

Introduction to Fall Protection



The University of Tennessee
Office of Environmental Health & Safety

What is Fall Protection?

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



Fall Protection from an Historical Perspective

For thousands of years man has used ropes and various knots to help or secure objects against the forces of gravity.

"When one falls, it is not one's foot that is to blame."

- Chinese proverb

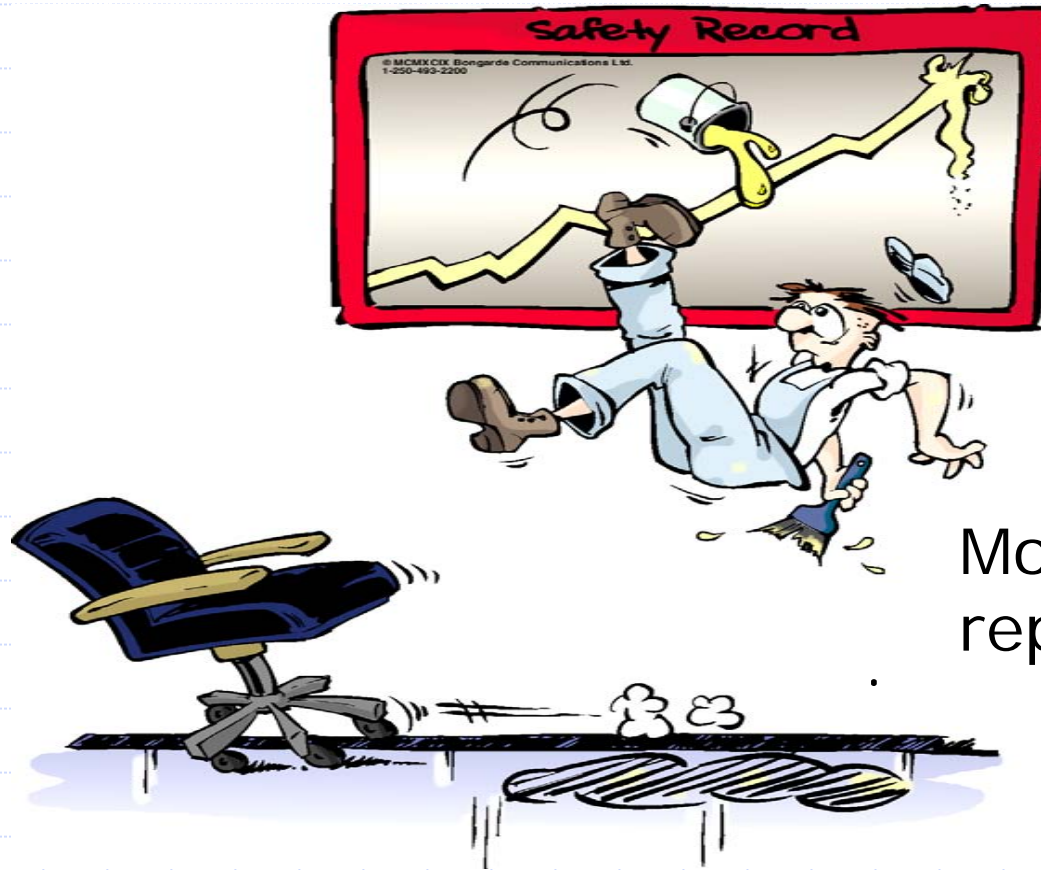
From an Historical Perspective

Some of the earlier users could be found on sailing ships, in church steeple construction and maintenance, and in tree-trimming trades.

From an Historical Perspective

The use of ropes and some type of body belt for restraint or work positioning support found particular interest during stormy seas and above the decks of ships

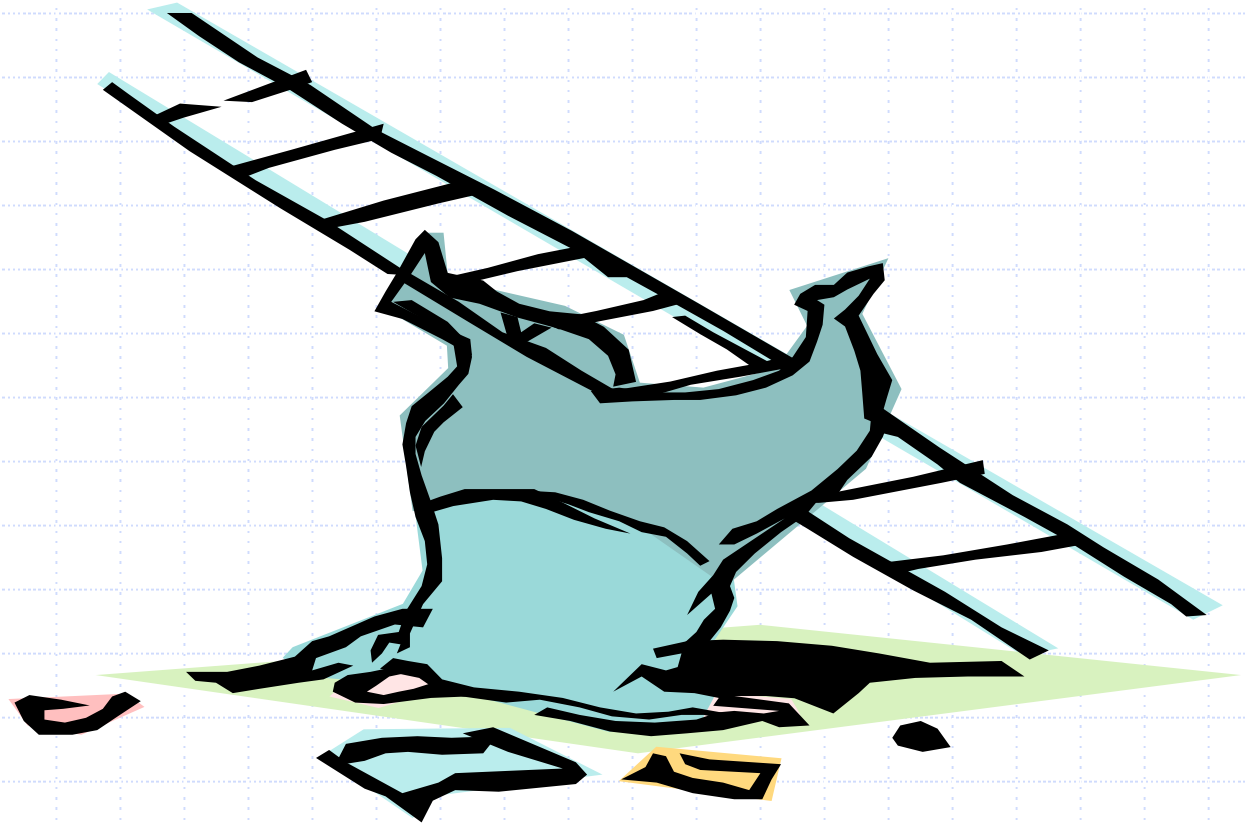
Slips, Trips and Falls on same Level



Most common of all reported falls

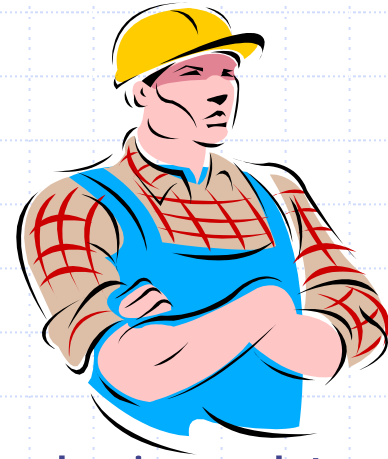
Slips, Trips and Falls from Elevation

Stair and elevated falls occur from one level to another.



Quiz Time!

Circle the correct answer below.

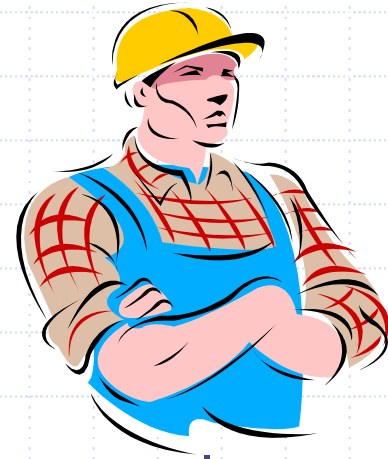


1. Fall Protection is a backup system designed to protect a worker from a fall from height.
 - a. True
 - b. False

2. Historically, the use of ropes and some type of body belt were used for restraint or body positioning aboard ships especially during heavy seas.
 - a. True
 - b. False

Quiz Time!

Circle the correct answer below.



1. Falls from heights are the most commonly reported of all falls.
 - a. True
 - b. False
2. Church steeple construction, maintenance and tree trimming workers are some of the earlier users of fall protection.
 - a. True
 - b. False

Fall Protection Systems

Fall protection systems can consist of devices that arrest a free fall or devices that restrain a worker in a position to prevent a fall from occurring.

A Fall Arrest System

A fall arrest system is employed when a worker is a risk of falling from an elevated position.



Fall Arrest System

1. Tie-off Point
2. Lifeline
3. Rope Grab
4. Shock-Absorbing Lanyard
5. Cross-Arm Strap
6. Retractable Lifeline
7. Full-Body Harness
8. Restraining Belt
9. Restraining Lanyard
10. Carabiner

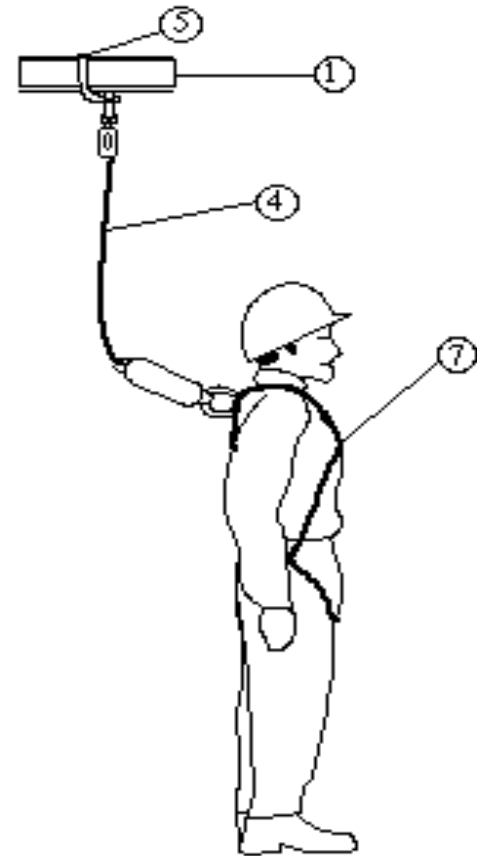


Figure A

Fall Arrest System

1. Tie-off Point
2. Lifeline
3. Rope Grab
4. Shock-Absorbing Lanyard
5. Cross-Arm Strap
6. Retractable Lifeline
7. Full-Body Harness
8. Restraining Belt
9. Restraining Lanyard
10. Carabiner

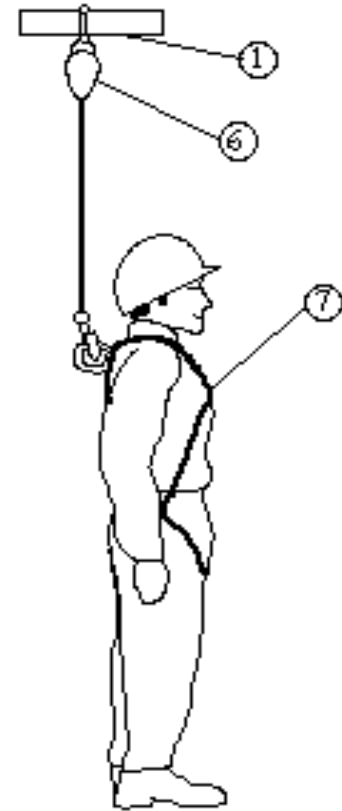


Figure B

Fall Arrest System

1. Tie-off Point
2. Lifeline
3. Rope Grab
4. Shock-Absorbing Lanyard
5. Cross-Arm Strap
6. Retractable Lifeline
7. Full-Body Harness
8. Restraining Belt
9. Restraining Lanyard
10. Carabiner

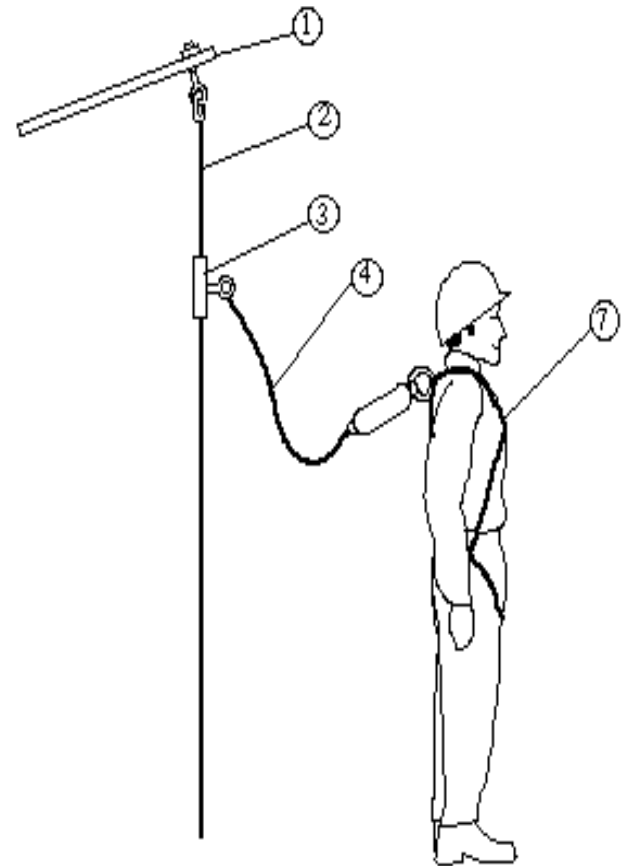


Figure C

A positioning System

A positioning system restrains the elevated worker, preventing him from getting into a hazardous position where a fall could occur, and also allows hands-free work. Both systems have three components: harnesses or belts, connection devices and tie-off points.

Positioning System

1. Tie-off Point
2. Lifeline
3. Rope Grab
4. Shock-Absorbing Lanyard
5. Cross-Arm Strap
6. Retractable Lifeline
7. Full-Body Harness
8. Restraining Belt
9. Restraining Lanyard
10. Carabiner

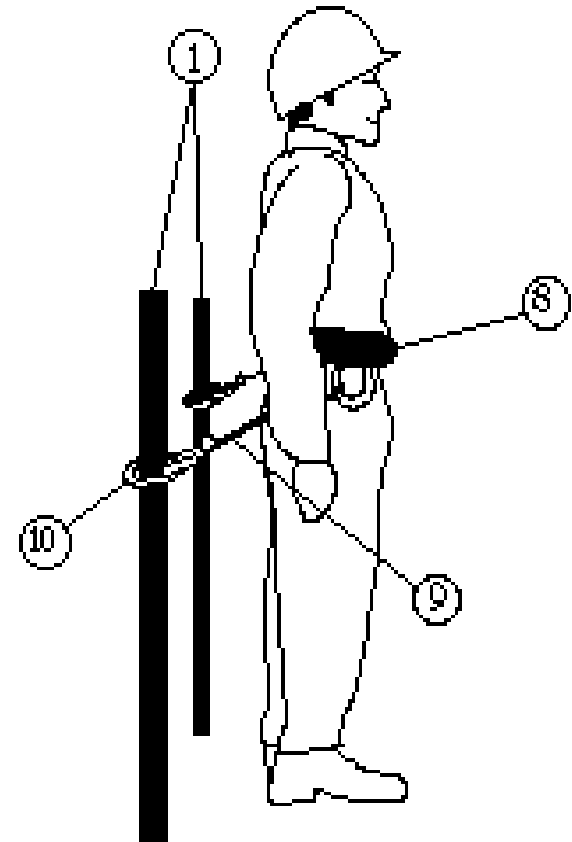
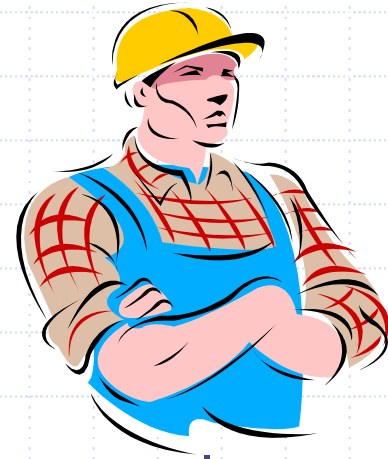


Figure A

Quiz Time!

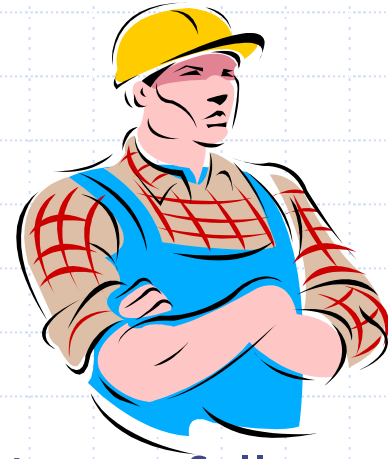
Circle the correct answer below.



1. Falls from heights are the most commonly reported of all falls.
 - a. True
 - b. False
2. Church steeple construction, maintenance and tree trimming workers are some of the earlier users of fall protection.
 - a. True
 - b. False

Quiz Time!

Circle the correct answer below.



1. Fall protection consists of two systems, fall-arrest and positioning.

a. True

b. False

2. A fall-arrest system is used when a worker is at risk of falling from an elevated position. A positioning system restrains the elevated worker, preventing him from getting into a position where a fall could occur.

a. True

b. False

Full-body Harnesses and Belts

Full-body harnesses wrap around the waist, shoulders and legs. A D-ring located in the center of the back provides a connecting point for lanyards or other fall arrest connection devices.

Belts are used in positioning system applications. These belts have two side D-rings, and are used only for restraining a worker in position. This type of belt is not used for any vertical free fall protection.

Attachment Location



The attachment of the body harness must be located in the center of the wearer's back, near the shoulder level, or above the head.

OSHA Standard:
1926.502(d)(17)

Body Harness

Body harnesses are designed to minimize stress forces on an employee's body in the event of a fall, while providing sufficient freedom of movement to allow work to be performed.

Do not use body harnesses to hoist materials.



Body Harnesses



As of January 1, 1998, body belts are not acceptable as part of a personal fall arrest system, because they impose a danger of internal injuries when stopping a fall.

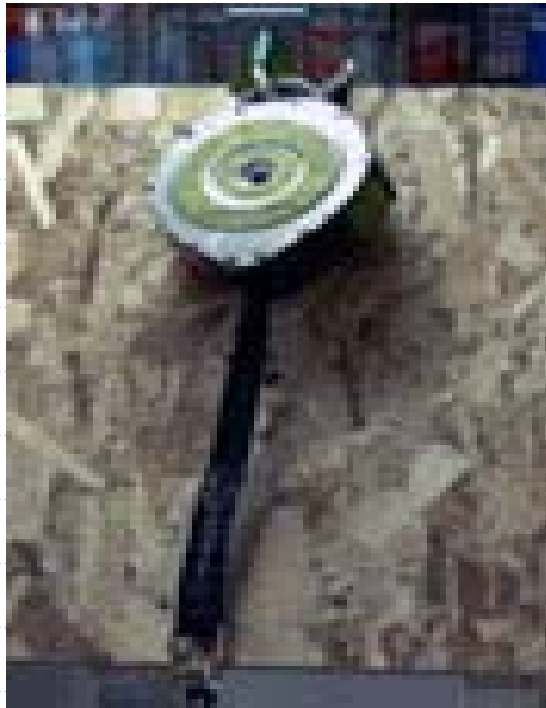
- [OSHA Standard: 1926.502\(d\)\(18\)](#)

Vertical Lifelines/Lanyards

Vertical lifelines or lanyards must have a minimum breaking strength of 5,000 pounds, and be protected against being cut or abraded.



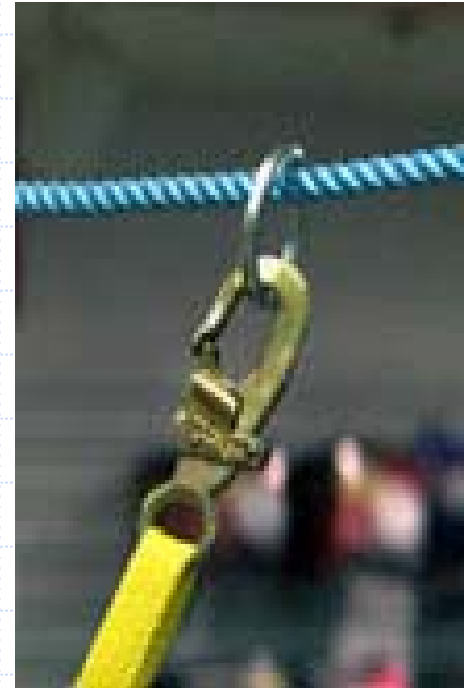
Self-retracting Lifelines/Lanyards



Self-retracting vertical lifelines and lanyards that automatically limit free fall distance to 2 feet or less must be capable of sustaining a minimum tensile load of 3,000 pounds when in the fully extended position.

Horizontal Lifelines

Horizontal lifelines are to be designed, installed, and used under the supervision of a qualified person, and as part of a complete personal fall arrest system which maintains a safety factor of at least two.



Webbing

Webbing are the ropes and straps used in lifelines, lanyards, and strength components of body harnesses. The webbing must be made from synthetic fibers.

[OSHA Standard:
1926.502\(d\)\(14\)](#)



Connectors



Connectors, including D-rings and snaphooks, must be made from drop-forged, pressed or formed steel, or equivalent materials. They must have a corrosion-resistant finish, with smooth

surfaces and edges to prevent damage to connecting parts of the system.

D-Rings

D-Rings must have a minimum tensile strength of 5,000 pounds, and be proof-tested to a minimum tensile load of 3,600 pounds without cracking, breaking, or becoming permanently deformed.



Snaphooks

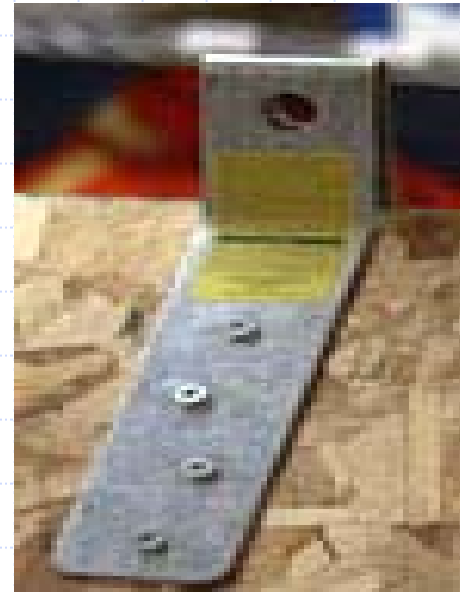
Snaphooks must have a minimum tensile strength of 5,000 pounds, and be proof-tested to a minimum tensile load of 3,600 pounds without cracking, breaking, or becoming permanently deformed.



Anchorage

Anchorage used for attachment of personal fall arrest equipment must be independent of any anchorage being used to support or suspend platforms, and capable of supporting at least 5,000 pounds per employee attached, or must be designed and used as follows:

- Under the supervision of a qualified person.



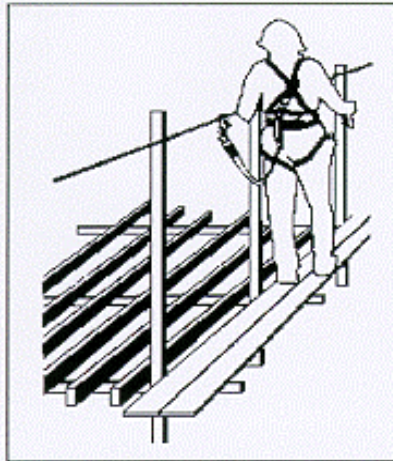
Anchorage

- As part of a complete personal fall arrest system which maintains a safety factor of at least two.

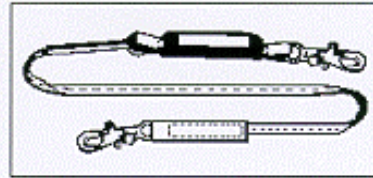


[OSHA Standard: 1926.502\(d\)\(15\)](#)

Fall Arrest Equipment - ABCs



Worker attached to a horizontal lifeline with a shock-absorbing lanyard.



Shock-absorbing lanyard



Rope lanyard



Self-retractable lanyard

A is for the Anchor Point. **B** is for the Body Harness.

C is for the Connecting Device.

“Roll out” occurs when the snaphook disengages from the Anchor Point.

WHICH FALL PROTECTION SYSTEM SHOULD BE USED?

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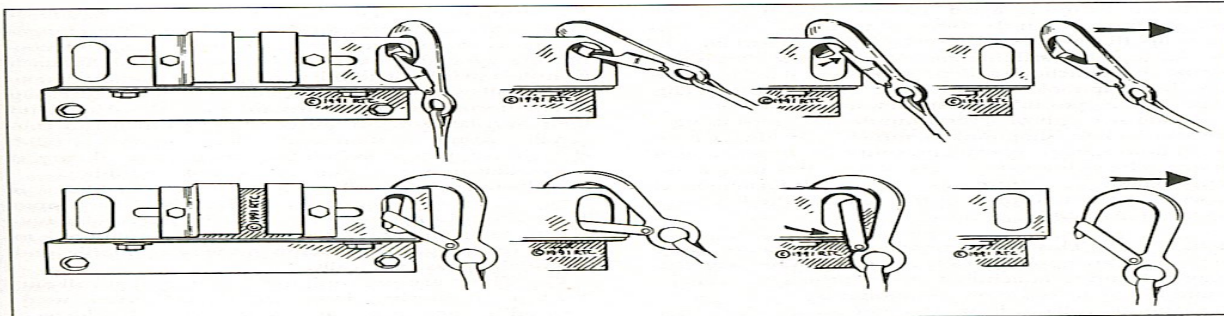


FIGURE 7.47

In a slotted fixture, examples of (top) dynamic roll-out and (bottom) static roll-out.

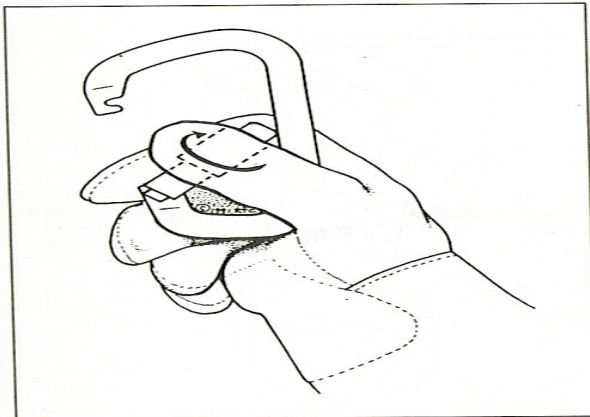


FIGURE 7.48

Field use of a carabiner locking snaphook.

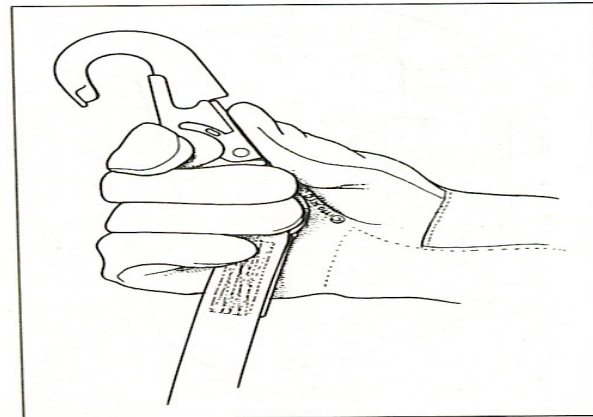
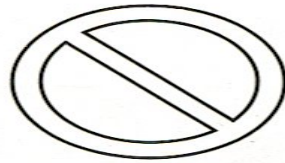


FIGURE 7.49

Equipment section use of a locking snaphook.



ANCHORAGE POINT DON'Ts!

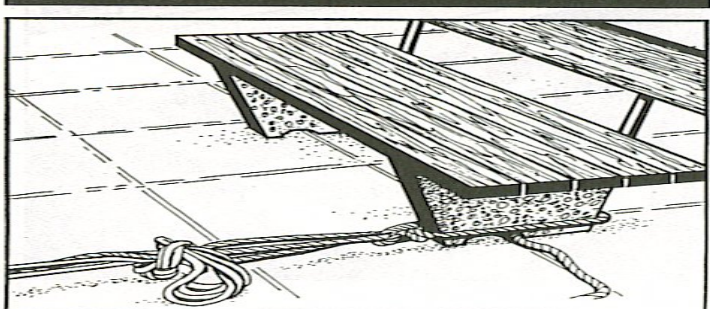
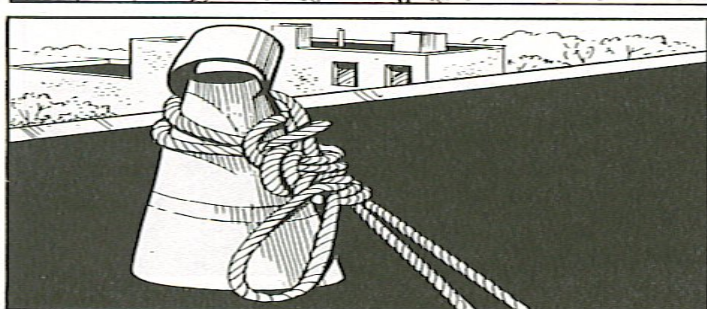
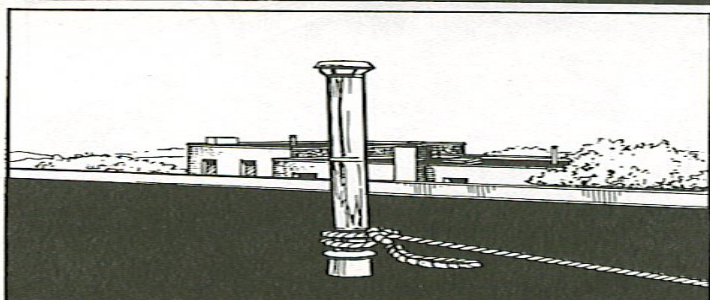
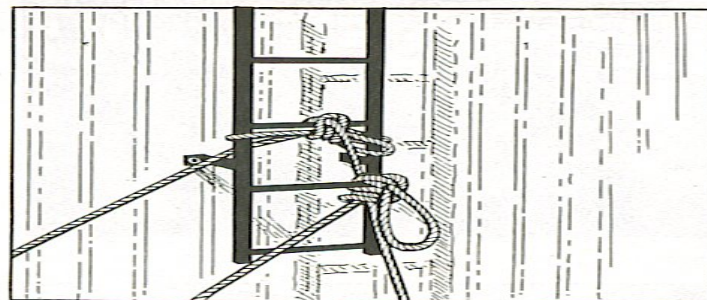
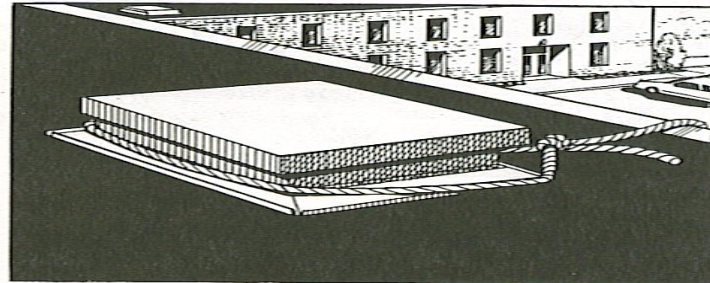
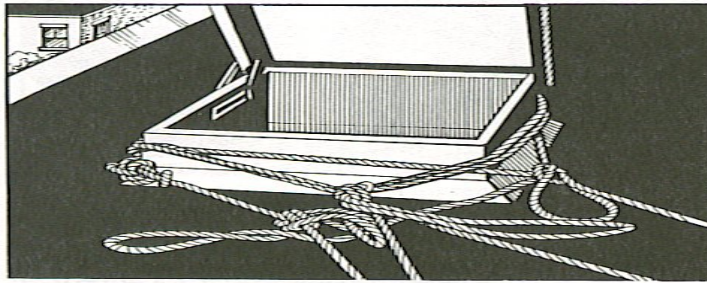
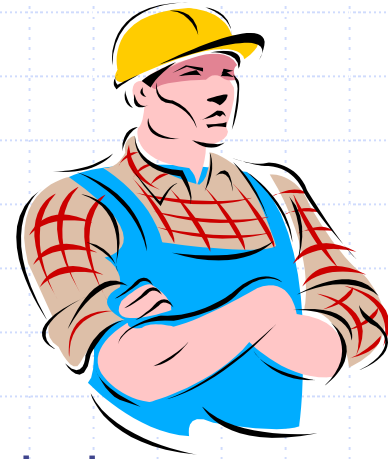


FIGURE 8.1
Anchorage Point Don'ts

Quiz Time!

Circle the correct answer below.



1. The D-ring attachment for the body harness must be located near the front center of the body directly over the breast bone .
 - a. True
 - b. False
2. Horizontal life lines can be employed at the users discretion provided they are UL approved.
 - a. True
 - b. False

Administrative Rules and Fall Arrest Maintenance

When fall protection of any kind is provided, the project's competent person must teach workers the limitations to that system's effectiveness.

Guardrails

Guardrails are the primary means of fall protection in industry and construction.



Orthostatic Intolerance / Suspension Trauma



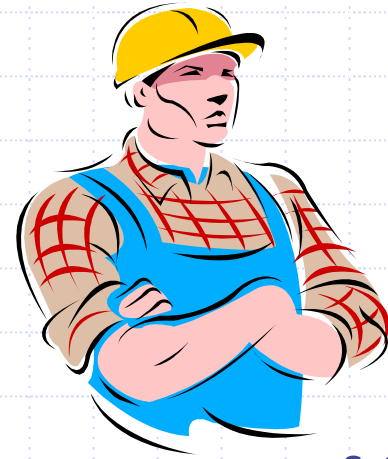
Orthostatic intolerance may be experienced by workers using fall arrest systems.

Prolonged suspension from a fall arrest systems can cause orthostatic intolerance, which in turn can result in physical injury, or potentially, death.

Research indicates that suspension in a fall arrest device can result in unconsciousness, followed by death, in less than 30 minutes.

Quiz Time!

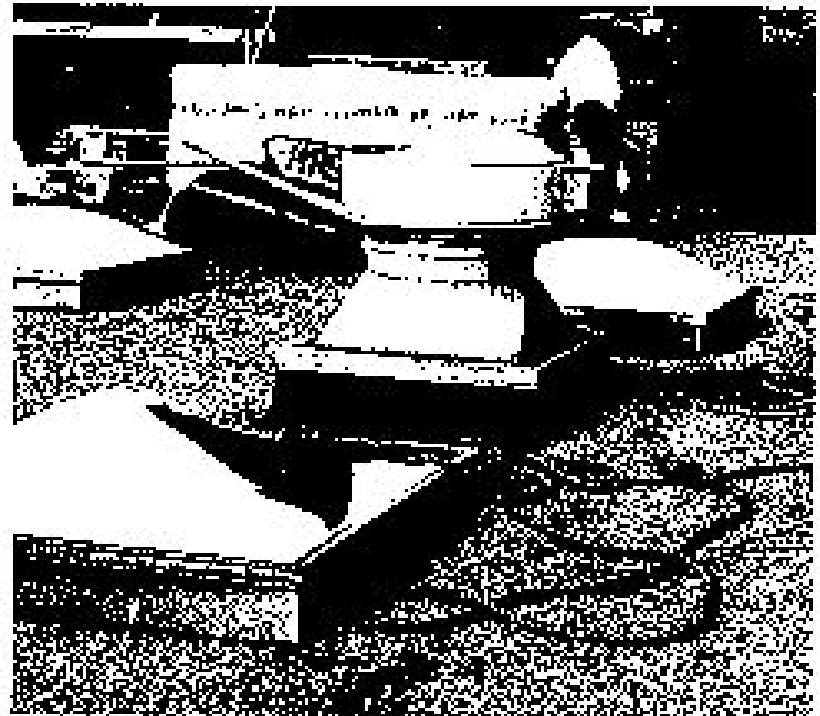
Circle the correct answer below.



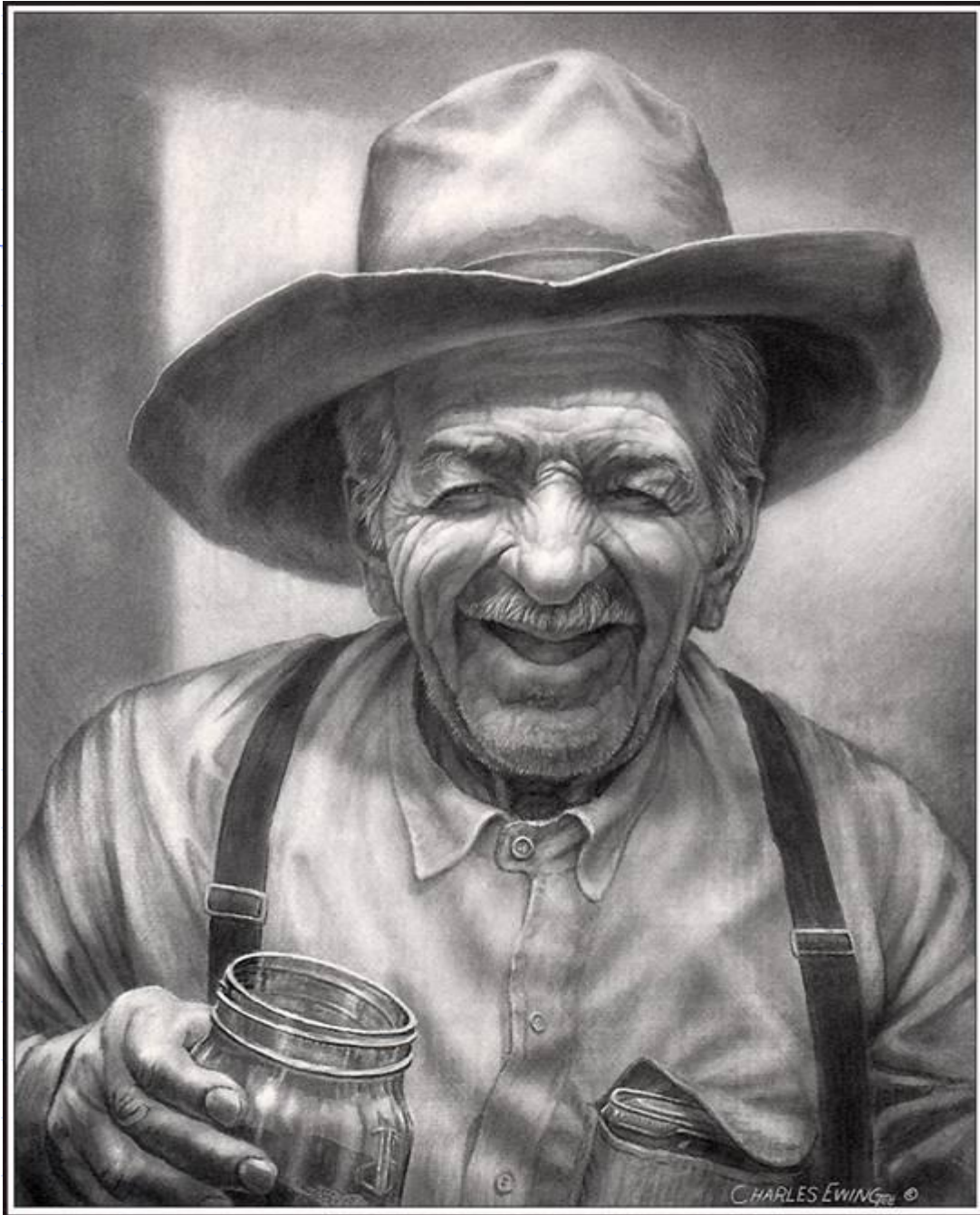
1. The full-body harness is the primary means of fall protection in general industry and construction.
 - a. True
 - b. False
2. Orthostatic Intolerance is a condition associated only with persons who work with high voltage.
 - a. True
 - b. False

NIOSH *ALERT!*

Fatal falls may result from failure to provide appropriate guarding and fall protection for work around skylights, Skylight openings, and other roof openings.



Scene of a skylight accident where a worker fell to his death



That's all folks