

PERSONAL FALL ARREST SYSTEMS

Introduction

In 2011, falls to a lower level were the second leading cause of occupational fatalities across all industries, claiming the lives of 541 workers. Over half of these involved falls of 20' or less. Within the construction industry, the percentage of fatalities was nearly equal when comparing flat roofs (18%) and sloped roofs (20%). Appropriate fall protection is critical to reducing the risk of falls.

Scope

While there are a number of different strategies for fall protection, this SOP is limited in scope to personal fall arrest systems. A personal fall arrest system is designed to arrest a person's fall from an elevated working-walking surface (roof, floor, platform, etc.), and consists of an anchorage (point of attachment for the fall arrest system), body harness, and connectors (devices used to connect the body harness to the anchorage system, such as shock absorbing lanyard or self-retracting lifeline and associated snaphooks, dee-rings, carabiners, etc.). A fall arrest system will come into service only if a fall should occur. A personal fall arrest system should only be used when passive systems are not feasible (e.g., guardrails, travel restraint systems). Definitions are provided at the end of this document.

Standards

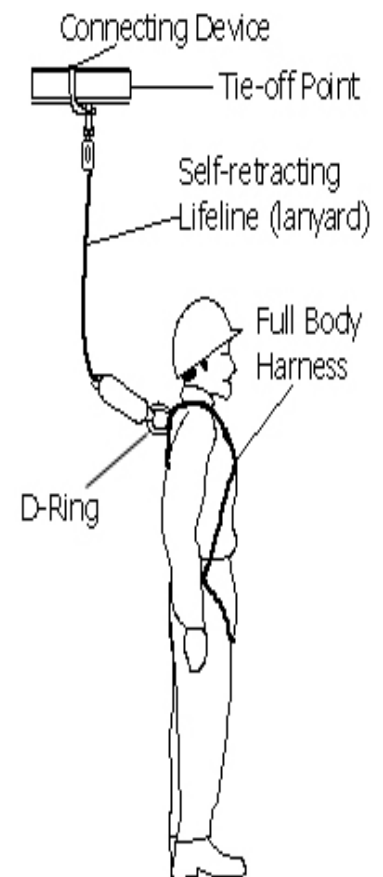
The content of this SOP is based on the following standards:

- 29 CFR 1926, Subpart M, Fall Protection (OSHA Construction Standards)
- 75 FR 28862 (May 24, 2010), OSHA Proposed Rule, Walking-Working Surfaces and Personal Protection Equipment (Fall Protection Systems) (Final rule expected June 2014)
- ANSI Z359.1, Safety Requirements for Personal Fall Arrest Systems, Subsystems, and Components
- ANSI Z359.2, Minimum Requirements for a Comprehensive Managed Fall Protection Program

Components

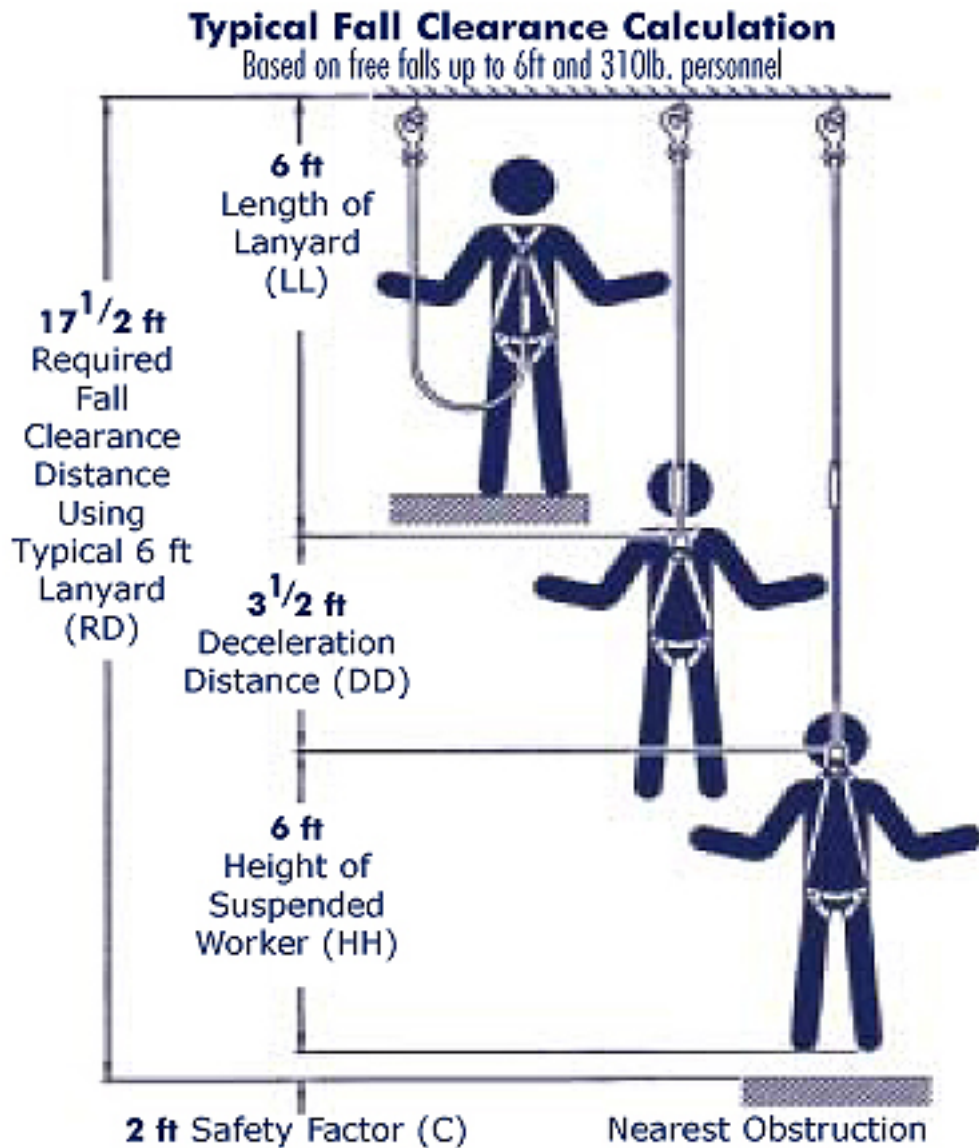
A. Selection

Selection of an appropriate fall arrest system requires considerations of both user and site-specific attributes; these systems are not universal. Only "qualified



persons” are authorized to select a particular fall arrest system for a particular situation.

- Of paramount importance is fall clearance. There must be sufficient clearance below the user to allow the system to arrest a fall before the user strikes the ground or other obstruction. This requires consideration of several user and site-specific factors, as depicted in the following illustration.



LL = Lanyard Length
 DD = Energy Absorber Deceleration Distance (3.5 Ft Total)
 HH = Height of the Harness Dorsal D-Ring from the Worker's Feet
 C = Clearance to Obstruction During

Fall Arrest (1 Ft Required Plus 1 Ft for D-Ring Movement and System Materials Stretch = 2 Ft Total)
 RD = Required Distance Below Anchor Point to Nearest Obstruction
 $RD = LL + DD + HH + C$

- System components are generally designed to accommodate a specific maximum weight of the user (and their tools). Do not use any component that is not rated for the weight of the intended user.
- Individual components must be compatible. Refrain from mixing components that were not designed to be used together. Use only a single lanyard or self-retracting lifeline. Never use in series.
- Fall clearance distance is greatly affected by the location of the anchorage point. An anchorage point lower than the height of the body will calculate to a greater fall clearance distance. Use lanyards specifically designed for tying off at feet level if this is necessary.
- Use only the designated anchorage points and fall arrest systems specified for a particular location and application.
- Consult with a representative of a fall protection supply distributor during your selection process to ensure the appropriate ensemble for the intended application.

B. Use

Following are general rules regarding fall arrest components:

- Read and adhere to the manufacturer's instructions for use and care. Strictly adhere to the manufacturer's recommendations for assembling the components, attaching to anchorage points, and fitting of the body harness
- Do not attempt to use a fall arrest system until you have been trained in its use and limitations by a competent person.
- Use a properly sized harness.
- Never attempt to use makeshift components that have not been specifically designed for fall arrest applications.
- Certain work (e.g., welding, painting, electrical arc flash hazard, etc.) may necessitate special design features to minimize potential damage to system components. Use only components that are compatible with the work task.
- After sustaining a fall, immediately remove the system from service. Depending on the type of system, it may need to be destroyed or returned to the manufacturer for refurbishment in accordance with the manufacturer's requirements. In addition, have anchorage points inspected by a competent or qualified person.
- Consider other possible environmental hazards (e.g., heat, chemicals, corrosive environments, high voltage power lines, moving machinery, sharp edges, etc.) and implement additional risk mitigation as appropriate.

Training

Every employee exposed to a fall hazard must receive training before they are assigned to a task that puts them at risk of fall from an elevated working-walking surface. At a minimum, this training must include the following topics:

- Nature of the fall hazards to which an employee is exposed.
- Information on the specific fall protection systems in use. In the case of personal fall arrest systems, this would include:
 - Proper assembly of the personal fall arrest system to be used.

- Location of appropriate anchorage points and proper means of attachment to the anchorage points.
- Proper inspection techniques for all components of the personal fall arrest system.
- Instruction on care and storage of personal fall arrest system.
- Instruction on procedure for removing components of the personal fall arrest system from service.
- Details on the established rescue plan.

Retraining is required when:

- Changes in the workplace render previous training incomplete or obsolete;
- Changes in the types of fall protection systems or equipment to be used render previous training incomplete or obsolete;
- Inadequacies in an employee's knowledge or use of fall protection systems or equipment indicate that the employee has not retained the requisite understanding or skill.

Supervisors are responsible to maintain a training record to include the name of the employee, date(s) of training, name of the person conducting the training, and content of the training to include specific name/model of fall equipment.

Inspection

All personal fall arrest systems must be inspected. Inspection requirements vary between the various cited standards. OSHA's Construction standard only requires the user to conduct an inspection before each use. ANSI standards require the user to conduct an inspection before each use and periodic inspections by a competent person. ANSI standards also require periodic factory authorized inspection of self-retracting lifelines, the frequency of which depends on use. At UNL, EHS encourages adherence to the inspection requirements stated in the ANSI standard.

User visual inspections shall include the following:

A. Full Body Harness

- Inspect for cleanliness. Follow manufacturer's recommendations for cleaning.
- Closely examine all of the nylon webbing to ensure there are no burn marks or holes.
- Verify there are no torn, frayed, broken fibers, pulled stitches, or frayed edges.
- Verify the presence of legible labels.
- Examine dee-ring for excessive wear, pits, deterioration, cracks, or corrosion.
- Verify that buckles are not deformed, cracked, and will operate correctly.
- Check to see that all grommets and rivets are secure and not deformed.

B. Lanyards/Shock Absorbing Lanyards

- Check lanyard material for cuts, burns, abrasions, kinks, knots, burns, broken stitches, excessive wear or soiling/staining, brittleness, chalking, or discoloration.

- Check carabiner for excessive wear, distortion, and lock operation.
- Ensure that all locking mechanisms seat and lock properly. Once locked, locking mechanism should prevent hood from opening.
- Verify that points where the lanyard attaches to the snaphooks are free of defects.

C. Snaphooks/Carabiners

- Inspect for cleanliness. Follow manufacturer's recommendations for cleaning.
- Inspect snaphook for any hook and eye distortions.
- Verify there are no cracks, pitted surfaces, eye distortions, sharp edges, burrs, or corrosion.
- The keeper latch should not be bent, distorted, or obstructed.
- Verify that the keeper latch seats into the nose without binding.
- Verify that the keeper spring securely closes the keeper latch.
- Test the locking mechanism to verify that the keeper latch locks properly.

D. Self-Retracting Lanyards

- Visually inspect to ensure there is no physical damage to the body.
- Make sure all back nuts or rivets are tight.
- Make sure the entire length of the nylon strap is free of any cuts, burns, abrasions, kinks, knots, broken stitches, and excessive wear and retracts freely.
- Test the unit by pulling sharply on the lanyard to verify that the locking mechanism is operating correctly.
- Verify that it has been factory inspected at the proper interval.

E. Tie-Off Adaptors/Anchorages

- Inspect hardware for damage, distortion, sharp edges, burrs, cracks, and corrosion.
- Inspect webbing for cuts, burns, tears, abrasions, frays, excessive soiling, and discoloration. Inspect stitching for pulled or cut stitches.
- Inspect anchors for cracks, sharp edges, burrs, deformations, corrosion, distortion, and as otherwise recommended by the manufacturer.

Safe Retrieval Plan

A safe retrieval plan must be established by a competent person in case someone becomes suspended in the air as a result of a fall. The plan should include equipment available to retrieve a suspended person and all workers should understand the plan. The plan should be designed to minimize the amount of time in suspension and consider the systems used, heights involved, hazards present, and potential medical situations.

For more information on the risk of injury from suspension after a fall and the importance of a safe retrieval plan, visit the OSHA web site at:

<<http://www.osha.gov/dts/shib/shib032404.html>>.

Definitions

Anchorage means a secure point of attachment for lifelines, lanyards, or deceleration devices.

Connectors means a device which is used to connect parts of the personal fall arrest system and position device systems together. It may be an independent component of the system, such as a carabiner, or it may be an integral component of part of the system (such as a buckle or dee-ring sewn into a body harness, or a snap-hook spliced or sewn to a lanyard or self-retracting lanyard).

- *Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials. Connectors shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of the system. Dee-rings and snaphooks shall have a minimum tensile strength of 5,000 pounds. Only locking type snaphooks shall be used.*

Body harness means straps which may be secured about the employee in a manner that will distribute the fall arrest forces over at least the thighs, pelvis, waist, chest and shoulders with means for attaching it to other components of a personal fall arrest system.

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

Lifeline means 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 which serves as a means for connecting other components of a personal fall arrest system to the anchorage.

Competent person means a person who is capable of identifying existing and predictable hazards and has authorization to take prompt corrective measures to eliminate them.

- *Competent persons are often supervisors or foremen who are experienced in fall protection as it relates to the specific tasks to be conducted.*

Qualified person means one with a recognized degree or professional certificate and extensive knowledge and experience in the subject field (fall protection and rescue) who is capable of design, analysis, evaluation and specifications in the subject work, project, or product (fall protection and rescue); and who has requisite authority.

- *Qualified persons often possess an engineering degree, which allows them to design systems and conduct structural analysis, calculation of impact forces and clearances, testing, anchorage certification, methods of control, equipment selection, etc.*