

SECTION	III.	Occupational Safety
Chapter	5.	Fall Protection
Revision Date		05/28/2020
Review Date		

# FALL PROTECTION

## INTRODUCTION

### Purpose

It is the policy of Duke University to provide appropriate fall protection to employees who may be exposed to unprotected sides or edges that are 4 feet or more above a lower level for general industry work (e.g., maintenance) and 6 feet or more above a lower level for construction work. Fall protection must be provided and used to protect personnel against hazards capable of causing injury, impairment, or death.

### Definitions

*Anchorage:* a secure point of attachment for equipment such as lifelines, lanyards, deceleration devices, and rope descent systems.

*Competent person:* a person who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

*Designated area:* a distinct portion of a walking-working surface delineated by a warning line in which employees may perform work without additional fall protection.

*Fall protection:* any equipment, device, or system that prevents an employee from falling from an elevation or mitigates the effect of such a fall.

*Fixed ladder:* a ladder with rails or individual rungs that is permanently attached to a structure, building, or equipment.

*Guardrail system:* a barrier erected along an unprotected edge or exposed side, edge, or other area of a walking-working surface to prevent employees from falling to a lower level.

*Hole:* a gap or open space in a floor, roof, horizontal walking-working surface, or similar surface that is at least 2 inches in its least dimension.

*Ladder safety system:* a system designed to eliminate or reduce the possibility of falling from a ladder. Ladder safety systems usually consist of a carrier, safety sleeve, lanyard, connectors, and body harness. Cages and wells are not ladder safety systems.

*Mobile Elevating Work Platform (MEWP):* Machine/device intended for moving persons, tools and material to working positions, consisting of at least a work platform with controls, an extending structure and a chassis.

*Opening:* a gap or open space in a wall, partition, vertical walking-working surface, or similar surface that is at least 30 inches high and at least 18 inches wide, through which an employee can fall to a lower level.

*Personal fall arrest system:* a system used to arrest an employee in a fall from a walking-working surface. It consists of a body harness, anchorage, and connector. The means of connection include a lanyard, deceleration device, lifeline, or a suitable combination of these.

*Platform:* a walking-working surface that is elevated above the surrounding area.

*Positioning system:* a system of equipment and connectors that, when used with a body harness or body belt, allows an employee to be supported on an elevated vertical surface, such as a wall or window sill, and work with both hands free. Positioning systems are also called “positioning system devices” and “work-positioning equipment.”

*Qualified Person:* a person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project.

*Rope descent system:* a suspension system that allows an employee to descend in a controlled manner and, as needed, stop at any point during the descent. A rope descent system usually consists of a roof anchorage, support rope, a descent device, carabiner(s) or shackle(s), and a chair (seatboard). A rope descent system also is called controlled descent equipment or apparatus. They do not include industrial rope access systems.

*Scaffold:* any temporary elevated or suspended platform and its supporting structure, including anchorage points, used to support employees, equipment, materials, and other items.

*Toeboard:* a low protective barrier that is designed to prevent materials, tools, and equipment from falling to a lower level, and protect employees from falling.

*Travel restraint system:* a combination of an anchorage, anchorage connector, lanyard (or other means of connection), and body support that Duke uses to eliminate the possibility of an employee going over the edge of a walking-working surface.

*Unprotected sides and edges:* any side or edge of a walking-working surface (except at entrances and other points of access) where there is no wall, guardrail system, or stair rail system to protect an employee from falling to a lower level.

*Walking-working surface:* any horizontal or vertical surface on or through which an employee walks works, or gains access to a work area or workplace location.

*Warning line:* a barrier erected to warn employees that they are approaching an unprotected side or edge, and which designates an area in which work may take place without the use of other means of fall protection.

## **Responsibilities**

Departments shall:

- Conduct risk assessments that identify locations and tasks that require fall protection.
- Develop an inventory of fixed ladders that are more than 24 feet to add ladder safety devices for OSHA requirements by the year 2036.

- Provide appropriate personal fall protection systems and training to employees, when needed.
- Ensure appropriate caution signs are posted for areas requiring personal fall protection systems.
- Ensure that employees use personal fall protection systems appropriately, where required.
- Ensure contractors have proper training and equipment for fall protection, when needed.

Supervisors shall:

- Ensure that fall protection assessments are conducted where appropriate.
- Ensure that appropriate personal fall protection systems and compatible equipment are available to employees.
- Ensure that employees complete fall protection training.
- Ensure that personal fall protection systems are used properly where it is required.
- Monitor the performance of the work of the operator of MEWP to ensure compliance.
- Ensure that fall protection devices are inspected as required by a competent or qualified person.

Employees shall:

- Use personal fall protection systems in accordance with instructions and training received.
- Care and inspect personal fall protection systems properly and guard against damage and contamination.
- Report personal fall protection system malfunctions, failed inspections, or other problems to their supervisor.

OESO shall:

- Assist departments and supervisors with their departmental fall protection programs.
- Assist departments in conducting fall protection assessments.
- Review departmental procedures and/or policies to ensure compliance with regulatory requirements.

## **PROCEDURES**

### **General**

Eliminate or reduce locations where fall protection is required when feasible. This may include modifying a structure, isolating the employee from the fall hazard, changing a process, substituting equipment or using work procedures organized in such a manner that the employee is not exposed to the fall hazard.

An unprotected side or edge that is 4 feet or more above a lower level shall be protected by a guardrail system or personal fall protection system, such as personal fall arrest, travel restraint, or positioning system. Other areas or tasks that require fall protection are listed below:

- If at any time a portion of a guardrail system, gate, or chains are removed, and an employee must lean over the edge of the access opening to facilitate hoisting, the employee must be protected by a personal fall arrest system.
- Holes or openings, such as pits or roof hatches, require fall protection including one or more of the following: covers, guardrail systems, travel restraint systems, or personal fall arrest systems.

Duke employees who are not utilizing personal fall protection systems are prohibited from working within 15 feet of an unprotected edge of a roof, without a proper guardrail system, unless the only task

performed is inspecting, investigating, or assessing workplace conditions. If further work is deemed necessary as a result of the inspection, then proper guardrail systems, personal fall protection systems, or designated areas must be in place before work begins.

Duke Contractors performing work on roofs or other fall protection areas must be trained and equipped by their employer to conduct the work safely according to OSHA regulations.

### **Fall Protection Systems**

Fall protection systems will be used in the following circumstances:

- When appropriate guardrail systems are not in place at unprotected sides or edges at a height of 4 feet or more.
  - When work is performed 15 feet or less from a roof's edge with no appropriate guardrail system, then a travel restraint system or personal fall arrest system must be used unless there is a designated area.
- When ascending or descending fixed ladders that extend more than 24 feet above a lower level.
- When using a rope descent system that is 4 feet or more above a lower level.
  - Each employee must be protected by a personal fall arrest system.

### **Guardrail Systems**

Guardrail systems must meet the following requirements:

- Top edge height of top rails are 42 inches, plus or minus 3 inches, above the walking-working surface.
- Midrails, screens, mesh, intermediate vertical members, or solid panels are installed between the walking-working surface and the top edge of the guardrail system when there is not a wall or parapet that is at least 21 inches high.
- Guardrail systems are capable of withstanding, without failure, a force of at least 200 pounds applied in a downward or outward direction of the top edge.
- Midrails, screen, mesh, intermediate vertical members, and solid panels are capable of withstanding, without failure, a force of at least 150 pounds applied in any downward or outward direction at any point along the intermediate member.
- Guardrail systems must be smooth-surfaced.
- Steel banding and plastic banding are not used for top rails or midrails.
- A removable guardrail section (consisting of a top rail and midrail) can be placed across access openings between guardrail sections for hoisting operations.
  - Chains or gates can be used instead of a removable guardrail section, only for hoisting operations and when it is demonstrated that the chains or gates provide a level of safety equivalent to guardrails.
- When guardrail systems are used around holes that serve as points of access, such as ladderways, there must be a self-closing gate that slides or swings away from the hole, and is equipped with a top rail and midrail (or equivalent intermediate member); or have an offset to prevent from walking or falling into the hole. Chains are not acceptable.

### **Designated Areas**

- If a guardrail system or personal fall protection system is not available, then a designated area is possible. If work is both temporary and infrequent, a designated area can be erected at least 6 feet

from the roof edge. If the work is not temporary or infrequent, then a designated area can be erected at least 15 feet from the roof edge. Designated area means a distinct portion of walking-working surface is delineated by a warning line consisting of rope, wire, tape, or chain in which employees may perform work without additional fall protection.

### **Fixed Ladders**

- Each fixed ladder installed on and after November 19, 2018, must be equipped with a personal fall arrest system or a ladder safety system.
- On and after November 18, 2036; all fixed ladders must be equipped with a personal fall arrest system or a ladder safety system.

### **Scaffolds or Mobile Elevated Work Platforms**

Work can sometimes be conducted from the ground with proper safety equipment, such as a scaffold or a mobile elevated work platform.

- Scaffolds:
  - Each employee more than 10 feet above a lower level shall be protected from falls by guardrails or a fall arrest system, except those on single-point and two-point adjustable suspension scaffolds which will be protected by both a personal fall arrest system and a guardrail.
  - Guardrail height of the toprail for scaffolds must be between 38 inches and 45 inches.
    - When the crosspoint of crossbracing is used as a toprail, it must be between 38 inches and 48 inches above the work platform.
  - Guardrail height of the midrails must be installed approximately between the toprail and the platform surface.
    - When a crosspoint of crossbracing is used as a midrail, it must be between 20 inches and 30 inches above the work platform.
  - Support scaffold footings shall be level and capable of supporting the loaded scaffold.
  - Supported scaffold platforms shall be fully planked or decked.
  - Supported scaffolds with a height-to-base of more than 4:1 shall be restrained from tipping by guying, tying, bracing, or the equivalent.
  - Scaffolds and scaffold components must support at least four times the maximum intended load. Suspension scaffold rigging must support at least six times the intended load.
- Mobile Elevated Work Platforms (MEWP)
  - Only trained and authorized Duke personnel are allowed to operate and/or occupy the MEWP.
  - The operator shall read and understand the manufacturer's operator's manual or have it explained to him/her prior to use.
  - Preventive maintenance shall be established in accordance with the manufacturer's recommendations.
  - Inspections shall be conducted at least before use or before start of shift, and on an annual basis.
  - Operators shall comply with the requirements to install and position guardrails, and that access gates or openings shall be properly closed or in appropriate positions per the manufacturer's instructions.

- When guardrails are not available then employees must use personal fall protection, either travel restraint or fall arrest, and operators shall comply with the instructions provided by the manufacturer regarding anchorage(s).
  - A rescue plan is required when using fall arrest systems to determine how the affected worker will return safely to the platform or ground, as well as prevention of suspension trauma (e.g., trauma strap).
- When working in the area of energized conductors, the operator shall stay at least 10 feet away from power lines with any part of their body, conductive object or any part of the MEWP.
- An aerial lift requires a body harness and a lanyard attached to the boom or basket when working. The use of a body belt on an aerial lift is only acceptable with a tether anchored to the boom or basket (fall restraint system).
- MEWPs are not specifically designed to transfer personnel from one level to another or for leaving the work platform. Exiting, or entering, a MEWP at height shall only be permitted through a procedure provided by the manufacturer and approval from OESO for appropriate fall protection during the procedure.
- Specific equipment training is required when a scaffold or MEWP is used.
- Where used, toeboards shall be:
  - Capable of withstanding a force of at least 50 pounds applied to any downward or horizontal direction at any point along the toeboard.
  - At least 3 ½ inches high from the top edge of the toeboard to the level of the walking/working surface.

### **Personal Fall Protection Systems**

- Personal Fall Arrest System:
  - Attachment of the body harness must be located in the center of the wearer's back, near the shoulder level, or above the head.
    - Body belts are not acceptable as part of the personal fall arrest system.
  - Anchorages used for attachment of personal fall arrest equipment must be:
    - independent of any anchorage being used to suspend employees or platforms on which employees work, and either
    - capable of supporting at least 5,000 pounds per employee attached, or
    - designed and used as part of a complete personal fall arrest system which maintains a safety factor of at least two.
  - A competent person must inspect systems before each use for wear, damage, and other deterioration, and remove defective components from service.
  - The use of a personal fall arrest system requires a rescue plan to determine how the affected worker will return safely to a lower platform or the ground, as well as prevention of suspension trauma (e.g., trauma strap).
- Travel Restraint System:
  - A travel restraint system must be limited to a walking-working surface that is flat.
  - Travel restraint lines must be capable of sustaining a tensile load of at least 5,000 pounds.
  - Anchorages selected for restraint systems must have a strength capable of sustaining static loads applied in the directions permitted by the system:
    - No less than 1,000 pounds for non-certified anchorages; or
    - At least two times the foreseeable force for certified anchorages; or
    - As determined for personal fall arrest systems.

- A competent person must inspect the system before use each day to determine that the equipment is in safe working condition.
- **Positioning systems (Work-Positioning Systems):**
  - Anchorages used for attachment of positioning systems must be:
    - Capable of supporting at least twice the potential impact load of an employee's fall, or 3,000 pounds of force, whichever is greater.
  - Must be rigged so that an employee can free fall no more than two feet.
  - A competent person must inspect the system before use each day to determine that the equipment is in safe working condition.

**Rope Descent Systems**

Before any rope descent systems are to be used, Duke must have, in writing, that Duke has identified, tested, certified, and maintained each anchorage so it is capable of supporting at least 5,000 pounds. This information must be based on an annual inspection by a qualified person and certification of each anchorage by a qualified person, as necessary, and at least every 10 years.

**Safety Nets**

If more than 25 feet above the walking-working surface, construction only, where the use of ladders, scaffolds, MEWP, personal fall arrest systems, or positioning systems are impractical, then a safety net can be used.

- Nets must extend beyond the edge of the work surface where employees are exposed 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	8 feet
5 to 10 feet	10 feet
More than 10 feet	13 feet

- Nets must be installed as close under the work surface as practical but not more than 25 feet below such work surface.
- Nets must be hung with sufficient clearance to prevent contact with the surfaces or structures below. Determine clearance by impact load testing.
- The mesh size of the safety must not exceed 6 inches by 6 inches.
- All new safety nets must meet accepted performance standards of 17,500 foot-pounds minimum impact resistance as determined and certified by manufacturers, and must bear a label of proof test.
  - Edge ropes must have a minimum breaking strength of 5,000 pounds.

**REFERENCES**

Code of Federal Regulations, Title 29, Part 1926.105 (OSHA), *Safety Nets*

Code of Federal Regulations, Title 29, Part 1926.451 (OSHA), *General Requirements for Scaffolds*

Code of Federal Regulations, Title 29, Part 1926.453 (OSHA), *Aerial Lifts*

Code of Federal Regulations, Title 29, Part 1926.501 (OSHA), *Duty to Have Fall Protection*

Code of Federal Regulations, Title 29, Part 1926.502 (OSHA), *Fall Protection Systems Criteria and Practices*

Code of Federal Regulations, Title 29 Part 1910 (OSHA) Subpart D, *Walking-Working Surfaces*

Code of Federal Regulations, Title 29, Part 1910.140 (OSHA), *Personal Fall Protection Systems*

American National Standards Institute (ANSI)/ Scaffold & Access Industry Association (SAIA), A92.22, *Safe Use of Mobile Elevating Work Platforms (MEWPs)*

American National Standards Institute (ANSI)/ American Society of Safety Engineers (ASSE), Z359.2, *Minimum Requirement for a Comprehensive Managed Fall Protection Program*