

FESHM 7060: FALL PROTECTION PROGRAM

Revision History

Author	Description of Change	Revision Date
Angela Aparicio David Cathey Tom Gibbs	Revised the fall rescue plan requirements in Section 5.2 and created a fall rescue plan form. Clarified blanket 6-foot fall protection rule for all construction activities, including steel erection and scaffolding erection, use and dismantlement.	February 2021
Angela Aparicio Raul Cantu Tom Gibbs	Updated to meet revised OSHA Walking Working Surfaces updates <ul style="list-style-type: none"> • Added additional definitions • Addition of requirements for openings, holes and dockboards • Revised requirements for travel/fall restraint anchors and positioning systems • Clarified harness/lanyard design standard requirements (ANSI Z359.1-2009 or later) • Added reference to FESHM 7080 for non-fall protection concrete anchors 	September 2020
John Cassidy	<ul style="list-style-type: none"> • Updated the ANSI references • Clarified the language regarding annual inspections of personal fall arrest system components • Corrected the calculations of Appendix 4 • Removed Section 11 Audits and Evaluations because self-assessments are outlined in QAM 12080 • Added anchorage points and lifelines to Appendix 2 	September 2014
John Cassidy	Changes were editorial in nature with no changes to policies or procedures.	April, 2011

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1.0 INTRODUCTION AND SCOPE

The nature of work activities at Fermilab (and spaces rented/leased by Fermilab) exposes workers to a variety of fall hazards while performing inspection, service, maintenance, repair, experiment support, and building remodeling projects. The first approach to fall protection safety is to prevent a fall from occurring. When fall prevention is not possible, fall protection in the form of fall positioning, travel restraint or a personal fall arrest system is required in accordance with Title 29 of the Code of Federal Regulations (CFR) Parts 1910 and 1926.

One hazard that comes as a result of a fall while wearing a harness is that of orthostatic intolerance. Following a fall, a worker may remain suspended in a harness. Depending on the length of time the suspended worker is hanging, the worker may sustain injuries resulting from orthostatic intolerance, which could ultimately lead to death. For this reason, when planning a job involving the use of fall protection, where a worker could become suspended, a rescue action must be identified.

2.0 DEFINITIONS

Anchorage – A secure point of attachment for lifelines, lanyards or deceleration devices able to withstand 5000 pounds of dead weight per person for fall arrest systems; and 3000 pounds for positioning systems.

ANSI – American National Standards Institute

Body Harness - Straps which may be secured about the worker 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.

Capacity (CAP) – The combined weight for which the component is designed to be used. Combined weight includes the user's body weight and clothing, tools, and other objects borne or carried by the user.

Carabiner – A connector component generally comprised of a trapezoidal or oval shaped body with a normally closed gate or similar arrangement which may be opened to permit the body to receive an object and, when released, automatically closes to retain the object. It has a self-closing mechanism that requires at least two consecutive deliberate actions to open.

Certification – An act or process resulting in documentation that determines and attests to criteria that meet the requirements of ANSI Z359.1. Such act or process may be carried out by testing or applying proven analytical methods, or both, under the supervision of a qualified person or entity.

CFR – Code of Federal Regulations

Competent Person - A person who is capable of identifying hazardous or dangerous conditions in any personal fall arrest system or any component thereof, as well as in their application and use with related equipment.

Connector - Means a device which is used to couple (connect) parts of the personal fall arrest system and positioning 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 D-ring sewn into a body harness, or a snap-hook spliced or sewn to a lanyard or self-retracting lanyard).

Construction – The combination of erection, installation, assembly, demolition, or fabrication activities involved to create a new facility or to alter, add to, rehabilitate, dismantle, or remove an existing facility. Construction also includes the alteration and repair (including dredging, excavating, and painting) of buildings, structures, or other real property, as well as any construction, demolition, and excavation activities conducted as part of environmental restoration or remediation efforts.

Deceleration Device - Any mechanism with a maximum length of 3.5 feet, such as a rope grab, rip stitch lanyard, tearing or deforming lanyards, self-retracting lifelines, etc. which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limit the energy imposed on the worker during fall arrest.

Deceleration Distance - Means the additional vertical distance a falling worker travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which the deceleration device begins to operate. It is measured as the distance between the location of a worker's body belt or body harness attachment point at the moment of activation (at the onset of fall arrest forces) of the deceleration device during a fall, and the location of that attachment point after the worker comes to a full stop. See Technical Appendix 4 for calculating total fall distance.

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.

Dockboard – A portable or fixed device that spans a gap or compensates for a difference in elevation between a loading platform and a transport vehicle. Dockboards include, but are not limited to, bridge plates, dock plates, and dock levelers.

Fall Hazard – Any condition on a walking-working surface that exposes a worker to a risk of harm from a fall on the same level or to a lower level.

Fall Protection System - A barrier erected to prevent workers from falling to lower levels. It can also be a system/procedure intended to prevent workers from falling off, onto or through working levels.

Free Fall – The act of falling before the personal fall arrest system begins to react by applying force to arrest the fall.

Free Fall Distance - The vertical displacement of the fall arrest attachment point on the worker's body harness between onset of the fall and just before the system begins to apply force to arrest the fall (maximum of 6 feet). This distance excludes deceleration distance, and lifeline/lanyard elongation, but includes any deceleration device slide distance or self-retracting lifeline/lanyard extension before they operate and fall arrest forces occur.

Hole – A gap or void in a floor, roof, horizontal walking-working surface, or similar surface that is at least 2 inches (5 cm) in its least dimension.

Inspection - The activity of investigating or assessing the condition of equipment, buildings, and property to determine the status and any required actions prior to the commencement of construction work and upon the completion of the work.

- *Note: No fall protection is required for roof inspections conducted under 1926.500 prior to commencement of work or after work is complete.*

Lanyard - A flexible line of rope, wire rope, or strap which generally has a connector at each end for connecting the body belt or body harness to a deceleration device, lifeline or anchorage.

Leading Edge – The edge of a floor, roof, or formwork for a floor or other walking/working surface (such as the deck) which changes location as additional floor, roof, decking, or formwork sections are placed, formed, or constructed. A leading edge is considered to be an “unprotected side and edge” during periods when it is not actively and continuously under construction.

Lifeline - 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.

Low Slope Roof – A roof that has a slope less than or equal to a ratio of 4 in 12 (vertical to horizontal).

OSHA – Occupational Safety and Health Administration

Opening – A gap or open space in a wall, partition, vertical walking-working surface, or similar surface that is at least 30 inches (76 cm) high and at least 18 inches (46 cm) wide, through which a person could fall to a lower level.

Personal Fall Arrest System (PFAS) - A system used to arrest a worker in a fall from a walking-working surface. It consists of an anchorage point, connectors, and a body harness and may include a lanyard, deceleration device, lifeline, or suitable combinations of these. As of January 1, 1998, the use of a body belt for fall arrest is prohibited.

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, allows an employee to be supported on an elevated vertical surface, such as a wall or window sill, and work with both hands free while leaning. Positioning devices limit free falls to two feet or less. Positioning devices must be secured to an anchorage capable of supporting at least 3000 pounds.

Qualified Person- One with a recognized degree or professional certificate and/or extensive knowledge, training, and experience in the subject field that 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 a worker 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). Rope descent systems do not include industrial rope access systems.

Rope Grab - A deceleration device which travels on a lifeline and automatically, by friction, engages the lifeline and locks so as to arrest the fall of a worker. A rope grab usually employs the principle of inertial locking, cam/level locking, or both.

Self-Retracting Lifeline/Lanyard - A deceleration device containing a drum-wound line which can be slowly extracted from, or retracted onto, the drum under slight tension during normal worker movement, and which, after onset of a fall, automatically locks the drum and arrests the fall.

Travel Restraint System – A combination of anchorage, anchorage connector, lanyard, and body support that limits travel in such a manner that the user is not exposed to a fall hazard. Travel restraint anchorages must be capable of withstanding a force of 3,000 pounds or twice the maximum expected force that is needed to restrain the person from exposure to the fall hazard.

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 a worker from falling to a lower level.

Walking-Working Surface – Any horizontal or vertical surface on or through which a worker walks, works, or gains access to a work area or workplace location.

Warning Line – A barrier erected to warn personnel 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.

Work Activities – All work performed throughout the Lab that has not been deemed construction.

3.0 RESPONSIBILITIES

3.1 Division/Section/Project Manager

- Identifying activities that present a fall hazard to their workers under their control.

- Assigning a competent person to review the work, developing a hazard analysis, and implementing internal procedures.
- Assuring workers are trained in fall protection measures.
- Incorporating fall protection requirements into designs for new and retrofitted equipment as well as planned and existing structures where known or predictable fall hazards are expected to occur.
- Involving a qualified person when load rating of anchorage points must be determined or is in doubt.
- Ensuring all personal fall arrest system components are inspected annually.
- Identifying anchor points in buildings or installing new ones where necessary in accordance with the policy.

3.2 Division Safety Officer (DSO)

- Providing guidance to supervisors, employees, and users on acceptable fall protection equipment that may be necessary to complete work.

3.3 Task Managers/Construction Coordinators/Service Coordinators

- Verifying that fall protection training was completed for subcontractor workers who will/are exposed to a fall hazard.
- Verifying that the subcontractor has a written fall rescue plan in place before any subcontractor worker is exposed to a fall hazard. The fall rescue plan may be part of the written hazard analysis or may be attached to the hazard analysis as a separate document.
- Exchanging information regarding fall hazards and fall protection in Fermilab owned facilities during pre-construction meetings.
- Obtaining information from the subcontractor regarding fall protection methods that the subcontractor will follow while engaged in work activities.

3.4 Supervisors/Points of Contact

- Defining work as Construction, if applicable.
- Determining applicable standards, precautions, and training per the flow charts in 7060 Technical Appendix 7.1 and 7.2 Fall Protection Flow Charts.
- Identifying workers exposed to fall hazards in the Individual Training Needs Assessment (ITNA), and assuring they are trained before using a fall protection device.
- Ensuring personnel who utilize personal fall protection equipment have an adequate hazard analysis (see [FESHM 2060](#)) and fall rescue plan.
- Observing workers while engaged in work at heights, ensuring protection methods are being followed per the work plan and addressing/correcting any observed at-risk behaviors.
- Assuring that fall rescue plans are incorporated into the hazard analysis before a worker is exposed to a fall.

3.5 Fall Protection Users

- Complete initial and requalification fall protection/prevention training.
- Inspects personal fall arrest/travel restraint systems prior to use.
- Works in compliance with this program.

3.6 ES&H Section

- Providing consultation by a competent person to D/S/P personnel upon request.
- Developing, providing and updating fall protection training.
- Assisting divisions, sections and projects in fall protection assessments when requested.
- Providing annual inspections of fall protection equipment by a competent person and maintaining inspection documentation.

4.0 PROGRAM DESCRIPTION

Any employee, visiting scientist, subcontractor, or user involved in work activities and exposed to a fall hazard at or greater than four (4) feet must be trained to recognize fall hazards and the selection and use of fall prevention, travel restraint equipment or personal fall arrest equipment. For **all** construction activities, the fall hazard cannot be at or greater than six (6) feet. This includes steel erection work, scaffolding erection, use and dismantlement, etc.

29 CFR 1910 and 29 CFR 1926 shall be followed when the work involves hazards that require fall protection. Exceptions to fall protection requirements, as provided in 29 CFR 1926.500, are **ONLY** for construction-related activities.

Individuals whose weight falls outside the range of 130 to 310 pounds will require additional work planning before wearing fall protection. Consult with your Division Safety Officer (DSO) in these situations.

A written Hazard Analysis and written fall rescue plan is required for any work activities requiring the use of fall arrest systems where there is the potential for a person to be suspended after a fall arrest event. (This includes the use of fall protection equipment in aerial lifts.)

5.0 PROCEDURES

5.1 Education and Training Requirements

Any worker, visiting scientist, or subcontractor involved in work activities and exposed to a fall hazard must be trained and made aware of the fall hazards and the use of fall protection equipment. At a minimum, the training shall include:

- Recognition of the hazard,
- The nature of fall hazards in work areas,
- The procedures to be followed to minimize fall hazards,
- The correct way to use/inspect/maintain fall protection systems,
- Identification of required anchor points, and
- Employee and employer responsibility.

For Fermilab employees and scientific users, this can be accomplished by completing FN000304 - *Fall Protection Orientation*. To remain qualified, they must also attend refresher training in fall protection principles and practices every two years. This training may be classroom-based or computer-based.

5.2 Work Planning and Fall Rescue

A written [Hazard Analysis \(HA\)](#) is required whenever the free fall distance could result in the worker left in a suspended position. A fall rescue plan must be included with or attached to the HA and shall include emergency procedures, methods of rescue, and equipment required for a timely rescue to prevent the consequences of orthostatic shock/suspension trauma.

A rescue plan should include more than one approach to provide assistance in the event of a fall. The rescue response procedure should follow these guidelines:

- Call x3131 prior to rescue attempt. – Calling x3131 alone is not an acceptable rescue plan and the plan must incorporate and document at least one of the methods listed below into the plan.
- Initiate rescue assist utilizing rescue equipment – list out methods you will use to get the fall victim either to the ground safely or so they can relieve pressure on the legs from the harness, considering the following:
 - Self-rescue
 - Assisted self-rescue
 - Unconscious state with mechanically aided hauling/rope system
 - Assisted rescue with aerial lift
 - Assisted rescue from an aerial lift
 - Ground controls
 - Second aerial lift
- Following rescue assist, ensure victim is seen by the Fermilab Fire Department or Fermilab Medical Office, then make notifications to line management and the ESH representative.

The Fermilab Fire Department (FFD) can be consulted before work begins to inform them of where the work site is located and what some of the potential access problems may be, as well determining out how long it could take for an ambulance or fire truck to get to the site. Ask the FFD, if necessary, to come to the job site to assess any specific job risks. When working in areas that present unique hazards (e.g. underground, hi-rise work), notify the FFD prior to utilizing fall protection in these areas.

Information to consider for the fall rescue plan:

- What is the emergency contact information, such as the Fermilab Fire Department, and what are the instructions for summoning immediate assistance?

- Is rescue equipment immediately available for this location? (Ladders, aerial devices, elevating work platforms, tripods, additional harnesses, controlled descent devices, winches, pulleys, etc.)
- What obstructions may be in the way of reaching the suspended worker?
- How will rescue be assured within 15 minutes of the occurrence of a fall to minimize the risk of further injury or death due to suspension trauma?
- How will the safety of the rescuers be assured as well as that of the suspended worker?
- What communication systems will be used between the suspended worker and rescue team?

Subcontractors must develop fall rescue plans for their work that involves the use of fall protection and the subcontractor must provide trained personnel to perform rescue duties. Those trained personnel must be on the job site when there is a possibility of a worker being suspended after a fall.

The Fall Rescue Plan form (Form 7060-F1) is available for personnel to develop their rescue plans.

5.3 Fall Protection Systems

The following is a list of the various types of fall protection systems that may be used at Fermilab. See Technical Appendix 3 – Fall Protection Equipment – Selection and Use for additional information.

5.3.1. Permanent Facilities Work Platforms

Fall prevention is required when workers are working off a permanent platform and the height from the platform surface to the lower level is at or above four (4) feet but less than six (6) feet. Fall prevention is achieved by installing railings on the platform and on the stairs leading to the platform. Fall prevention can also be achieved by installing a restraint system if the installation of railings is not feasible. At six feet or higher, either fall prevention or fall protection may be used.

5.3.2. Travel Restraint System

This system consists of a harness, a non-shock absorbing lanyard or restraint line and anchorage point. It will allow a worker to approach a fall hazard and work with both hands free, and yet not allow the worker to fall any distance. The harness must be attached to securely rigged restraint lines. The anchorage should be able to withstand a minimum force of 3000 pounds or twice the maximum expected force that is needed to restrain the person from exposure to the fall hazard. Anchorages must be labeled stating “This anchorage is for travel restraint use only. DO NOT use for fall arrest.”

Restraint protection shall be rigged to allow the movement of workers only as far as the sides and edges of the walking/working surface.

5.3.3. Custom Made Fall Protection Systems

There may be instances where a work process and the environment do not lend themselves to using commercially available equipment. In these cases, the division or section may design a fall protection system in-house or procure custom designed systems from several companies that engage in this kind of service. However, there are steps that must be taken to ensure that the system meets all the parameters required by the performance standards within OSHA and ANSI.

1) Fermilab Designed Systems

A Fermilab qualified engineer may design a system and oversee the installation. Acceptance of the system requires an engineering note that must be created and accepted. The engineering note must also include installation specifications.

Excluded from the requirement are systems designed as part of new construction or modifications that are included in engineering drawings and specifications and signed by a Fermilab professional engineer, or a professional engineer from a contractor under contract to Fermilab.

Oversight over the installation of the system may be by the designer or by a qualified task manager or construction coordinator. The task manager or construction coordinator must create and sign a document certifying that the installation followed the specifications laid out by the designer. The original certification will be attached to the engineering note and the documentation shall be stored in Teamcenter.

2) Commercially Designed Systems

Systems designed by companies who specialize on fall protection systems must also follow similar rules as systems designed by a Fermilab engineer. The company must provide a product sheet that describes the system as meeting the OSHA and ANSI standards for fall protection. Installation specifications must also be provided. Installation of the system must be by subcontractors who are qualified to do so.

These custom designed systems are subject to yearly inspections by a qualified person. Inspections must be documented. The qualified person may be a Fermilab employee or a subcontractor meeting the definition.

5.4 Working from Articulating and/or Telescoping Boom Lifts

Anyone working from a telescoping and/or articulating boom lift and bucket trucks must wear a personal fall arrest system attached to the manufacturer's designated anchorage point.

The use of a personal fall arrest system is not required on scissor lifts as long as the guardrail system is intact and both feet are on the platform; unless required by the manufacturer.

5.5 Personal Fall Arrest System Components Inspection

To maintain their service life and high performance, all personal fall arrest system components must be visually inspected before each use. In addition, a competent person shall inspect all personal fall arrest system components every 12 months and document the inspection. If any personal fall arrest system component is found to be deficient, it shall be taken out of service immediately and replaced.

All components of a personal fall arrest system shall be removed from service if subject to a fall.

Marking or writing can only be done on the blank label in the back of the harness label pack to use for identification.

Technical Appendix 3 provides specific guidance in conducting these inspections.

5.6 Loading Dock (Dockboard) Requirements

Dockboards put into service on or after January 17, 2017 must be designed, constructed and maintained to prevent transfer vehicles from running off the dockboard edge. Personnel must be protected from falling 4 feet (1.2 m) or more to a lower level by a guardrail system or handrails. There are some exceptions to this but reach out to the Division Safety Officer (DSO) to determine whether those would apply to the situation.

5.7 Protection from Falling Objects

When a worker may be exposed to falling objects, each worker must wear head protection (e.g. hard hats). In addition, one or more of the following protection methods must be implemented:

- Erecting toeboards, screens, or guardrails systems to prevent objects from falling to a lower level.
- Erecting canopy structures and keeping potential falling objects far enough from an edge, hole, or opening to prevent them from falling to a lower level.
- Barricading the area into which objects could fall, prohibiting workers from entering the barricaded area, and keeping objects far enough from an edge or opening to prevent them from falling to a lower level.

5.8 Protection of Holes and Openings

5.8.1. Holes

Each worker must be protected from falling through any hole (including skylights) that is 4 feet (1.2 m) (6 feet (1.8 m) for construction) or more above a lower level by use of covers, guardrail systems, travel restraint systems or personal fall arrest systems.

Each worker must be protected from tripping or stepping into or through any hole that is less than 4 feet (1.2 m) for general industry (6 feet (1.8 m) for construction) above a lower level by covers or guardrail systems.

Each worker must be protected from falling into a ladderway floor hole or ladderway platform hole by a guardrail system and toeboards erected on all exposed sides, except at the entrance to the hole, where a self-closing gate or an offset must be used. There is no allowance for grandfathering systems in.

5.8.2. Openings

Each worker on a walking-working surface near an opening, including one with a chute attached, where the inside bottom edge of the opening is less than 39 inches (99 cm) above that walking-working surface and the outside bottom edge of the opening is 4 feet (1.2 m) (6 feet (1.8 m) for construction) or more above a lower level is protected from falling by the use of a guardrail system, safety net system, travel restraint system or personal fall arrest system.

6.0 REFERENCES

29 CFR 1910, General Industry Standards (specific subparts are referenced in the flow diagram found in the Technical Appendix)

29 CFR 1926, Subpart M – Fall Protection (Construction Standards)

FESHM 2060, Work Planning and Hazard Analysis

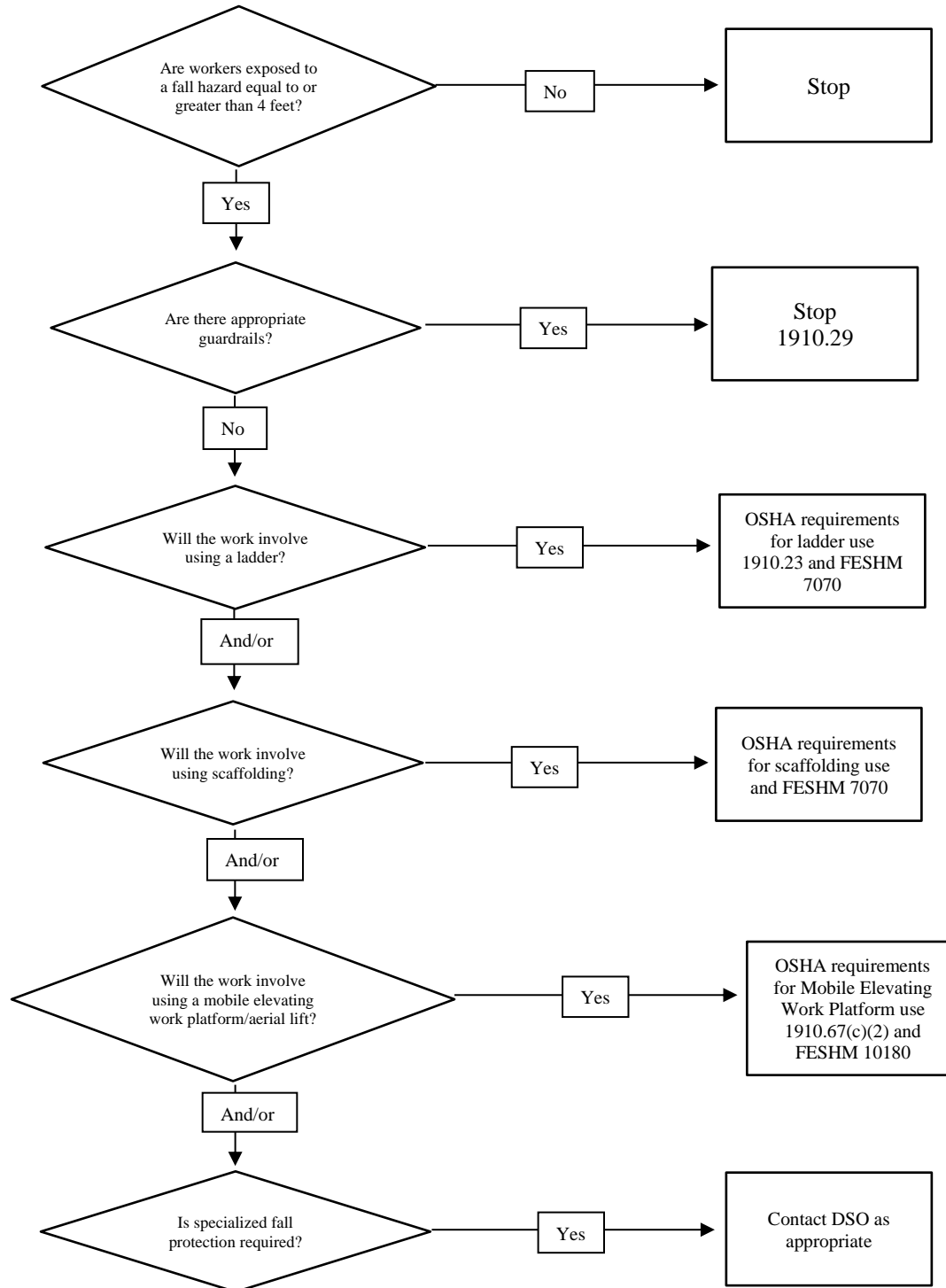
FESHM 7080, Concrete Anchor Devices

ANSI/ASSP Z359 – The Fall Protection Code

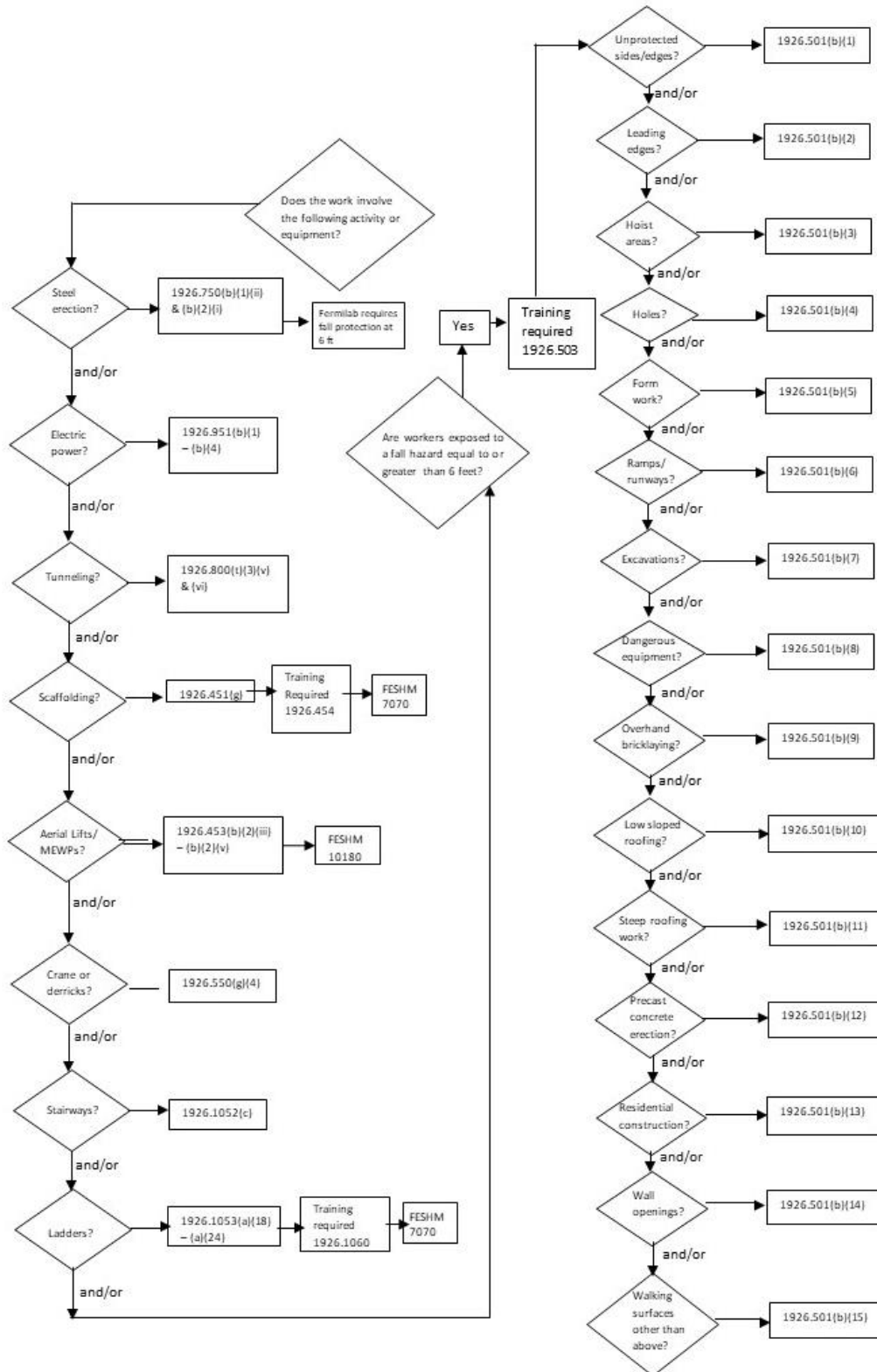
ANSI/ASSP A10.32 – Personal Fall Protection Used in Construction and Demolition Operations

7.0 TECHNICAL APPENDICES

7.1 Fall Protection Flow Chart – General Industry



7.2 Fall Protection Flow Chart - Construction



7.3 Inspection, Storage, Care and Maintenance of Personal Fall Arrest Systems Guidance

Manufacturer's instructions shall be retained on file for reference. All fall protection equipment will be inspected annually by a competent person. The inspections must be documented. Any equipment that shows signs of damage must be removed from service and given to the competent person who will dispose and can assist in replacement of the equipment.

7.3.1. Anchorage Points/Lifelines

Newly installed anchorage points/lifelines must be inspected by a competent person prior to initial use, and annually thereafter. Anchorage points and lifelines must be inspected daily by the personnel who will be using them.

Pay special attention to any cracks developing around the anchor points or if the anchor points are unstable or loose. End users shall not tie-off to unsafe anchorages and they must bring it to the attention of the competent person if such a situation exists.

Fall arrest anchors shall be labeled as "For Fall Protection Only." Travel/fall restraint anchors must be labeled to indicate they are for travel/fall restraint use only.

All concrete anchors, including fall protection anchors must meet the requirements of [FESHM 7080: Concrete Anchors](#) for inspection, care and maintenance requirements. Fall protection anchors are not tested after installation.

7.3.2. Harness Inspection

1. For a harness, inspections begin at one end. Hold the body side of the belt toward you, grasping the belt with your hands six to eight inches apart. Bend the belt in an inverted "U." Watch for frayed edges, broken fibers, pulled stitches, cuts or chemical damage.
2. Check D-rings and D-ring metal wear pads for distortion, cracks, breaks, and rough or sharp edges. The D-ring bar should be at a 90-degree angle with the long axis of the belt and should pivot freely.
 - a. D-rings must be capable of sustaining a minimum tensile load of 5,000 pounds. D-rings must meet the design standards of ANSI Z359.1-2009 or later and will be so marked.
3. Attachments of buckles and D-rings should be given special attention. Note any unusual wear, frayed or cut fibers, or distortion of the buckles. Rivets should be tight and irremovable with fingers. Body side rivet base and outside rivets should be flat against the material. Bent rivets will fail under stress.
4. Inspect frayed or broken strands. Broken webbing strands generally appear as tufts on the webbing surface. Any broken, cut or burnt stitches will be readily seen.
5. Tongue Buckle: Buckle tongues should be free of distortion in shape and motion. They should overlap the buckle frame and move freely back and forth in their socket. Rollers should turn freely on the frame. Check for distortion, sharp edges, and loose, distorted, or broken grommets.
6. Friction Buckle: Inspect the buckle for distortion. The outer bar or center bars must be straight. Pay special attention to corners and attachment points of the center bar.

7.3.3. Lanyard Inspection

When inspecting lanyards, begin at one end and work to the opposite end. Slowly rotate the lanyard so that the entire circumference is checked. Spliced ends require particular attention. Hardware should be examined under procedures detailed below.

1. Snap-hooks/carabiners

Snap hooks and carabiners must be capable of sustaining a minimum tensile load of 5,000 pounds. Snap hooks and carabiners gate strength must be capable of withstanding a minimum load of 3,600 pounds without the gate separating from the nose of the snap hook or carabiner body by more than 0.125 inches.

Snap hooks and carabiners must be the automatic locking type that require two consecutive movements to open.

The snap hook or carabiner must meet the design standards of ANSI Z359.1-2009 or later and will be so marked.

2. Web Lanyard

While bending webbing over a piece of pipe, observe each side of the webbed lanyard. This will reveal any cuts or breaks. Due to the limited elasticity of the web lanyard, fall protection without the use of a shock absorber is not recommended.

3. Rope Lanyard

Rotation of the rope lanyard while inspecting from end to end will bring to light any fuzzy, worn, broken or cut fibers. Weakened areas from extreme loads will appear as a noticeable change in original diameter. The rope diameter should be uniform throughout, following a short break-in period. When a rope lanyard is used for fall protection, a shock-absorbing system should be included.

4. Shock-Absorbing Packs

The outer portion of the shock-absorbing pack should be examined for burn holes and tears. Stitching on areas where the pack is sewn to the D-ring, belt or lanyard should be examined for loose strands, rips and deterioration.

5. Visual Indication of Damage to Webbing and Rope Lanyards

Heat - In excessive heat, nylon becomes brittle and has a shriveled brownish appearance. Fibers will break when flexed and should not be used above 180 degrees Fahrenheit.

Chemical - Change in color usually appears as a brownish smear or smudge. Transverse cracks appear when belt is bent over tight. This causes a loss of elasticity in the belt.

Ultraviolet Rays - Do not store webbing and rope lanyards in direct sunlight. Ultraviolet rays can reduce the strength of some materials.

Molten Metal or Flame - Webbing and rope strands may be fused together by molten metal or flame. Watch for hard, shiny spots or a hard and brittle feel. Webbing will not support combustion, nylon will.

Paint and Solvents - Paint will penetrate and dry, restricting movements of fibers. Drying agents and solvents in some paints will appear as chemical damage.

Hardware - Inspect snap hooks closely for hook and eye distortion, cracks, corrosion, scale, pitted surfaces or deposits of foreign matter. The keeper or latch should seat into the nose without binding and should not be distorted or obstructed. The keeper spring should exert sufficient force to firmly close the keeper. Keeper rocks must provide the keeper from opening when the keeper closes.

Thimbles - The thimble (protective plastic sleeve) must be firmly seated in the eye of the splice, and the splice should have no loose or cut strands. The edges of the thimble should be free of sharp edges, distortion, or cracks.

7.3.4. Care and Storage of Equipment

Basic care for fall protection safety equipment will prolong the life of the equipment and contribute toward the performance of its vital safety function. Proper storage and maintenance after use is as important as cleaning the equipment of dirt, corrosives or contaminants. The storage area should be clean, dry and free of exposure to fumes, mists, vapors or corrosive elements.

For nylon and polyester articles, clean according to the manufacturer's instructions. Drying- Harness, belts and other equipment should be dried thoroughly without exposure to heat, steam or long periods of sunlight.

7.4 Fall Protection Harnesses

Fall protection harnesses are designed for a capacity range of 130 pounds to 310 pounds (59- 140 Kg). This range is selected in order to stay within the maximum arresting force of 1800 pounds directed by government safety regulations. Workers outside these parameters must undergo an evaluation by the respective ESH representative before they are allowed to use a personal fall arrest system. If allowed to use fall arresting gear these workers are restricted to the use of a retractable lanyard.

WARNING

All straps built into the harness must be attached as per the manufacturer's instructions. Leaving the leg straps unhooked may cause the user to slip through and out of the harness with the possibility of serious injury or death.

Hoisting materials with any component of a worker positioning system or with any component of a personal fall arrest system is prohibited.

All components of a personal fall arrest system subjected to the stresses of a fall must be taken out of service and disposed of properly.

Fall protection equipment purchased to protect workers from a fall hazard cannot be used for any other purpose. Equipment subjected to the forces of a fall arrest must be rendered inoperable and removed from service immediately or be sent to the ES&H Section for use as a training aid and marked "NOT FOR FALL PROTECTION USE".

Snap hooks and carabiners shall be self-closing and self-locking and shall be capable of being opened by at least two consecutive deliberate actions. Snap hooks and carabiners must be marked with ANSI Z359.12-2009 or later.

The shock absorber end on the lanyards must be connected next to the D-ring with the other end attached to the anchorage point. Do not use two connectors on the same D-ring.

7.5 Calculating Total Fall Distance

To avoid striking a lower surface by any part of the body, it is necessary for the user of a PFAS to understand clearly the total distance traveled from the onset of a fall to the end of the fall. To understand the calculation, we will assume that the anchorage point and the D-ring of the harness are at the same level.

Total Distance traveled¹ = total length of the lanyard + total length of extended shock absorber² + height of the person³ + Stretch⁴ ± (diff. from anchor to D-Ring)⁵

Note 1: This is the total distance from anchorage point to the bottom of the feet at the end of a fall.

Note 2: The shock absorber may be a rip stitch type or bungee cord type. Regardless of type, any shock absorber will elongate a total of 42 inches (3½ feet). This elongation is prescribed in ANSI Standard 359.1-1992 (R1999).

Note 3: Height is determined to nearest foot. For example, a person 5 Ft 6 in. in height would use 6 ft. as his/her height. A person 5 Ft 5 inches would use 5 ft. as his/her height.

Note 4: Stretch must be accounted for because all fall protection lanyards, shock absorbers and harnesses are made of synthetic fiber such as nylon or polyester. At the end of a fall these materials will stretch depending on the weight of the person. Account for a distance of 3- 5 ft. of stretch based on your body weight and tools. For workers whose body weight with tools is less than 250 pounds may use 3 feet for stretch. Workers over whose body weight with tools exceed 250 pounds may use 5 feet.

Note 5: Add the difference in feet if the anchor point is below the D-Ring or subtract the difference in feet if the anchor point is above the D-Ring. Using a person that is 6ft tall weighting 200 pounds and tied to an anchorage 2 feet above the D-Ring using a 6ft shock absorbing lanyard. The total distance for the fall would be,

Total Distance= 6+3½ feet+6 + 3 – 2= 16½ feet (In this example the free fall is only 4 ft.)

If tied below the D-Ring by two feet, then the distance is:

*Total Distance= 6+3½ feet+6 + 3 + 2= 20½ feet (In this example the free fall would be 8 ft. **)*

**** A free fall of more than 6ft is strictly prohibited by the standards. In this case, all that the wearer of a personal fall arrest system can use would be a 4ft shock absorbing lanyard to be able to remain within the 6 ft. rule.**