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Fall Protection

Understanding Fall Exposure



Webinar Instructor

Scott Staffon, CSP
Director of Risk Management

Industry Expertise:

- ✓ **Heavy Highway**
- ✓ **Infrastructure, Bridges & Foundations**
- ✓ **Alternative Energy**
- ✓ **Specialty Construction**
- ✓ **Utilities**
- ✓ **Trucking/Fleet**





Webinar Disclosure

Cobb Strecker Dunphy & Zimmermann's presenter, Scott Staffon has no actual or potential conflict of interests concerning any proprietary interests in any product, service or any other materials presented in this webinar.

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Learning Outcomes

1. Identify the essential terms and phrases of OSHA's Subpart M
2. Understand fall distances and the physics of falling
3. Understand the necessary components of a personal fall arrest system (PFAS)
4. Identify swing fall hazards and how to minimize or prevent these situations
5. Describe guardrail and floor hole applications for fall protection
6. Identify other fall protection considerations: Aerial lifts and ladders
7. Identify rescue and response strategies
8. Define employer/employee training requirements

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There are Many Ways to Prevent Falls

HIERARCHY OF FALL PROTECTION

The Hierarchy of Fall Protection is the preferred order of control for fall hazards. As the Hierarchy progresses, so does the risk.

1 HAZARD ELIMINATION
Preferred solution is to eliminate exposure to the fall hazard.

2 PASSIVE FALL PROTECTION
Physical barriers, like guardrails around unprotected edges and covers over holes.

3 FALL RESTRAINT SYSTEMS
Use personal protective equipment to restrict the worker's range of movement so they cannot fall.
* Training required

4 FALL ARREST SYSTEMS
Use personal protective equipment to arrest a fall within acceptable force and clearance margins.
** Training and rescue planning required

5 ADMINISTRATIVE CONTROLS
Least preferred solution is work practices or procedures that increase a worker's awareness of a fall hazard.
** Not recommended

PROTECTING WORKERS AT HEIGHT | ENGINEERING | TRAINING | EQUIPMENT | TESTING

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The Fall Arrest System (PFAS)





Proper Use and Body Position

**“D” ring between
shoulder blades**

**Butt strap
supports the load**



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Proper Use and Body Position

**Chest strap tightened
at mid chest**

***These keep you in
the body harness***

**Leg straps snug
but not binding**



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Adjusting Your Harness



**Slide your four fingers between the leg straps and leg –
Fingers should slide with ease up to the knuckle and hand area.**

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Continuous Fall Protection

“Double Lanyard”

Provides the ability to maintain 100% continuous fall protection



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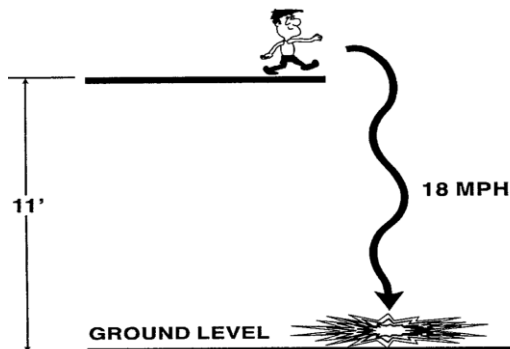
Understanding Falls

Fall Distances and the Physics of Falling



It's a Coin Flip!!

Studies indicate that 50% of all fall victims impacting against a hard surface with a velocity of 18 mph (27'/second) will be killed. This is equivalent to a fall of about 11 feet



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Why Fall Protection



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How Fast do I Fall?

Fall Height	Velocity		Time
6 ft	19.7 ft/sec	13 mph	.6 sec
10 ft	25.4 ft/sec	17 mph	.8 sec
15 ft	31.1 ft/sec	21 mph	.9 sec
20 ft	35.8 ft/sec	24 mph	1 sec
25 ft	40.1 ft/sec	27 mph	1.2 sec
50 ft	56.7 ft/sec	38 mph	1.76 sec

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Impact Force

The amount of impact force created in arresting a fall is based upon three items:

- Individual's weight**
- Fall distance**
- Suddenness of stop**

The suddenness of the stop is the key factor

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Consider the Impact

A worker weighing 220 lbs is attached to an anchor point at D-ring height. What will be the total potential force created when the lanyard is impacted?

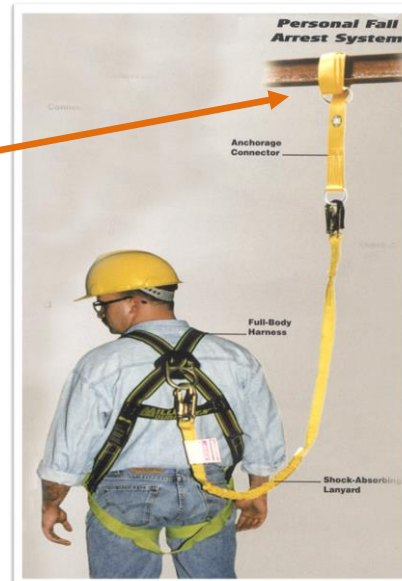
**220 lb x 6' (length of free fall) =
1320 lbs (energy to be absorbed)**

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What's Important?

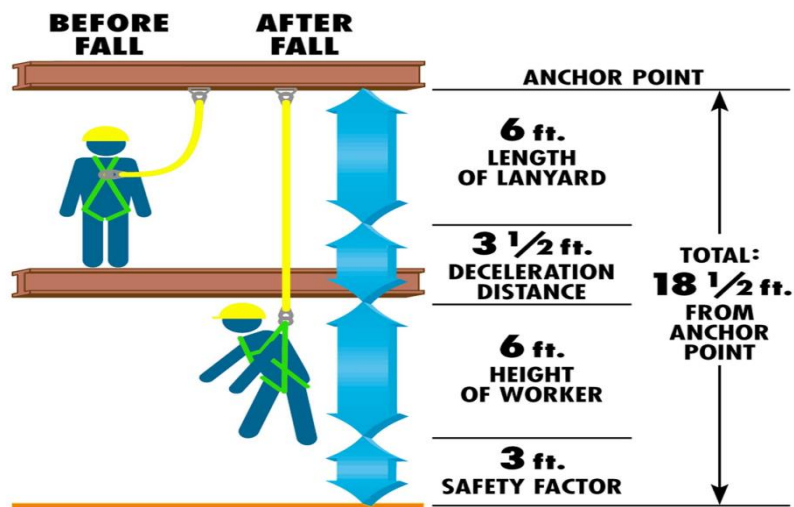
The higher the anchor point from the workers feet – the less the free-fall distance



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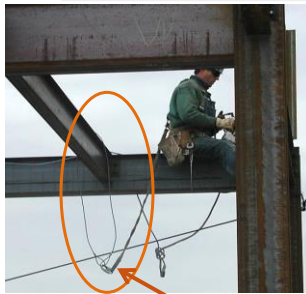
Fall Distance – Standard Lanyard



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Is This Worker Protected?



- ✓ Distance from elevated work area to concrete floor below is 15 feet
- ✓ Approximate free-fall distance of the worker's fall protection set-up is 20 feet



- ✓ Anchor point is extremely low – this causes a greater fall distance



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Easy Isn't Always the Best



What is the Fall Distance?

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Shock Absorbers



A shock absorber can expand as much as 3 ½ feet during a fall.

- ✓ This needs to be part of the overall fall distance calculation



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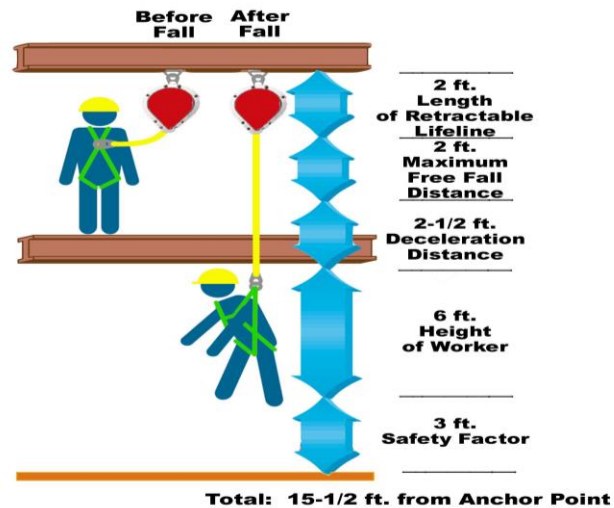
What is Below You?



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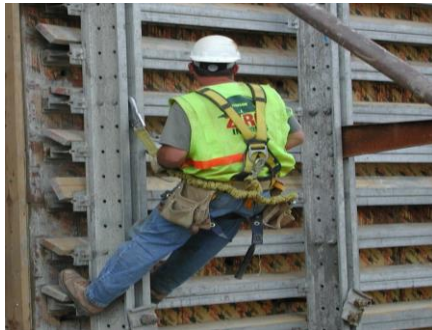
Fall Distance – Retractable



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Positioning Devices



- ➔ **Positioning devices are not intended to be used as fall protection (Only for hands-free work)**
- ➔ **Shock-absorbing lanyard with adequate anchorage point shall be used in combination**

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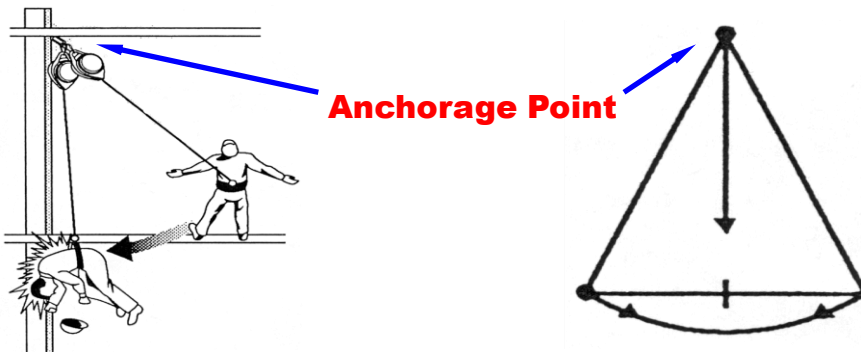
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Swing Falls



Swing Fall Hazard

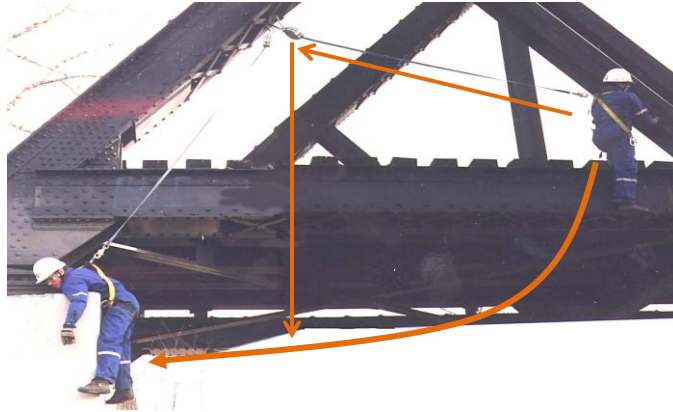


Sing fall occurs when the worker moves away horizontally from the anchorage point. The danger from swing fall is the impact with vertical objects. The shock absorber may not activate with this type of fall

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Swing Fall – The Pendulum Effect



Worker has moved in a horizontal direction from the vertical anchor point

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Retractable's For Leading Edge



A clear understanding by the employee on how to use in this scenario is critical

✓ **Swing fall exposure can be created easily**

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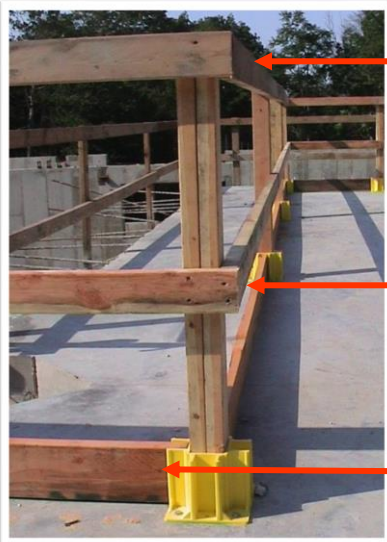
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Understanding Falls

Guardrails & Floor Holes



Guardrail Systems



Top-Rail
39" - 45"

Mid-Rail
21" - 23"

Toe board





Perimeter Barriers for Guardrails



For permanent barriers (parapet walls, concrete barrier, etc.) that are less than 39" – 42" in height, a secondary top-rail needs to be added to be in compliance

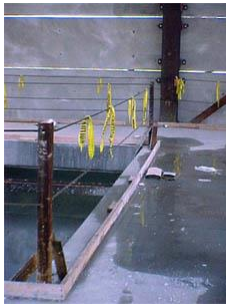
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Wire Rope Guardrails



Wire-rope used for guardrails:

- ✓ Meet the same height requirements wood/solid guardrails
- ✓ Must be flagged every 6 feet with high visibility material
- ✓ No more than 3 inches of deflection on either cable

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Tie-Off to Guardrails



Guardrails need to be designed and engineered to use for an anchorage point

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When a Guardrail isn't Fall Protection



Once you are evaluated above the guardrail - you no longer have adequate fall protection

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When a Guardrail isn't Fall Protection



Once guardrails are removed and workers are exposed to fall hazards, other fall protection methods need to be used

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Floor Holes



Hole means a gap or void 2 inches or more in its least dimension, in a floor, roof, or other walking/working surface.

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Floors Openings



Flagging isn't an acceptable means of protecting large floor opening



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Floor Holes

- **Employees shall be protected from falling through holes**
- **All covers for holes shall be capable of supporting at least twice the weight of employees, equipment & materials**
- **All covers shall be secured to prevent accidental displacement by wind, equipment or employees**
- **All covers shall be color coded or marked with the word "hole" or "cover"**

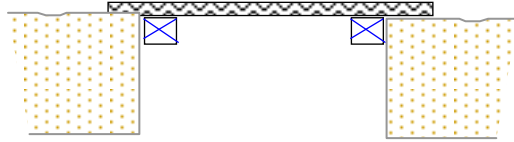
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Floor Holes

Covers

- ✓ Secured in place
- ✓ Color coded or marked "HOLE" or "COVER"
- ✓ Able to support twice the weight of vehicle, equipment, materials or employees



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Warning Lines

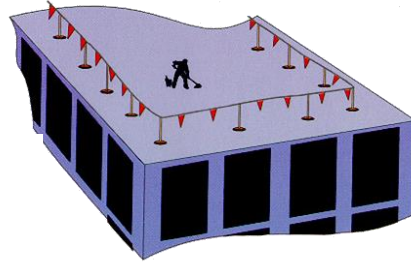




Warning Line System

Barrier to warn workers approaching the edge

- Defines area where roofing work can be done without conventional fall protection
- Consists of ropes, wires or chains erected around all sides of the roof
- Line must attach to each stanchion so slack will not lesson in one section when another is pulled
- High-visibility flags not more than 6 feet apart
- Line no more than 39 inches or no less than 34 inches from roof surface



- Used only on low-sloped roofs
- No worker allowed between edge and line unless provided with proper fall protection

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Warning Line Boundary

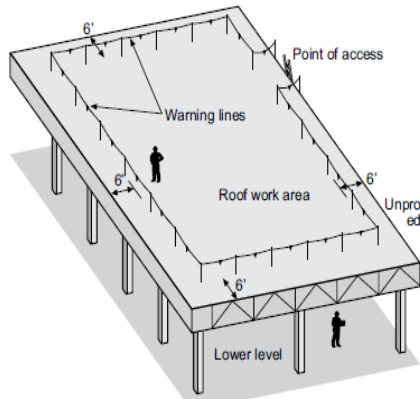


No worker is allowed beyond the warning Line and roof edge unless proper fall protection is provided

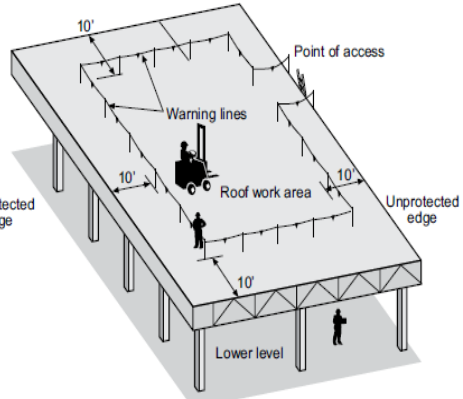
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Warning Line Set-Up



Warning-line system where no mobile equipment is used



Warning-line system where mobile equipment is used

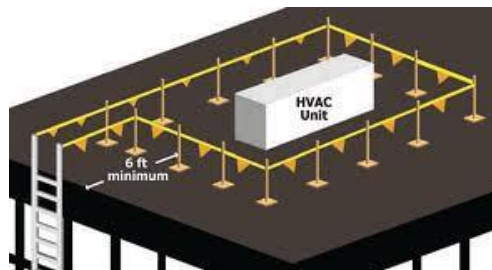
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The Challenge of Roof-Top Work



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Warning Lines – Can I use on Floors



Are these expectable for “leading edge” fall protection?

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U.S. Department of Labor
Occupational Safety & Health Administration
www.osha.gov MyOSHA Search [GO Advanced Search](#) [A-Z Index](#)

Standard Interpretations
05/12/2000 - Fall protection non-conforming guardrail criteria for application of a de minimis policy.

[Standard Interpretations - Table of Contents](#)

Standard Number: [1926.500](#); [1926.501\(b\)\(4\)\(i\)](#); [1926.502\(f\)\(2\)](#)

OSHA requirements are set by statute, standards and regulations. Interpretations and guidance are provided by OSHA. This letter constitutes OSHA's enforcement guidance. This letter may be affected by updates to OSHA's standards, regulations, interpretations, and guidance. Consult OSHA's website at <http://www.osha.gov>.

May 12, 2000

Mr. Barry A. Cole
Executive Vice-President
Steel Erectors Safety Association
of Colorado
5750 Pecos Street, Suite 6
Denver, Colorado 80221

Re: Fall Protection/Use of barricades: 1926.500, Subpart M

Dear Mr. Cole:

This is in response to your letter dated July 24, 1998, addressed to OSHA regarding fall protection. In the letter you ask a series of questions regarding 29 CFR 1926.500. We apologize for the long delay in responding.

Issue: In viewing your questions together, we understand them to amount to the following issue: Subpart M generally requires fall protection (personal fall protection, guardrails, covers) when there is a fall distance of 6 feet or more. In a few, very specific situations, the standard permits the use of control lines instead of guardrails to keep employees away from a hole or edge. Apart from those situations, if an employee is far enough from a hole or edge, may control lines be used instead of the specified fall protection devices? If so, how far is that distance?

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OSHA's Warning Line Interpretation

We continue to believe that **distance alone is ineffective to protect workers from unprotected sides or edges**. However, we have determined that, in the area farther back from the distances specified for the warning lines permitted under the standard, there is a point that is sufficiently far from the edge or hole to warrant the application of a *de minimis* policy regarding non-conforming guardrails.

At 15 feet from the edge or hole (in the case of a hole, measured from the nearest edge of the hole), **a warning line, combined with effective work rules**, can be expected to prevent workers from going past the line and approaching the edge. Also, at that distance, the failure of a barrier to restrain a worker from unintentionally crossing it would not place the worker in immediate risk of falling off the edge.

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Rescue & Response Strategies





A Rescue Plan is Critical

The U.S. Air Force and OSHA studied “prolonged motionless suspension”. It was determined that the average amount of time that test subjects could hang motionless in a **full-body harness before experiencing nausea, tingling or numbness was 14.38 minutes.**



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What's Affected While Suspended?

Suspension Trauma

3 Brain Circulation

- Diminished Blood Flow
- Blocked Airway
- Cardiac Arrest or Brain Damage
- Death

2 Heart Circulation

- Anxiety and Onset of Shock
- Heart Rate Increases
- Cardiac Irritability*

1 Leg Circulation

- Straps Impede Blood Return
- Muscle Venous Pump Fails
- Blood Becomes Toxic & Highly Acidic*

*Even if able to recover before asphyxiation/airway block occurs, the acidic, oxygenated blood will return due to the "siphon" effect. Blood pooling back to the lower body (called "gravidity") the weight of deoxygenated blood may cause a further and possibly unrelated other prolonged suspension.

TRAUMA

Prolonged Effects of Suspension Trauma

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Trauma Straps

SUSPENSION TRAUMA SAFETY STRAP

- Allows workers to stand up in harness, relieving pressure
- Can accommodate either one foot or both feet to keep at a time
- Increased comfort, balance and improved circulation in legs
- Compact, lightweight and easily installed

3M
Rescue Strap
Fall Support R-100

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What's Your Plan for Rescue?



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Rescue

The employer shall provide for prompt rescue of employees in the event of a fall or shall assure that employees are able to rescue themselves.

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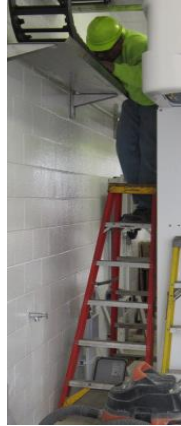
Fall Protection

Other Areas of Fall Protection to Consider





Ladder Use



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Ladder Use

General Safety Guidelines

Do not...

- ✓ **Place ladders in front of doors opening toward the ladder**
- ✓ **Climb carrying heavy tools, use a rope to haul them up or down**
- ✓ **Use a metal ladder around electrical hazards**
- **Always face the ladder when ascending or descending**
- **Only one person should be on the ladder at one time unless it is designed for alternative use**



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Use The Right Ladder



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Ladder Access Fall Exposure



Unprotected Open End



Use offset to protect ladder opening

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Elevated Walkways for Access



Fall protection required for walkways over 6'

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Work Platforms Used With Rough Terrain Forklift



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Work Platforms Used With Rough Terrain Forklift

Work platform requirements:

- Ensure the platform is **securely attached** to the forks or carriage, or load back rest
- The forklift must have firm and level footing.
- A trained operator shall **at all times** be in a position to control the vehicle.
- All controls must be set in **neutral and the parking brake applied** when workers are in the raised position
- Personnel must **at all times** remain on the platform floor
- All workers shall be **tied-off** to approved connectors in the basket at all times

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Aerial Lift – Fall Protection



**Aerial “boom
type” lifts
require 100 %
fall protection**



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Aerial Lift – Fall Protection



Scissor lifts are regulated as mobile scaffolds and not as aerial lifts

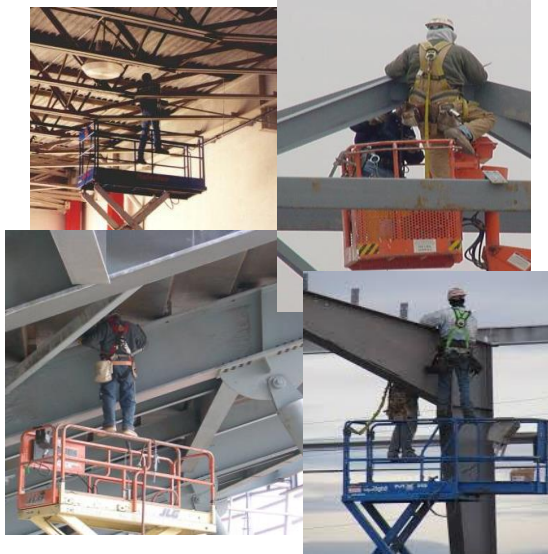
- ✓ Scissor Lifts Fall Protection Regulations - 1926.451
- ✓ Personal Fall Arrest System is not required

Personal fall arrests systems can be used or guardrail systems (with closing gate or latch chain) that meet the requirements of 1926.451 must be installed on all open sides and ends of platforms.

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Aerial Lift - Fall Protection



Firm footing on the platform floor – standing on the rails not allowed

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Excavations

1926.501(b)(7)(i)

Each Employee at the Edge of an Excavation 6 feet (1.8 m) or More in Depth Shall be Protected from Falling by Guardrail Systems, Fences, or Barricades when the Excavations are not Readily seen because of Plant Growth or Other Visual Barrier.



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Employee Training





OSHA's Training Requirements

The Employer:

- **Must provide a training program to each employee who might be exposed to fall hazards. Must enable the employee to recognize fall hazards and train them in the procedures to minimize the hazards.**

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Training

Each employee has been trained by competent person in:

- The nature of fall hazards in work areas
- Procedures for erecting, maintaining, disassembly, inspection of fall protection systems to be used
- Use and operation of any fall protection systems
- Correct procedures for handling/storing equipment and use of overhead protection
- The role of employees in fall protection plans
- Subpart M standards

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Certification and Retraining

Employer must verify each employee has been trained:

- Written record should include name and identification of person trained and date(s) of training
- Training by others, record must indicate date that employer determined the training was adequate

Retraining:

- When the employer believes a previously trained employee does not have the understanding or skills
- When new hazards, workplace, work task, fall protection systems/equipment are introduced

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Questions

Scott Staffon

Director of Risk Management

7/26/2018

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