

## **Fall Protection and Roof Safety Design Standard**

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### 1. Introduction

The purpose of this document is to outline fall protection and roof safety design standards for new construction, remodeling, re-roofing and any other construction project that involves the installation of fall protection systems, working on, or replacing a roof. The applicable Occupational Safety and Health Administration (OSHA) regulations and American National Standards Institute (ANSI) standards that govern fall protection and fall protection systems will be outlined. This document also outlines the desired design criteria, the preferred hazard controls, and the hierarchy of controls that should be considering during all design and construction phases. The goal is to have a finished design plan that eliminates fall hazards and in instances where fall hazards cannot be eliminated, utilize the established hierarchy of controls to mitigate the risks.

### 2. Fall Protection and Roof Design Criteria

- a. Fall protection and roof safety design plans must be reviewed and approved by representatives from Facilities Planning and Management and Environmental Health and Safety.
- b. If a design has any unprotected fall hazard(s) with an elevation change of four feet or greater, it must be reviewed by Environmental, Health and Safety.
- c. Installation of personal fall protection systems (anchor points, horizontal lifelines, etc.) must be selected from one of two manufacturers. These manufactures are Guardian Fall Protection or 3M-DBI/Sala. This allows for compatibility and consistency of fall protection systems and equipment across campus and assists with meeting regulatory equipment training requirements for end users.
- d. An on-site review performed by Facilities Planning and Management and Environmental Health and Safety must be completed before commissioning of personal fall protection systems.
- e. The design, manufacture, and installation of every fall protection system to be installed must meet state, local and regulatory requirements.
- f. Follow the fall protection hierarchy of controls in Section 5 of this document.
- g. Provide fixed stairs or ladders where roof sections have different elevations.
- h. Skylights that are non-load bearing must be guarded by a load-bearing screen, cover, or a railing system.
- i. Provide sufficient clearance for working space around all equipment for safe operation and maintenance of equipment.

- j. All components of selected fall protection equipment and systems installed at Iowa State University should be selected from the same manufacturer.
  - k. Guardrail systems shall consist of a top rail with a height of 42 inches, an intermediate rail halfway between the top rail and the roof surface, vertical posts, and withstand the minimum required forces applied in the horizontal and vertical direction.
  - l. Anchor points of the tip over variety should not be installed as they cannot be load tested and certified.
  - m. If a parapet wall is to be utilized for fall protection, it must have a minimum height of 42 inches from the roof surface and withstand the minimum required forces.
  - n. All anchoring systems, including anchor points and horizontal lifelines designed for fall restraint, must be designed to meet fall arrest requirements. This allows the system to be used for either fall restraint or fall arrest depending on the specific application and task.
  - o. All personal fall protection systems must be tested and certified at the time of installation with the appropriate documentation sent to Facilities Planning and Management and Environmental Health and Safety.
3. Roof Access Criteria
- a. The roof access must be placed in a safe location at least six feet away from any fall hazard, when possible.
  - b. Fixed ladders are limited to locations where employees are not required to carry tools or supplies when climbing.
  - c. Provide a top landing that is large enough for employees to set down tools and supplies when opening the door or hatchway.
  - d. Doorways
    - i. Access through a doorway is preferred. If a doorway is not feasible, a hatchway may be used.
  - e. Hatchways
    - i. Hatchway access via a stairway is preferred.
    - ii. Hatchway access via a fixed ladder must be secured at the base with a security door or access guard.
    - iii. Hatchway openings must be enclosed by guardrail system with a self-closing gate.
  - f. Fixed Ladders
    - i. Fixed ladders that extend more than 24 feet above a lower surface should be avoided, when possible.
    - ii. Fixed ladders that extend more than 24 feet above a lower surface must be equipped with a personal fall arrest system or ladder safety system.

1. A ladder cage does not constitute a personal fall arrest system or ladder safety system.
      - iii. The personal fall arrest system or ladder safety system must provide protection throughout the entire vertical distance of the ladder, including all ladder sections.
      - iv. If a fixed ladder has adjacent sections offset by landing platforms, each landing platform must be protected by guardrails, a toe board and a self-closing gate.
4. Equipment & Walkway Placement
  - a. The building should be designed in such a way that all fall hazards are minimized and the placing of equipment and walkways on roofs be strategic to reduce employee exposure to fall hazards.
  - b. Placement of equipment, walkways, and roof drains should be at least 15 feet away from any unprotected fall hazard, including the roof edge, or be protected by a fall protection system.
5. Fall Protection Hierarchy of Controls
  - a. Hazard Elimination
    - i. The best solution is to eliminate the fall hazards by having a design where no one is within 15 feet of an unprotected fall hazard and where maintenance and access is temporary and infrequent.
  - b. Passive Fall Protection
    - i. These are physical barriers, like guardrails or walls, around unprotected edges, roof openings and other fall hazards. These systems require minimal, if any, user interaction and training.
    - ii. Examples include
      1. Fixed guardrail systems
      2. Parapet walls
  - c. Hybrid Systems
    - i. Collapsible guardrail systems
  - d. Fall Restraint Systems
    - i. These systems use personal protective equipment (e.g. anchoring device, harness, and lanyard) to restrict the range of a worker's movement so they cannot fall. Requires user to have equipment and system specific training.
    - ii. Examples include:
      1. Anchor points
      2. Horizontal lifelines
  - e. Fall Arrest Systems
    - i. These systems use personal protective equipment (e.g. anchoring device, harness, and lanyard) to arrest a fall within acceptable force and clearance limits. Since this exposes the worker to the possibility of a fall

and arrest situation, user equipment and system specific training, along with a rescue plan, are required.

- ii. Examples include:
  1. Anchor points
  2. Horizontal lifelines

f. Administrative Controls

- i. These are work practices or procedures that increase a worker's knowledge and awareness of a fall hazard and designed to limit exposure to fall hazards.
- ii. Examples include:
  1. Standard Operating Procedures
  2. Signage

6. Regulatory Standards

- a. This section summarizes the regulations that apply to fall protection and roof safety; however, it is not all-inclusive and other regulations may apply.
- b. General Industry OSHA Standards
  - i. OSHA 29 CFR 1910 Subpart D – Walking Working Surfaces
    1. Scope and Definitions – 1910.21
    2. General Requirements – 1910.22
    3. Ladders – 1910.23
    4. Duty to Have Fall Protection and Fall Object Protection – 1910.28
    5. Fall Protection Systems and Falling Object Protection: Criteria and Practices – 1910.29
    6. Training Requirements – 1910.30
  - ii. OSHA 29 CFR 1910 Subpart I – Personal Protective Equipment (PPE)
    1. Personal Fall Protection Systems – 1910.140
- c. ANSI Standards
  - i. ANSI/ASSE Z359
    1. Z359.1 – The Fall Protection Code
    2. Z359.2 – Minimum Requirements for a Comprehensive Managed Fall Protection Program
    3. Z359.3 – Safety Requirements for Positioning and Travel Restraint Systems
    4. Z359.4 – Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components
    5. Z369.6 – Specifications and Design Requirements for Active Fall Protection Systems
    6. Z359.7 – Qualification and Verification Testing of Fall Protection Products
    7. Z359.11 – Safety Requirements for Full Body Harnesses

8. Z359.12 – Connecting Components for Personal Fall Arrest Systems
  9. Z359.13 – Personal Energy Absorbers and Energy Absorbing Lanyards
  10. Z359.14 – Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems
  11. Z359.15 – Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems
- ii. ANSI A1264.1 – 2017 - Safety Requirements for Workplace Walking/Working Surfaces and Their Access; Workplace, Floor, Wall and Roof Openings; Stairs and Guardrail/Handrail Systems.
7. Conclusion
- a. If fall hazards are present, solutions limiting the amount of user involvement is preferred. This will eliminate the possibility for user error with specialized fall protection equipment. While there are many different solutions available, the hierarchy of controls must be followed to eliminate and mitigate fall hazards to lower the risk for employees working at heights.