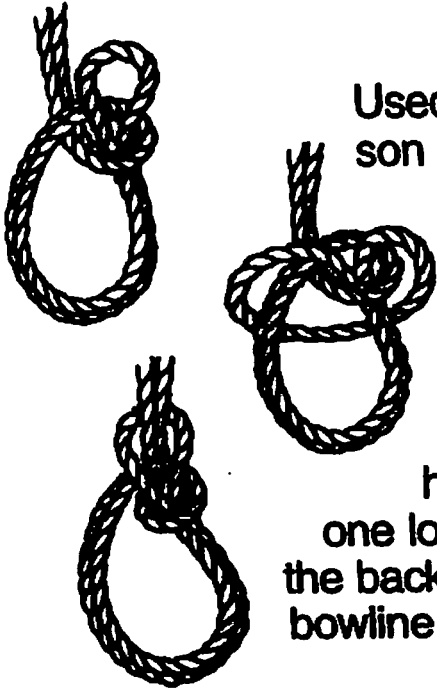
Used for joining large ropes together, and easier to untie than most knots after being subjected to strain.



Sheepshank

This knot is used for shortening a rope. The method shown is especially useful where the ends of the rope are not free, as it can be employed in the center of a tied rope. Taking the strain off a damaged piece of rope when there is not time to immediately replace with sound rope is another use. When seized, as shown, it is more secure.

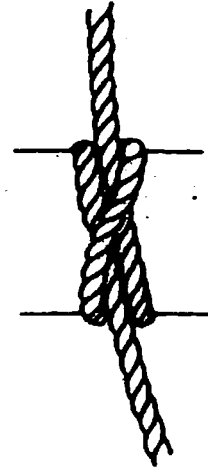
Bowline on the Bight



Used in emergencies to lift an injured person off a building or out of a hole. This is accomplished by sitting in one loop, and putting the other loop around the back and under the arms. Also used to tie bowline in middle of line. Used in emergencies to lift an injured person off a building or out of a hole. This is accomplished by sitting in one loop, and putting the other loop around the back and under the arms. Also used to tie bowline in middle of line.

Clove Hitch or Builder's Hitch

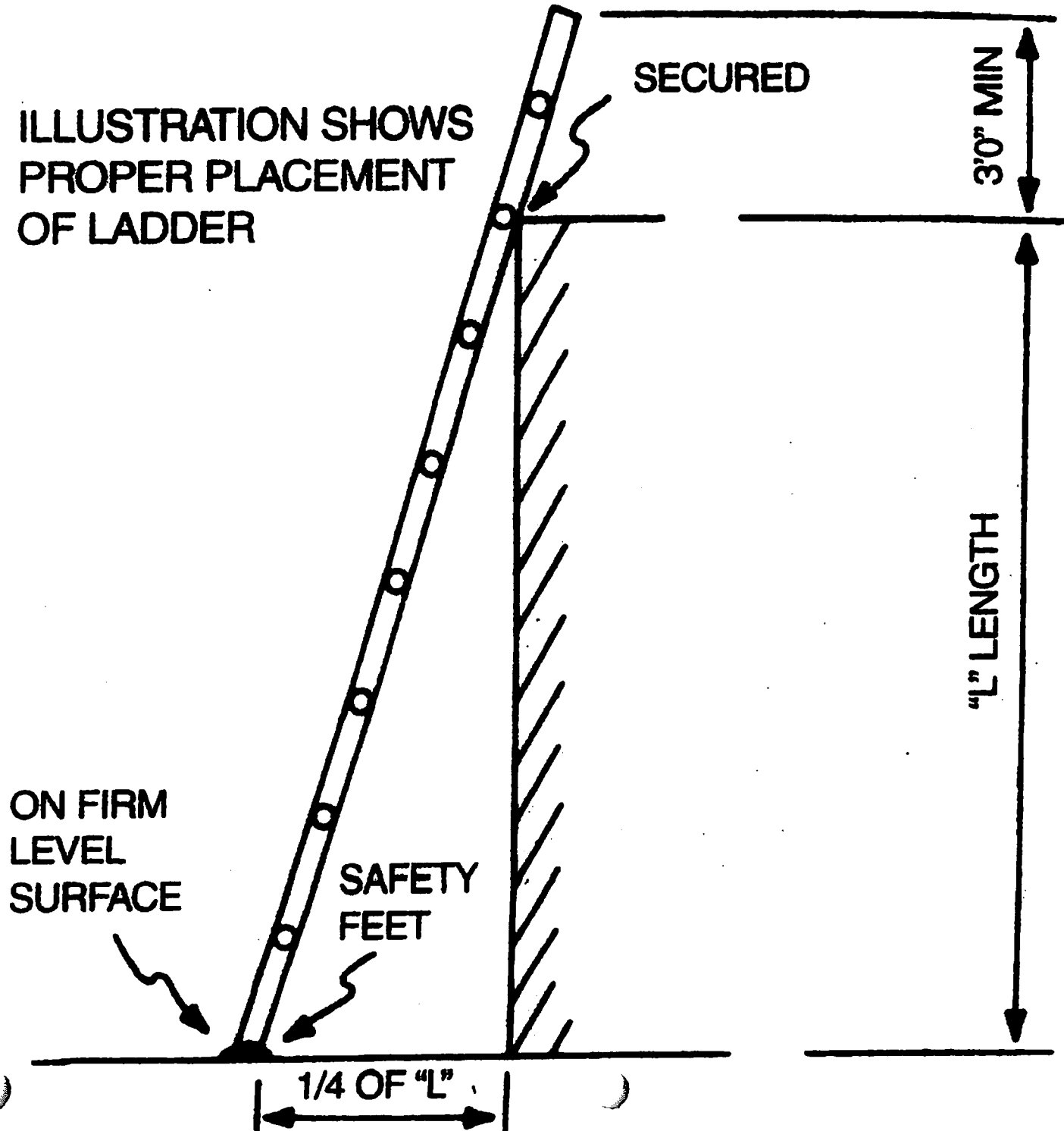
Because of its wide use by construction workers in fastening rope to upright posts on staging to act as a rail or warning line, it is also known as a builder's hitch. Making a line fast is another common use.



Running Bowline

This is merely a bowline knot made round the standing part of a rope to form a running noose or slip knot and is very reliable. Runs freely on the standing part and is easily untied. **This knot shall not be used for securing lifelines.**

ILLUSTRATION SHOWS
PROPER PLACEMENT
OF LADDER



SECURED

30" MIN

"L" LENGTH

ON FIRM
LEVEL
SURFACE

SAFETY
FEET

1/4 OF "L"

1926 - Subpart M Fall Protection

Effective Date February 6, 1995

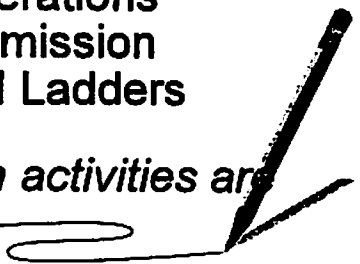
Appendices

- Appendix A - Determining Roof Widths
- Appendix B - Guardrail Systems
- Appendix C - Personal Fall Arrest Systems
- Appendix D - Positioning Device System
- Appendix E - Sample Fall Protection Plans

1926.500 - Scope, Application


- **Covers all fall hazards except:**
 - Subpart L - Scaffolds
 - Subpart N - Cranes and Derricks
 - Subpart R - Steel Erection in Buildings*
 - Subpart S - Tunneling Operations
 - Subpart V - Electric Transmission
 - Subpart X - Stairways and Ladders

**Until 8-6-95 All steel erection activities are exempt*

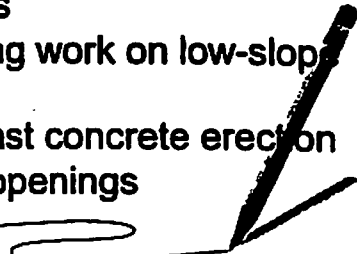


1926.501


Duty to have fall protection

- Protection at or above 6' level
 - Walking/working surfaces inspected before work begins
 - Employees can only work on surfaces strong enough to support them
- 

1926.501(b)(1) - (15) Protection required for;

- unprotected sides and edges
 - leading edges
 - ramps, runways and other walkways
 - dangerous equipment
 - overhand bricklaying and related work
 - steep roofs
 - residential construction
 - walking/working surfaces not otherwise addressed
 - hoist areas
 - holes
 - formwork and reinforcing steel
 - excavations, wells, pits, shafts
 - roofing work on low-slope roofs
 - precast concrete erection
 - wall openings
- 

1926.501(c) Protection from falling objects

- Each exposed employee shall wear a hardhat
 - Employer must take steps to prevent employees from being hit by falling objects
- 

1926.502

Fall protection systems and practices

(b) Guardrails

- Top rail height - 42" +/- 3"
- Midrails 21" high
- Intermediate members / openings - no greater than 19"
- Withstand 200 lbs. downward/outward force
- Midrails 150 lbs.
- No steel, plastic banding
- Wire rope toprail - flagged every 6'
- Manila, plastic or synthetic rope rails - inspect often
- All rails 1/4 " diameter or greater

1926.502

Fall protection systems and practices

(c) Safety net systems

- As close as practicable, no more than 30' below
- Bridges - fall area to net unobstructed
- Sufficient clearance to objects below
- Drop tested or certified

Outward extension of safety nets;

Vertical

Horizontal Distance

up to 5'

8'

>5 to 10'

10'

>10'

13'

1926.502

Fall protection systems and practices

(c) Safety net systems - con't

- No defective nets
- Weekly and after impact inspections
- Removal of objects daily or before next shift
- No greater than 6" openings on any side
- Border ropes 5,000 lbs. breaking strength
- Connections not more than 6" apart



1926.502

Fall protection systems and practices

(d) Personal fall arrest systems

*Body belts not allowed for fall
arrest starting January 1, 1998*




1926.502

Fall protection systems and practices

(d) Personal fall arrest systems - con't

Dee-rings, snaphooks -

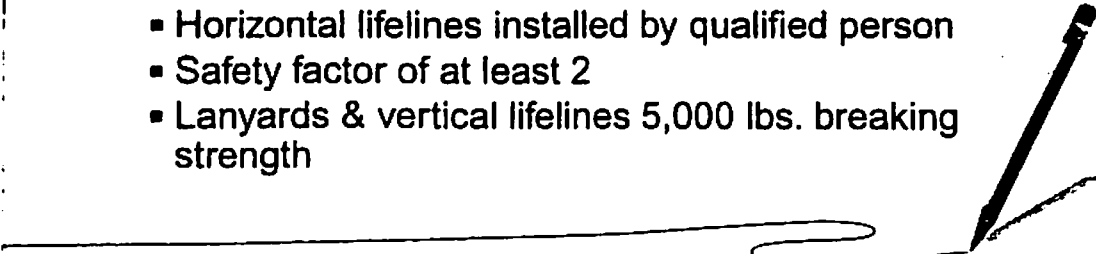
- 5,000 lbs. tensile strength
 - Proof-tested to 3,600 lbs.
 - Sized or locking type
 - Only locking type after 12-31-97
- 

1926.502

Fall protection systems and practices

(d) Personal fall arrest systems - con't

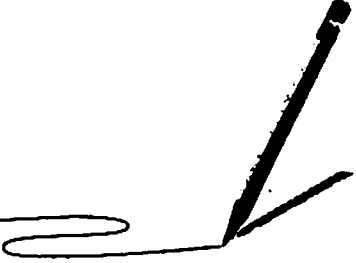
Lifelines;

- On suspended platforms, horizontal lifelines which may become vertical require locking capability in both directions
 - Horizontal lifelines installed by qualified person
 - Safety factor of at least 2
 - Lanyards & vertical lifelines 5,000 lbs. breaking strength
- 

1926.502

Fall protection systems and practices

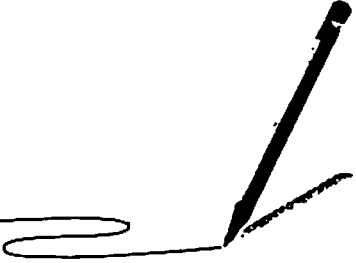
(d) Personal fall arrest systems - con't

- Body belt arresting force 900 lbs. maximum
 - Harness arrest force 1,800 lbs. maximum
 - Rigged to fall no more than 6' nor contact lower level;
3.5' deceleration maximum
 - Provide for prompt rescue
 - Inspect prior to each use
- 

1926.502

Fall protection systems and practices

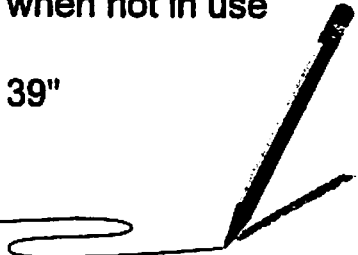
(e) Positioning device systems

- No more than 2' freefall
 - Inspected before each use
 - Safety belts okay for use
- 

1926.502

Fall protection systems and practices


(f) Warning line systems

- Erected around all sides of roof work area
 - No mechanical equipment in use within 6' from edge
 - Mechanical equipment in use - 6' parallel to direction of equipment and 10' on sides perpendicular to travel direction
 - Roof access points to be guarded when not in use
 - Flag with high visibility material
 - No lower than 34" nor higher than 39"
- 

1926.502

Fall protection systems and practices

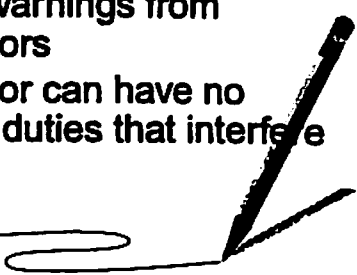
(g) Controlled access zones

- Leading edge work
 - Overhand bricklaying
 - Precast concrete
 - Accessible only to those qualified employees necessary to perform work
- 

1926.502

Fall protection systems and practices


(h) Safety monitoring systems

- Competent person to monitor
 - On same level, in visual sight of workers
 - Close enough to communicate orally
 - No mechanical equipment to be used or stored in area (roofing work only)
 - Only employees engaged in roofing work or covered by fall protection plan in area
 - Employees must comply with warnings from monitors
 - Monitor can have no other duties that interfere
- 

1926.502

Fall protection systems and practices

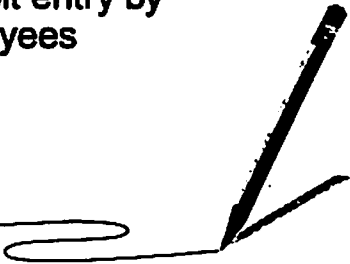
(i) Covers

- Vehicular traffic - 2 times maximum axle load of the largest vehicle
 - Foot traffic - 2 times weight of expected load
 - Secured to prevent displacement
 - Marked "HOLE"/"COVER" or color coded
- 

1926.502

Fall protection systems and practices

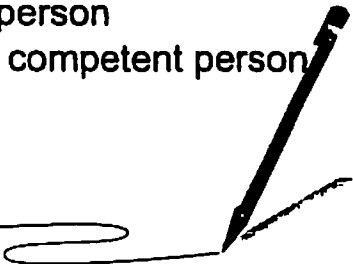
(j) Protection from falling objects

- Toeboards 3 1/2" tall
 - Screens - install where needed
 - Only masonry equipment/materials within 4' of edge
 - No material stored within 6' of edge unless guardrails have been installed and material is stable and self-supporting
 - Canopies must be strong enough to not collapse and to prevent penetration of objects
 - Barricade areas and prohibit entry by employees
- 

1926.502

Fall protection systems and practices

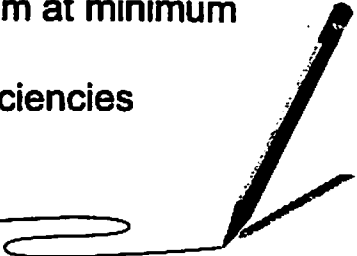
(k) Fall protection plans

- Only available for leading edge work, precast concrete erection, or residential construction work
 - Document reasons for infeasibility or greater hazard
 - Prepared by qualified person for each site
 - Maintained up to date at the site
 - Can only be changed by qualified person
 - Implemented under supervision of competent person
- 

1926.502


Fall protection systems and practices

(k) Fall protection plans - con't

- Document alternative measures
 - Include a written discussion of other ways to reduce or eliminate hazards
 - Identify each location where plan needed
 - Establish Controlled Access Zone
 - Implement safety monitoring system at minimum
 - Investigate near misses
 - Implement changes to correct deficiencies
- 

1926.503

Training Requirements

- Supplements 1926.21
 - Must train employees exposed to fall hazards
 - Prepare training certification
 - Latest training certification maintained
 - Retraining for changes in system, workplace
- 

FALL PROTECTION

INTRODUCTION

In the construction industry in the U.S., falls are the leading cause of worker fatalities. Each year, on average, between 150 and 200 workers are killed and more than 100,000 are injured as a result of falls at construction sites. OSHA recognizes that accidents involving falls are generally complex events frequently involving a variety of factors. Consequently the standard for fall protection deals with both the human and equipment-related issues in protecting workers from fall hazards. For example, employers and employees need to do the following:

- Where protection is required, select fall protection systems appropriate for given situations.
- Use proper construction and installation of safety systems.
- Supervise employees properly.
- Use safe work procedures.
- Train workers in the proper selection, use, and maintenance of all protection systems.

SCOPE AND APPLICATION

OSHA has revised its construction industry safety standards (29 *Code of Federal Regulations, Subpart M, Fall Protection*, 1926.500, 1926.501, 1926.502, and 1926.503) and developed systems and procedures designed to prevent employees from falling off, onto, or through working levels and to protect employees from being struck by falling objects (*Federal Register*, August 9, 1994, pp. 40672-40753). The performance-oriented requirements make it easier for employers to provide the necessary protection.

The rule covers most construction workers except those inspecting, investigating, or assessing workplace conditions prior to the actual start of work or after all work has been completed.

The rule identifies areas or activities where fall protection is needed. These include, but are not limited to, ramps, runways, and other walkways; excavations; hoist areas; holes; formwork and reinforcing steel; leading edge work; unprotected sides and edges; overhand bricklaying and related work; roofing work; precast concrete erection; wall openings; residential construction; and other walking/working surfaces. The rule sets a uniform threshold height of 6 feet (1.8 meters), thereby providing consistent protection. This means that construction employers must protect their employees from fall hazards and falling objects whenever an affected employee is 6 feet (1.8 meters) or more above a lower level. Protection must also be provided for construction workers who are exposed to the hazard of falling into dangerous equipment.

Under the new standard, employers will be able to select fall protection measures compatible with the type of work being performed. Fall protection generally can be provided through the use of guardrail systems, safety net systems, personal fall arrest systems, positioning device systems, and warning line systems, among others.

The OSHA rule clarifies what an employer must do to provide fall protection for employees, such as identifying and evaluating fall hazards and providing specific training. Requirements to provide fall protection for workers on scaffolds and

ladders and for workers engaged in steel erection of buildings are covered in other subparts of OSHA regulations.

PROVISIONS OF THE STANDARD

The new standard prescribes the duty to provide fall protection, sets the criteria and practices for fall protection systems, and requires training. It covers hazard assessment and fall protection and safety monitoring systems. Also addressed are controlled access zones, safety nets, and guardrail, personal fall arrest, warning line, and positioning device systems.

DUTY TO HAVE FALL PROTECTION

Employers are required to assess the workplace to determine if the walking/working surfaces on which employees are to work have the strength and structural integrity to safely support workers. Employees are not permitted to work on those surfaces until it has been determined that the surfaces have the requisite strength and structural integrity to support the workers. Once employers have determined that the surface is safe for employees to work on, the employer must select one of the options listed for the work operation if a fall hazard is present.

For example, if an employee is exposed to falling 6 feet (1.8 meters) or more from an unprotected side or edge, the employer must select either a guardrail system, safety net system, or personal fall arrest system to protect the worker. Similar requirements are prescribed for other fall hazards as follows.

Controlled Access Zones

A Controlled access zone is a work area designated and clearly marked in which certain types of work (such as overhand bricklaying) may take place without the use of conventional fall protection systems--guardrail, personal arrest or safety net--to protect the employees working in the zone.

Controlled access zones are used to keep out workers other than those authorized to enter work areas from which guardrails have been removed. Where there are no guardrails, masons are the only workers allowed in controlled access zones.

Controlled access zones, when created to limit entrance to areas where leading edge work and other operations are taking place, must be defined by a control line or by any other means that restrict access. Control lines shall consist of ropes, wires, tapes or equivalent materials, and supporting stanchions, and each must be:

- Flagged or otherwise clearly marked at not more than 6-foot (1.8 meters) intervals with high-visibility material;
- Rigged and supported in such a way that the lowest point (including sag) is not less than 39 inches (1 meter) from the walking/working surface and the highest point is not more than 45 inches (1.3 meters)—nor more than 50 inches (1.3 meters) when overhand bricklaying operations are being performed—from the walking/working surface;
- Strong enough to sustain stress of not less than 200 pounds (0.88 kilonewtons). Control lines shall extend along the entire length of the unprotected or leading edge and shall be approximately parallel to the unprotected or leading edge.
- Control lines also must be connected on each side to a guardrail system or wall.

When control lines are used, they shall be erected not less than 6 feet (1.8 meters) nor more than 25 feet (7.6 meters) from the unprotected or leading edge, except when precast concrete members are being erected. In the latter case, the control line is to be erected not less than 6 feet (1.8 meters) nor more than 60 feet (18 meters) or half the length of the member being erected, whichever is less, from the leading edge.

Controlled access zones when used to determine access to areas where overhand bricklaying and related work are taking place are to be defined by a control line erected not less than 10 feet (3 meters) nor more than 15 feet (4.6 meters) from the working edge. Additional control lines must be erected at each end to enclose the

controlled access zone. Only employees engaged in overhand bricklaying or related work are permitted in the controlled access zones.

On floors and roofs where guardrail systems are not in place prior to the beginning of overhand bricklaying operations, controlled access zones will be enlarged as necessary to enclose all points of access, material handling areas, and storage areas. On floors and roofs where guardrail systems are in place, but need to be removed to allow overhand bricklaying work or leading edge work to take place, only that portion of the guardrail necessary to accomplish that day's work shall be removed.

Excavations

Each employee at the edge of an excavation 6 feet (1.8 meters) or more deep shall be protected from falling by guardrail systems, fences, barricades, or covers. Where walkways are provided to permit employees to cross over excavations, guardrails are required on the walkway if it is 6 feet (1.8 meters) or more above the excavation.

Formwork and Reinforcing Steel

For employees, while moving vertically and/or horizontally on the vertical face of rebar assemblies built in place, fall protection is not required when employees are moving. OSHA considers the multiple hand holds and foot holds on rebar assemblies as providing similar protection as that provided by a fixed ladder; consequently, no fall protection is necessary while moving point to point for heights below 24 feet (7.3 meters). An employee must be provided with fall protection when climbing or otherwise moving at a height more than 24 feet (7.3 meters), the same as for fixed ladders.

Hoist Areas

Each employee in a hoist area shall be protected from falling 6 feet (1.8 meters) or more by guardrail systems or personal fall arrest systems. If guardrail systems (or chain gate or guardrail) or portions thereof must be removed to facilitate hoisting operations, as during the landing of materials, and a worker must lean through the

access opening or out over the edge of the access opening to receive or guide equipment and materials, that employee must be protected by a personal fall arrest system.

Holes

Personal fall arrest systems, covers, or guardrail systems shall be erected around holes (including skylights) that are more than 6 feet (1.8 meters) above lower levels.

Leading Edges

Each employee who is constructing a leading edge 6 feet (1.8 meters) or more above lower levels shall be protected by guardrail systems, safety net systems, or personal fall arrest systems. If the employer can demonstrate that it is infeasible or creates a greater hazard to implement these systems, he or she must develop and implement a fall protection plan that meets the requirements of 29 CFR 1926.502(k).

Overhand Bricklaying and Related Work

Each employee performing overhand bricklaying and related work 6 feet (1.8 meters) or more above lower levels shall be protected by guardrail systems, safety net systems, or personal fall arrest systems, or shall work in a controlled access zone. All employees reaching more than 10 inches (25 cm) below the level of a walking/working surface on which they are working shall be protected by a guardrail system, safety net system, or personal fall arrest system.

Precast Concrete Erection and Residential Construction

Each employee who is 6 feet (1.8 meters) or more above lower levels while erecting precast concrete members and related operations such as grouting of precast concrete members and each employee engaged in residential construction, shall be protected by guardrail systems, safety net systems, or personal fall arrest systems. Where the employer can demonstrate, however, that it is infeasible or creates a greater hazard to use those systems, the employer must develop and implement a

fall protection plan that meets the requirements of 29 CFR 1926.502(k).

Ramps, Runways, and Other Walkways

Each employee using ramps, runways, and other walkways shall be protected from falling 6 feet (1.8 meters) or more by guardrail systems.

Roofing

Low-slope Roofs

Each employee engaged in roofing activities on low-slope roofs with unprotected sides and edges 6 feet (1.8 meters) or more above lower levels shall be protected from falling by guardrail systems, safety net systems, personal fall arrest systems or a combination of a 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. On roofs 50 feet (15.24 meters) or less in width, the use of a safety monitoring system without a warning line system is permitted.

Steep Roofs

Each employee on a steep roof with unprotected sides and edges 6 feet (1.8 meters) or more above lower levels shall be protected by guardrail systems with toeboards, safety net systems, or personal fall arrest systems.

Wall Openings

Each employee working on, at, above, or near wall openings (including those with chutes attached) where the outside bottom edge of the wall opening is 6 feet (1.8 meters) or more above lower levels and the inside bottom edge of the wall opening is less than 39 inches (1.0 meter) above the walking/working surface must be protected from falling by the use of a guardrail system, a safety net system, or a personal fall arrest system.

FALL PROTECTION SYSTEMS CRITERIA AND PRACTICES

Guardrail Systems

If the employer chooses to use guardrail systems to protect workers from falls, the systems must meet the following criteria. Toprails and midrails of guardrail systems must be at least one-quarter inch (0.6 centimeters) nominal diameter or thickness to prevent cuts and lacerations. If wire rope is used for toprails, it must be flagged at not more than 6 feet intervals (1.8 meters) with high-visibility material. Steel and plastic banding cannot be used as toprails or midrails. Manila, plastic, or synthetic rope used for toprails or midrails must be inspected as frequently as necessary to ensure strength and stability.

The top edge height of toprails, or (equivalent) guardrails must be 42 inches (1.1 meters) plus or minus 3 inches (8 centimeters), above the walking/working level. When workers are using stilts, the top edge height of the top rail, or equivalent member, must be increased an amount equal to the height of the stilts.

Screens, midrails, mesh, intermediate vertical members, or equivalent intermediate structural members must be installed between the top edge of the guardrail system and the walking/working surface when there are no walls or parapet walls at least 21 inches (53 centimeters) high. When midrails are used, they must be installed at a height midway between the top edge of the guardrail system and the walking/working level. When screens and mesh are used, they must extend from the top rail to the walking/working level and along the entire opening between top rail supports. Intermediate members, such as balusters, when used between posts, shall not be more than 19 inches (48 centimeters) apart.

Other structural members, such as additional midrails and architectural panels, shall be installed so that there are no openings in the guardrail system more than 19 inches (48 centimeters).

The guardrail system must be capable of withstanding a force of at least 200 pounds (890 newtons) applied within 2 inches of the top edge in any outward or downward

direction. When the 200 pound (890 newtons) test is applied in a downward direction, the top edge of the guardrail must not deflect to a height less than 39 inches (1 meter) above the walking/working level.

Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members shall be capable of withstanding a force of at least 150 pounds (667 newtons) applied in any downward or outward direction at any point along the midrail or other member.

Guardrail systems shall be surfaced to protect workers from punctures or lacerations and to prevent clothing from snagging.

The ends of top rails and midrails must not overhang terminal posts, except where such overhang does not constitute a projection hazard.

When guardrail systems are used at hoisting areas, a chain, gate, or removable guardrail section must be placed across the access opening between guardrail sections when hoisting operations are not taking place.

At holes, guardrail systems must be set up on all unprotected sides or edges. When holes are used for the passage of materials, the hole shall have not more than two sides with removable guardrail sections. When the hole is not in use, it must be covered or provided with guardrails along all unprotected sides or edges.

If guardrail systems are used around holes that are used as access points (such as ladderways), gates must be used or the point of access must be offset to prevent accidental walking into the hole.

If guardrails are used at unprotected sides or edges of ramps and runways, they must be erected on each unprotected side or edge.

Personal Fall Arrest Systems

These consist of an anchorage, connectors, and a body belt or body harness and may include a deceleration device, lifeline, or suitable combinations. If a personal fall arrest system is used for fall protection, it must do the following:

- Limit maximum arresting force on an employee to 900 pounds (4 kilonewtons) when used with a body belt;
- Limit maximum arresting force on an employee to 1,800 pounds (8 kilonewtons) when used with a body harness;
- Be rigged so that an employee can neither free fall more than 6 feet (1.8 meters) nor contact any lower level;
- Bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet (1.07 meters); and
- Have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet (1.8 meters) or the free fall distance permitted by the system, whichever is less.

As of January 1, 1998, the use of a body belt for fall arrest is prohibited.

Personal fall arrest systems must be inspected prior to each use for wear damage, and other deterioration. Defective components must be removed from service. Dee-rings and snaphooks must have a minimum tensile strength of 5,000 pounds (22.2 kilonewtons). Dee-rings and snaphooks shall be proof-tested to a minimum tensile load of 3,600 pounds (16 kilonewtons) without cracking, breaking, or suffering permanent deformation.

Snaphooks shall be sized to be compatible with the member to which they will be connected, or shall be of a locking configuration.

Unless the snaphook is a locking type and designed for the following connections, they shall not be engaged (a) directly to webbing, rope or wire rope; (b) to each other; (c) to a dee-ring to which another snaphook or other connector is attached; (d) to a horizontal lifeline; or (e) to any object incompatible in shape or dimension relative to the snaphook, thereby causing the connected object to depress the snaphook keeper and release unintentionally.

OSHA considers a hook to be compatible when the diameter of the dee-ring to which the snaphook is attached is greater than the inside length of the snaphook when measured from the bottom (hinged end) of the snaphook keeper to the inside curve of the top of the snaphook. Thus, no matter how the dee-ring is positioned or moved (rolls) with the snaphook attached, the dee-ring cannot touch the outside of the keeper, thus depressing it open. As of January 1, 1998, the use of nonlocking snaphooks is prohibited.

On suspended scaffolds or similar work platforms with horizontal lifelines that may become vertical lifelines, the devices used to connect to a horizontal lifeline shall be capable of locking in both directions on the lifeline.

Horizontal lifelines shall be designed, installed, and used under the supervision of a qualified person, as part of a complete personal fall arrest system that maintains a safety factor of at least two. Lifelines shall be protected against being cut or abraded.

Self-retracting lifelines and lanyards that automatically limit free fall distance to 2 feet (0.61 meters) or less shall be capable of sustaining a minimum tensile load of 3,000 pounds (13.3 kilonewtons) applied to the device with the lifeline or lanyard in the fully extended position.

Self-retracting lifelines and lanyards that do not limit free fall distance to 2 feet (0.61 meters) or less, ripstitch lanyards, and tearing and deforming lanyards shall be capable of sustaining a minimum tensile load of 5,000 pounds (22.2 kilonewtons) applied to the device with the lifeline or lanyard in the fully extended position.

Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses shall be made of synthetic fibers.

Anchorage shall be designed, installed, and used under the supervision of a qualified person, as part of a complete personal fall arrest system that maintains a safety factor of at least two, i.e., capable of supporting at least twice the weight expected to be imposed upon it. Anchorages used to attach personal fall arrest systems shall be independent of any anchorage being used to support or suspend platforms and must be capable of supporting at least 5,000 pounds (22.2 kilonewtons) per person attached.

Lanyards and vertical lifelines must have a minimum breaking strength of 5,000 pounds (22.2 kilonewtons).

Positioning Device Systems

These body belt or body harness systems are to be set up so that a worker can free fall no farther than 2 feet (0.6 meters). They shall be secured to an anchorage capable of supporting at least twice the potential impact load of an employee's fall or 3,000 pounds (13.3 kilonewtons), whichever is greater. Requirements for snaphooks, dee-rings, and other connectors used with positioning device systems must meet the same criteria as those for personal fall arrest systems.

Safety Monitoring Systems

When no other alternative fall protection has been implemented, the employer shall implement a safety monitoring system. Employers must appoint a competent person to monitor the safety of workers and the employer shall ensure that the safety monitor:

- Is competent in the recognition of fall hazards;
- Is capable of warning workers of fall hazard dangers and in detecting unsafe work practices;

- Is operating on the same walking/working surfaces of the workers and can see them;
- Is close enough to work operations to communicate orally with workers and has no other duties to distract from the monitoring function.

Mechanical equipment shall not be used or stored in areas where safety monitoring systems are being used to monitor employees engaged in roofing operations on low-sloped roofs.

No worker, other than one engaged in roofing work (on low-sloped roofs) or one covered by a fall protection plan, shall be allowed in an area where an employee is being protected by a safety monitoring system.

All workers in a controlled access zone shall be instructed to promptly comply with fall hazard warnings issued by safety monitors.

Safety Net Systems

Safety nets must be installed as close as practicable under the walking/working surface on which employees are working and never more than 30 feet (9.1 meters) below such levels. Defective nets shall not be used. Safety nets shall be inspected at least once a week for wear, damage, and other deterioration. The maximum size of each safety net mesh opening shall not exceed 36 square inches (230 square centimeters) nor be longer than 6 inches (15 centimeters) on any side, and the openings, measured center-to-center, of mesh ropes or webbing, shall not exceed 6 inches (15 centimeters). All mesh crossings shall be secured to prevent enlargement of the mesh opening. Each safety net or section shall have a border rope for webbing with a minimum breaking strength of 5,000 pounds (22.2 kilonewtons). Connections between safety net panels shall be as strong as integral net components and be spaced no more than 6 inches (15 centimeters) apart.

Safety nets shall be installed with sufficient clearance underneath to prevent contact with the surface or structure below.

When nets are used on bridges, the potential fall area from the walking/working surface to the net shall be unobstructed.

Safety nets must extend outward from the outermost projection of the work surface as follows:

Vertical distance from working level to horizontal plane of net.	Minimum required horizontal distance of outer edge of net from the edge of the working surface.
Up to 5 feet (1.5 meters)	8 feet (2.4 meters)
More than 5 feet (1.5 meters) up to 10 feet (3 meters)	10 feet (3 meters)
More than 10 feet (3 meters)	13 feet (3.9 meters)

Safety nets shall be capable of absorbing an impact force of a drop test consisting of a 400-pound (180 kilogram) bag of sand 30 inches (76 centimeters) in diameter dropped from the highest walking/working surface at which workers are exposed, but not from less than 42 inches (1.1 meters) above that level.

Items that have fallen into safety nets including--but not restricted to, materials, scrap, equipment, and tools--must be removed as soon as possible and at least before the next work shift.

Warning Line Systems

Warning line systems consist of ropes, wires, or chains, and supporting stanchions and are set up as follows:

- Flagged at not more than 6-foot (1.8 meters) intervals with high-visibility material;

- Rigged and supported so that the lowest point (including sag) is no less than 34 inches (0.9 meters) from the walking/working surface and its highest point is no more than 39 inches (1 meter) from the walking/working surface.
- Stanchions, after being rigged with warning lines, shall be capable of resisting, without tipping over, a force of at least 16 pounds (71 newtons) applied horizontally against the stanchion, 30 inches (0.8 meters) above the walking/working surface, perpendicular to the warning line and in the direction of the floor, roof, or platform edge;
- The rope, wire, or chain shall have a minimum tensile strength of 500 pounds (2.22 kilonewtons) and after being attached to the stanchions, must support without breaking, the load applied to the stanchions as prescribed above.
- Shall be attached to each stanchion in such a way that pulling on one section of the line between stanchions will not result in slack being taken up in the adjacent section before the stanchion tips over.

Warning lines shall be erected around all sides of roof work areas. When mechanical equipment is being used, the warning line shall be erected not less than 6 feet (1.8 meters) from the roof edge parallel to the direction of mechanical equipment operation, and not less than 10 feet (3 meters) from the roof edge perpendicular to the direction of mechanical equipment operation.

When mechanical equipment is not being used, the warning line must be erected not less than 6 feet (1.8 meters) from the roof edge.

Covers

Covers located in roadways and vehicular aisles must be able to support at least twice the maximum axle load of the largest vehicle to which the cover might be subjected. All other covers must be able to support at least twice the weight of employees, equipment, and materials that may be imposed on the cover at any one time. To prevent accidental displacement resulting from wind, equipment, or

workers' activities, all covers must be secured. All covers shall be color coded or bear the markings "HOLE" or "COVER."

PROTECTION FROM FALLING OBJECTS

When guardrail systems are used to prevent materials from falling from one level to another, any openings must be small enough to prevent passage of potential falling objects. No materials or equipment except masonry and mortar shall be stored within 4 feet (1.2 meters) of working edges. Excess mortar, broken or scattered masonry units, and all other materials and debris shall be kept clear of the working area by removal at regular intervals.

During roofing work, materials and equipment shall not be stored within 6 feet (1.8 meters) of a roof edge unless guardrails are erected at the edge, and materials piled, grouped, or stacked near a roof edge must be stable and self-supporting.

Canopies

When used as protection from falling objects canopies must be strong enough to prevent collapse and to prevent penetration by any objects that may fall onto them.

Toeboards

When toeboards are used as protection from falling objects, they must be erected along the edges of the overhead walking/working surface for a distance sufficient to protect persons working below. Toeboards shall be capable of withstanding a force of at least 50 pounds (222 newtons) applied in any downward or outward direction at any point along the toeboard. Toeboards shall be a minimum of 3.5 inches (9 centimeters) tall from their top edge to the level of the walking/working surface, have no more than 0.25 inches (0.6 centimeters) clearance above the walking/working surface, and be solid or have openings no larger than 1 inch (2.5 centimeters) in size.

Where tools, equipment, or materials are piled higher than the top edge of a toeboard, panelling or screening must be erected from the walking/working surface or toeboard to the top of a guardrail system's top rail or midrail, for a distance sufficient to protect employees below.

TRAINING

Employers must provide a training program that teaches employees who might be exposed to fall hazards how to recognize such hazards and how to minimize them. Employees must be trained in the following areas: (a) the nature of fall hazards in the work area; (b) the correct procedures for erecting, maintaining, disassembling, and inspecting fall protection systems; (c) the use and operation of controlled access zones and guardrail, personal fall arrest, safety net, warning line, and safety monitoring systems; (d) the role of each employee in the safety monitoring system when the system is in use; (e) the limitations on the use of mechanical equipment during the performance of roofing work on low-sloped roofs; (f) the correct procedures for equipment and materials handling and storage and the erection of overhead protection; and, (g) employees' role in fall protection plans.

Employers must prepare a written certification that identifies the employee trained and the date of the training. The employer or trainer must sign the certification record. Retraining also must be provided when necessary.

GLOSSARY

Anchorage--A secure point of attachment for lifelines, lanyards or deceleration devices.

Body belt--A strap with means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device.

Body harness ---Straps that may be secured about the person in a manner that distributes the fall-arrest forces over at least the thighs, pelvis, waist, chest, and shoulders with a means for attaching the harness to other components of a personal fall arrest system.

Connector--A device that is used to couple (connect) parts of a personal fall arrest system or positioning device system together.

Controlled access zone--A work area designated and clearly marked in which certain types of work (such as overhand bricklaying) may take place without the use of conventional fall protection systems--guardrail, personal arrest or safety net--to protect the employees working in the zone.

Deceleration device--Any mechanism--such as rope, grab, ripstitch lanyard, specially-woven lanyard, tearing or deforming lanyards, automatic self-retracting lifelines/lanyards--which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limits the energy imposed on an employee during fall arrest.

Deceleration distance--The additional vertical distance a falling person travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which a deceleration device begins to operate.

Guardrail system--A barrier erected to prevent employees from falling to lower levels.

Hole--A void or gap 2 inches (5.1 centimeters) or more in the least dimension in a floor, roof, or other walking/working surface.

Lanyard--A flexible line of rope, wire rope, or strap that generally has a connector at each end for connecting the body belt or body harness to a deceleration device, lifeline, or anchorage.

Leading edge--The edge of a floor, roof, or formwork for a floor or other walking/working surface (such as the deck) which changes location as additional floor, roof, decking, or formwork sections are placed, formed or constructed.

Lifeline--A component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline) and that serves as a means for connecting other components of a personal fall arrest system to the anchorage.

Low-slope roof--A roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

Opening--A gap or void 30 inches (76 centimeters) or more high and 18 inches (46 centimeters) or more wide, in a wall or partition, through which employees can fall to a lower level.

Personal fall arrest system--A system including but not limited to an anchorage, connectors, and a body belt or body harness used to arrest an employee in a fall from a working level. As of January 1, 1998, the use of a body belt for fall arrest is prohibited.

Positioning device system--A body belt or body harness system rigged to allow an employee to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning backwards.

Rope grab--A deceleration device that travels on a lifeline and automatically, by friction, engages the lifeline and locks to arrest a fall.

Safety-monitoring system--A safety system in which a competent person is responsible for recognizing and warning employees of fall hazards.

Self-retracting lifeline/lanyard--A deceleration device containing a drum-wound line which can be slowly extracted from, or retracted onto, the drum under minimal tension during normal employee movement and which, after onset of a fall, automatically locks the drum and arrests the fall.

Snaphook--A connector consisting of a hook-shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released automatically closes to retain the object.

Steep roof--A roof having a slope greater than 4 in 12 (vertical to horizontal).

Toeboard--A low protective barrier that prevents material and equipment from falling to lower levels and which protects personnel from falling.

Unprotected sides and edges--Any side or edge (except at entrances to points of access) of a walking/working surface (e.g. floor, roof, ramp, or runway) where there is no wall or guardrail system at least 39 inches (1 meter) high.

Walking/working surface--Any surface, whether horizontal or vertical, on which an employee walks or works, including but not limited to floors, roofs, ramps, bridges, runways, formwork, and concrete reinforcing steel. Does not include ladders, vehicles, or trailers on which employees must be located to perform their work duties.

Warning line system--A barrier erected on a roof to warn employees that they are approaching an unprotected roof side or edge and which designates an area in which roofing work may take place without the use of guardrail, body belt, or safety net systems to protect employees in the area.