SECTION 21

FALL PROTECTION

21.A GENERAL.

a. The ***fall protection threshold height requirement is 6 ft (1.8 m) for ALL WORK covered by this manual, unless specified differently below, whether performed by Government or Contractor work forces,*** *to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work.*

b. For all ***permanent facilities*** *(including* ***USACE-owned/operated fixed facilities)*** *with open-sided floors, platforms or unprotected edges 4 ft (1.2m) or more above adjacent floor or ground level, see Section 24.A.01.d.*

c. Floating plant and vessels are excluded from these requirements except where specifically cited in Sections 19.D and 19.E.

21.A.01 Workers exposed to fall hazards shall be protected from falling to a lower level by the use of standard guardrail as defined in

21.E.01.b, work platforms, temporary floors, safety nets, engineered fall protection systems, personal fall arrest systems, or the equivalent, in the following situations:

a. Whenever workers are exposed to falls from unprotected sides or edges, access ways; fixed ladders over 20 ft (6 m) in height ;unprotected roof edge or floor openings; holes and skylights; unstable surfaces; leading edge work, excavations; scaffolds; formwork; work platforms, re-bar assembly, steel erection and engineered metal buildings;

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b. For access ways or work platforms over water, machinery, or dangerous operations;

c. When installing or removing sheet piles, h-piles, cofferdams, or other interlocking materials from which workers may fall 6 ft (1.8 m) or more. ***> NOTE: The use of sheet pile stirrups as a fall protection method is prohibited****;*

> For Steel Erection activities, when connectors are working at same connecting point, they shall connect one end of the structural member before going out to connect the other end. Whenever possible, the connectors shall straddle the beam instead of walking along the top flange. Connectors shall remain 100% tied off.

d. Where there is a possibility of a fall from any height onto dangerous equipment, into a hazardous environment, or onto an impalement hazard.

21.A.02 The order of control measures (the hierarchy of controls) to abate fall hazards or to select and use a fall protection method to protect workers performing work at heights shall be:

a. Elimination: Remove the hazard from work areas or change task, process, controls or other means to eliminate the need to work at heights with its subsequent exposure to fall hazards (i.e. build roof trusses on ground level and then lift into place or design change by lowering a meter or valve at high locations to a worker's level). This is the most effective control measure;

b. Prevention (Passive or same-level barrier): isolate and separate fall hazards from work areas by erecting same level barriers such as guardrails, walls, covers or parapets;

c. Work platforms (movable or stationary): Use scaffolds, scissors lifts, work stands or aerial lift equipment to facilitate access to work location and to protect workers from falling when performing work at high locations;

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d. Personal Protective Systems and Equipment: Use of fall protection systems, including restraint, positioning or personal fall arrest, (all systems require the use of full body harness, connecting means and safe anchorage system;

e. Administrative Controls: Introduce new work practices that reduce the risk of falling from heights, or to warn a person to avoid approaching a fall hazard (i.e. warning systems, warning lines, audible alarms, signs or training of workers to recognize specific fall hazards).

21.A.03 When using stilts, or working from raised platforms, or floors above a walking/working surface that exposes workers to a fall of 6 ft (1.8 m) or more in areas protected by guardrails, the height of the guardrail must be raised accordingly to maintain a protective height of 42 in (107 cm) above the stilt, raised platform, floors or work stands.

21.A.04 When conducting inspection, investigation or assessment work during construction activities, fall protection is required for employees exposed to fall hazards.

21.A.05 When conducting inspection, investigation and assessment work more than 6 feet (1.8 meters) away from the unprotected leading edge for the purpose of repairs, replacement or improvements, before start of construction or after construction work is complete, fall protection may not be required. When the inspection, investigation and assessment work is conducted within six feet from the unprotected leading edge, fall protection is required. An AHA shall be developed for this activity.

21.B TRAINING.

21.B.01 Each worker who might be exposed to fall hazards from heights shall be trained before using fall protection equipment by a Competent Person for Fall Protection, who is qualified in delivering fall protection training to the workers in the safe use of fall protection systems/equipment and the recognition of fall hazards

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related to their use, including: ***> See Appendix Q for definition of Competent Person for Fall Protection.***

a. The nature of fall hazards in the work area;

b. The correct procedures for erecting, using, dismantling, inspecting, maintaining, and storing fall protection equipment;

c. The application limits, free fall distance, total fall distance and clearance requirements of fall protection systems and equipment;

d. Rescue equipment and procedures;

e. Hands-on training and practical demonstrations;

f. Proper anchoring and tie off techniques;

g. All applicable requirements from this Section.

21.B.02 Retraining shall be provided, as necessary, for workers to maintain an understanding of these subjects.

21.B.03 The employer shall verify worker training by a written certification record identifying the worker trained, the dates of the training, and the signature of the trainer and trainee.

21.B.04 Training of all personnel involved in the FP Program – Program Administrators/Managers, Qualified Persons, Competent Persons, End Users (i.e., Authorized Persons), Authorized Rescuers, as well as any associated FP trainers – shall be as described in ANSI/ASSE Z359.2.

a. Effective the date of this manual, acceptable Competent Person for Fall Protection training shall be a minimum of 32 hours, with a combination of at least 16 hours of formal classroom training and 16 hours of practical application. Training will be performed by a competent person trainer or a qualified person trainer conforming

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to the requirements of ANSI/ASSE Z490.1, Criteria for Accepted Practices in Safety, Health and Environmental Training.

b. Competent person refresher training shall be conducted at least every two years to stay current with the fall protection and rescue educational industry requirements or when new fall protection systems are used or installed of new fall hazards are encountered.

21.C FALL PROTECTION PROGRAM.

21.C.01 If Contractor has personnel working at heights, exposed to fall hazards and using fall protection equipment, he shall develop a Site-Specific Fall Protection and Prevention Plan and submit it to the GDA for review and acceptance as part of their APP. This plan may be developed by either the Competent Person for Fall Protection (CP for FP) or Qualified Person for Fall Protection (QP for FP). If the plan includes FP components or systems requiring direction, supervision, design calculations or drawings by a QP for FP, the name, qualifications and responsibilities of the QP for FP shall be addressed in this plan. The plan shall describe, in detail, the specific practices, equipment and control methods used to protect workers from falling to lower levels. This plan shall be updated as conditions change, at least every six months and shall include:

a. Duties and responsibilities. Identify Competent and Qualified Persons for fall protection and their responsibilities and qualifications. **> *See Appendix Q for definition of Qualified Person for Fall Protection***;

b. Description of the project or task performed;

c. Training requirements to include the safe use of fall protection equipment;

d. Anticipated hazards and fall hazard prevention and control;

e. Rescue plan and procedures;

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f. Design of anchorages/fall arrest and horizontal lifeline systems:

(1) It is realized that the provision of fall protection for the first person up for establishing anchorages ONLY would be difficult. In this situation, fall protection may not be required. After anchorages are installed, fall protection is required.

(2) The contractor shall identify all locations where anchorages need to be established, and detail in the Plan/AHA how work will be performed safely.

g. Inspection, maintenance and storage of fall protection equipment;

h. Incident investigation procedures;

i. Evaluation of program effectiveness and,

j. Inspection and oversight methods employed.

21.C.02 Each Government-owned facility shall develop a written fall protection program if they have personnel working at heights, exposed to fall hazards and using fall protection equipment. The facility shall conduct a fall hazard survey, prepare survey report at existing buildings or structures, and comply with the program elements and requirements as identified in 21.C.01.

21.D CONTROLLED ACCESS ZONES. The use of Controlled Access Zone as a fall protection method is prohibited.

21.E FALL PROTECTION SYSTEMS.

➢ ***NOTE: In order for parapet walls to be considered adequate fall protection systems, they shall have a height of 42 in +/- 3 in (106.6cm +/- 7.6 cm) unless:***

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- ***For existing parapet walls with heights of less than 42 in (1 m), the parapet wall may be used as fall protection system if the vertical height is a minimum of 30 in (76 cm) and the width a minimum of 18 in (46 cm) for a total of 48 in (1.2 m) combined. The effective height of a parapet wall is the sum of the height of the wall and the wall width at the top of the wall.***

21.E.01 Standard Guardrail Systems.

a. For marine and floating plant guardrail systems, see Sections 19.D and 19.E.

b. A standard guardrail shall consist of:

(1) Toprails, midrails, and posts, and shall have a vertical height of 42 +/- 3 in (106.6 cm +/- 7.6 cm) from the upper surface of the toprail to the floor, platform, runway, or ramp level.

(2) Midrails shall be erected halfway between the toprails and the floor, platform, runway, or ramp.

(3) The ends of the toprails and midrails shall not overhang the terminal posts except where such overhang does not create a projection hazard.

(4) Toe boards shall be provided on all open sides/ends at locations where persons are required or permitted to pass or work under the elevated platform or where needed to prevent persons and material from falling from the elevated platform.

c. Strength requirements: toprails and midrails shall be designed to meet the following requirements:

(1) Toprail shall be capable of withstanding, without failure, a force of at least 200 lb (0.9 kN) applied within 2 in (5 cm) of the top edge, in any outward or downward direction, at any point along the top edge;

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(2) When the force described in (1), above, is applied in a downward direction, the top edge of the top rail shall not deflect more than 3 in (7.6 cm) nor to a height less than 39 in (99 cm) above the walking/working level;

(3) Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members shall be capable of withstanding, without failure, a force of at least 150 lb (666 N) applied in any downward or outward direction at any point along the midrail or other member;

(4) Guardrail systems shall be so surfaced as to prevent injury to a worker from punctures or lacerations and to prevent snagging of clothing.

d. Minimum construction materials for standard guardrail components. The following are the minimum requirements used for constructing guardrail systems. The employer is responsible for designing a complete system and assembling these components in accordance with 21.E.01.

- ***Synthetic or natural fiber ropes shall not be used as toprails or midrails.***
- ***Wood railing components shall be minimum 1,500 lb-ft/square inch fiber (stress grade) construction grade lumber.***

(1) Wood railings:

(a) Toprails: Constructed of at least 2-in x 4-in (5-cm x 10-cm) lumber;

(b) Midrails: Constructed of at least 1-in x 6-in (2.5-cm x 15.2-cm) lumber; and,

(c) Posts: Constructed of at least 2-in x 4-in (5-cm x 10-cm) lumber spaced not to exceed 8 ft (2.4 m) on centers.

(2) Pipe railings:

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(a) Toprails and midrails: At least 1 ½ in (3.8 cm) nominal diameter (schedule 40 steel pipe); and

(b) Posts: At least 1½ in (3.8 cm) nominal diameter (schedule 40 steel pipe) spaced not more than 8 ft (2.4 m) on centers.

(3) Structural steel railings:

(a) Toprails and midrails: At least 2-in x 2-in x 3/8 in (5 cm x 5 cm x .9 cm) angles; and,

(b) Posts: At least 2-in x 2-in x 3/8-in (5 cm x 5 cm x .9 cm) angles spaced not more than 8 ft (2.4 m) on centers.

(4) Steel Cable (Wire Rope) railings:

(a) Toprail and midrail: ¼ in (6.25 mm) steel cable, flagged every 6 ft (1.8 m) with high visibility material, may be used if tension is maintained to provide not more than 3 in (7.5 cm) deflection, in any direction from the center line, under a 200 lb (0.89 kN) load;

(b) Support posts shall be located to insure proper tension is maintained;

(c) Perimeter safety cables shall meet the criteria and requirements for guardrail systems. If the perimeter safety cables are used by the workers as a method of attaching a lanyard to the cables they shall meet the requirements of Horizontal Lifeline System (see 21.H.05(c)(5)(b)).

e. Toe boards (Used to protect those below from falling objects).

(1) Toe boards shall be 3½ in (8.75 cm) in vertical height and shall be constructed from 1-in x 4-in (2.5-cm x 10.1-cm) lumber or the equivalent.

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(2) Toe boards shall be securely fastened in place and have not more than ¼ in (0.6 cm) clearance above floor level.

(3) Toe boards shall be made of any substantial material, either solid or with openings between adjacent pieces not greater than 1 in (2.5 cm).

(4) Where material is piled to such a height that a standard toe board does not provide protection, paneling or screening from floor to toprail or midrail shall be provided.

(5) Toe boards shall be able to withstand, without failure, a force of 50 lbs (0.22 kN) applied in any outward or downward direction at any point along the toe board.

21.E.02 Guardrails receiving heavy stresses from workers trucking or handling materials shall be provided additional strength by using heavier stock, closer spacing of posts, bracing, or by other means.

21.E.03 When guardrails are used at hoisting areas, a minimum 6 ft (18. m) of guardrail shall be erected on each side of the access point through which materials are hoisted.

21.E.04 A gate or removable guardrail section may be used as long as it meets the standard guardrail height 42 +/- 3 in (106.6 +/- 7.6 cm) and is secured across the opening between the guardrail sections when hoisting operations are not taking place.

21.E.05 When guardrails are used at bitumen pipe outlets on roofs, a minimum of 6 ft (1.8 m) of guardrail shall be erected on each side of the pipe.

21.F COVERS.

21.F.01 Install covers on any hole 2 in (5.1cm) or more in its least dimension on walking/working surfaces such as floors, roofs or other openings.

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21.F.02 Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.

21.F.03 Covers shall be secured when installed, clearly marked with the word “HOLE”, “COVER” or “Danger, Roof Opening-Do Not Remove” or color-coded or equivalent methods (e.g., red or orange “X”). Workers must be made aware of the meaning for color coding and equivalent methods.

21.G SAFETY NET SYSTEM (for fall protection).

> Debris nets are addressed in Section 14.C Housekeeping.

21.G.01 Safety nets shall be installed as close under the work surfaces as practical but in no case more than 25 ft (7.6 m) below such work surface. Nets shall be hung with sufficient clearance to prevent contact with the surfaces or structures below. Such clearance shall be determined by impact load testing. When nets are used on bridges, multi story buildings or structures, the potential fall area from the walking/working surface to the net shall be unobstructed.

a. The maximum size of the mesh openings shall not exceed 36 in^2 (230 cm^2), nor be longer than 6 in (15 cm) on any side.

b. The border rope or webbing shall have a minimum breaking strength of 5,000 lb (22.2 kN).

21.G.02 Nets shall extend outward from the outermost projection of the work surface as shown in Table 21-1:

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TABLE 21-1

SAFETY NET DISTANCES

Vertical Distance From Working Level To Horizontal Plane Of Net	Minimum Required Horizontal Distance Of Outer Edge Of Net From Edge Of Working Surface
Up to 5 feet (up to 1.5 m)	8 feet (2.5 m)
5 feet up to 10 feet (1.5 m up to 3.1 m)	10 feet (3.1 m)
more than 10 feet (more than 3.1 m)	13 feet (4 m)

21.G.03 Operations requiring safety net protection shall not be undertaken until the net(s) is in place and has been tested without failure.

a. Safety nets and safety net installations shall be tested in the suspended position immediately after installation under the supervision of Qualified Person and in the presence of the GDA and before being used as a fall protection system; whenever relocated, after major repair; and when left at one location, at not more than 6 month intervals.

b. The test shall consist of dropping into the net a 400 lb (180 kg) bag of sand, not more than 30 in+/- 2 in (76.2 cm +/- 5 cm) in diameter, at least 42 in (106.6 cm) above the highest working/walking surface at which workers are exposed to fall hazards. Means must be taken to ensure the weight can be safely retrieved after the test is conducted.

21.G.04 Shackles and hooks used in safety net installations shall be made of forged steel.

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21.G.05 When used with safety nets, debris nets shall be secured on top of the safety net but shall not compromise the design, construction, or performance of the safety nets.

21.G.06 Materials, scrap pieces, equipment, and tools that have fallen into the safety net shall be removed as soon as possible and at least before the next work shift. Safety nets shall be protected from sparks and hot slag resulting from welding and cutting operations.

21.G.07 Inspection of safety nets.

a. Safety nets shall be inspected by a Competent Person in accordance with the manufacturer's instructions and recommendations.

b. Inspections shall be conducted immediately after installation, at least weekly thereafter, and following any alteration, repair, or any occurrence that could affect the integrity of the net system. Inspections shall be documented.

c. If any welding or cutting operations occur above the net(s), noncombustible barriers shall be provided. The frequency of inspections shall be increased in proportion to the potential for damage to the nets.

d. Defective nets shall not be used. Defective components shall be removed from service and replaced.

21.H PERSONAL FALL PROTECTION SYSTEMS

21.H.01 Personal fall protection equipment and systems (to include fall arrest, positioning and restraint) shall be used when a person is working at heights and exposed to a fall hazard.

21.H.02 Inspection of personal Fall Protection Equipment. Personal fall protection equipment shall be inspected by the end user prior to each use to determine that it is in a safe working condition. A Competent Person for fall protection shall inspect the

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equipment at least once semi-annually and whenever equipment is subjected to a fall or impacted. Inspection by the Competent Person shall be documented. Defective or damaged equipment shall be immediately removed from service and replaced. Inspection criteria shall include:

a. Harnesses, lanyards, straps and ropes: Check all components for cuts, wear, tears, damaged threads, broken or torn stitching, discoloration, abrasions, burn or chemical damage, ultraviolet deterioration and missing markings and/or labels.

b. Hardware: Check all components for signs of wear, cracks, corrosion and deformation.

21.H.03 Personal fall protection equipment shall be used, inspected, maintained and stored in a safe place in accordance with manufacturer's instructions and recommendations or as prescribed by the Competent Person for fall protection.

21.H.04 Selection of personal fall protection equipment shall be based on the type of work being performed; the work environment; the weight, size, and shape of the worker; the type and position/location of anchorage; and the required length of the lanyard.

21.H.05 Personal Fall Arrest System (PFAS): Consists of body support (full body harness), connecting means, and an anchorage system. ***> NOTE: All PFAS shall meet the requirements contained in ANSI/ASSE Z359, Fall Protection Code.***

a. PFAS are generally certified for users within the capacity range of 130 to 310 lbs (59 to 140.6 kg) including the weight of the worker, equipment and tools. Workers shall not be permitted to exceed the 310 lbs (140.6 kg) limit unless permitted in writing by the manufacturer. For workers with body weight less than 130 lbs (59 kg), a specially designed harness and also a specially designed energy absorbing lanyard shall be utilized which will properly deploy if this person were to fall.

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b. When stopping a fall, PFAS shall:

(1) Limit maximum arresting force on the body of the employee to 1,800 lbs (8.0 kN) when used with a full body harness;

(2) Be rigged such that a worker can neither free fall more than 6 ft (1.8 m) nor contact any lower level or other physical hazard in the path of the fall. The free fall distance of 6 ft (1.8 m) can be exceeded if the proper energy absorbing lanyard is used.

(3) Stop the fall with a maximum deceleration distance of not more than 3.5 ft (1.1 m). When using new ANSI/ASSE Z359 products or equipment, the deceleration distance of 3.5 ft (1.1 m) can be exceeded up to 5 ft (1.8 m) if the maximum arrest force on the body of the employee is kept under 1,800 lbs (8.0 kN).

c. When designing new fall arrest systems, the Qualified Person for fall protection shall attempt to minimize fall distances including free fall distances and arrest forces. If it is necessary to increase free fall distances and arrest forces in order to accommodate existing and new structures or provide mobility to end users:

(1) Only the Qualified Person for fall protection shall make this determination; and,

(2) The maximum arrest force shall be kept below 1,800 lbs (8.0 kN).

d. PFAS Components.

(1) Full Body Harness. ***> Only full body harnesses meeting the requirements of ANSI/ASSE Z359, Fall Protection Code are acceptable. Full body harnesses labeled to meet the requirements of the ANSI A10.14 shall not be used.***

(a) PFAS require the use of a full-body harness. The use of body belts is not acceptable.

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(b) The fall arrest attachment point on the full body harness shall be integrally attached and located at the wearer's upper back between the shoulder blades (dorsal D-ring).

> A frontal D-ring attachment point integrally attached to wearer's front full body harness and located at the sternum, can be used for fall arrest (i.e. used with a ladder climbing device), provided the free fall distance does not exceed 2 ft (0.6 m) and the maximum arresting force does not exceed 900 lbs (4 kN).

(c) All full body harnesses shall be equipped with Suspension Trauma preventers such as stirrups, relief steps, or similar in order to provide short-term relief from the effects of orthostatic intolerance.

(2) Lineman's equipment (electrically rated harnesses). The full body harness used around high voltage equipment or structures shall be an industry designed "linemen's FP harness" that will resist arc flashing and shall meet the ASTM F887 and ANSI Z359 standards and the equipment must bear a label or similar stating such.

(3) Hardware (connecting components).

(a) Snaphooks and carabiners shall be self-closing and self-locking capable of being opened only by at least two consecutive deliberate actions. Snaphooks and carabiners having a gate strength of 3,600 lbs (16 kN) in all directions, per ANSI Z359, Fall Protection Code, shall be used.

(b) Snaphooks and carabiners shall have a minimum tensile strength of 5,000 lbs (22.2 kN); D-rings, O-rings, snaphooks and carabiners shall be Capable of withstanding a tensile load of 5,000 lbs (22.2. kN).

(c) Connectors, adjusters and any buckles used as adjusters shall be capable of withstanding a minimum tensile load of 3,372 lbs (15 kN) and shall be made of drop forged, pressed or

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formed steel, or made of equivalent materials; shall have corrosion resistant finish; and all surfaces and edges shall be smooth to prevent damage to interfacing parts of the system.

(d) All connecting components used in PFAS shall be compatible and shall be used properly.

(4) Connecting Subsystem. Connecting subsystems may include energy absorbing lanyards (shock absorbing lanyards) with snaphooks or carabiners at each end, self-retracting devices (SRDs), and/or fall arrestors (rope grabs).

(a) Lanyards. Lanyards shall be made of ropes, straps or webbing made from synthetic materials. Energy absorbing lanyards, (including rip stitch/tearing and deforming lanyards) shall be capable of sustaining a minimum tensile load of 5,000 lbs (22.2 kN). The maximum length of single or "Y" lanyards used in fall arrest shall not exceed 6 ft (1.8 m).

(i): The 6 ft (1.8 m) Free Fall (FF) energy absorbing lanyard shall only be used when the tie-off point is above the dorsal D-ring creating a FF distance of less than 6 ft (1.8 m). The average arrest force on the body shall not exceed 900 lbs (4 kN);

(ii) When an anchor point is below the dorsal D-ring, a FF distance greater than 6 ft (1.8 m) is created. For these situations, a 12 ft (3.6 m) FF energy absorbing lanyard shall be used in accordance with manufacturer's instructions and recommendations. The average arrest force on the body shall not exceed 1,350 lbs (6 kN). The 12 ft (3.6 m) FF energy absorbing lanyard shall be used when the tie-off point is above the dorsal D-ring.

NOTE: A 12 ft (3.6 m) FF energy absorbing lanyard does not refer to the lanyard length. Instead it refers to a FF that is greater than 6 ft (1.8 m) up to 12 ft (3.6 m) which is created by the anchor point being located below the dorsal

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D-ring. The maximum length of the lanyard used shall not exceed 6 ft.

(iii) The 6 ft (1.8 m) and 12 ft (3.6 m) FF energy absorbing lanyards shall meet the requirements of ANSI/ASSE Z359.13 Standard. ***See Figures F-1 and F-2.***";

- ***Lanyards shall not be looped back over or through an object and then attached back to themselves unless permitted by the manufacturer.***

(b) When using lanyard with two integrally connected legs for 100% tie-off, attach only the snaphook at the center of the lanyard to the fall arrest attachment element of the harness (D-ring).

(i) The two legs of the lanyard and the joint between the legs shall withstand a force of 5,000 lbs (22.2 kN).

(ii) When one leg of the lanyard is attached to the anchorage, the unused leg of the lanyard shall not be attached to any part of the harness except to attachment points specifically designated by the manufacturer for this purpose.

(iii) The 6 ft (1.8 M) FF "Y" lanyard shall only be used when the tie-off point is above the dorsal D-ring height and when the FF distance is less than 6 ft (1.8 M).

iv. When the tie-off point is located below the dorsal D-ring, the FF distance is greater than 6 ft (1.8 m) so a 12 ft (3.6 m) FF "Y" lanyard may be used.

- ***NOTE: A 12 ft (3.6 m) FF energy absorbing "Y" lanyard does not refer to the lanyard length. Instead it refers to a FF that is greater than 6 ft (1.8 m) up to 12 ft (3.6 m) which is created by the anchor point being located below the dorsal D-ring. The maximum length used shall not exceed 6 ft (1.8 m).***

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v. The maximum arrest force on the body shall not exceed 1800 lbs (8 kN).

vi. The 6 ft (1.8 m) and 12 ft (3.6 m) FF energy absorbing "Y" lanyards shall meet ANSI/ASSE Z359.13 standard. ***See Figures F-3 and F-4.***

> Effective 2 years from date of publication, all energy absorbers used shall be equipped with deployment indicator.

(c) Self Retracting Devices. The SRDs shall meet the requirements of the ANSI/ASSE Z359 Fall protection Code. (1) Self-retracting lanyard (SRL) is a device mounted or anchored such that possible FF distance is limited to 2 ft (60 cm) or less and the average arrest distance shall not exceed 1,350 lbs (6 kN) or a maximum peak force of 1,800 lbs (8 kN). The device is only used for vertical applications..

(2) Self-retracting lanyard with leading edge capability (SRL-LE) is designed for applications where during use the device is not necessarily mounted or anchored overhead and may be at foot level and where the possible free fall distance is up to 5 ft (1.5 m). The device is equipped with energy absorber to withstand impact loading of the line constituent with a sharp or abrasive edge during fall arrest and for controlling fall arrest forces on the worker.

> All SRDs used shall be equipped with visual indicator.

(d) Fall arrestors (rope grabs) designed to be used with a vertical lifeline and ladder climbing devices (rope, cable or rail) shall be approved by the manufacturer for such use**.** Fall arresters shall have a minimum ultimate strength of 3,600 lbs (16 kN).

> For vertical lifelines or ladder climbing devices, use fall arrestors that move in one direction only.

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(5) Anchorage System. The anchorage system consists of anchorage (the rigid part of the building, facility, structure or equipment) and anchorage connector.

(a) Anchorages used for attaching the PFAS shall be independent of any anchorage used to support or suspend platforms. They shall be capable of supporting at least 5,000 lbs (22.2 kN) per worker attached or designed by a Qualified Person for fall protection for twice the maximum arrest force on the body.

(b) Anchorage connectors are used to tie the PFAS to the anchorage and shall be capable of withstanding without breaking 5000 lbs (22.2 kN) load per worker attached.

(c) If cables are used as guardrails and also used as an anchorage for tying off a worker as part of a PFAS, they shall be designed to meet the Horizontal Life Line criteria, per 21.E.01.d (4)(c).

- ***Do not use electric conduits, utility pipes, ductwork or unstable points as anchorages for PFAS.***

(6) Lifelines.

(a) Vertical lifeline (VLL). A VLL is a vertically suspended flexible line with a connector at the upper end for tying it to a 5000 lbs (22.2 kN) <u>single</u> overhead anchorage along which a fall arrestor (rope grab) travels. VLL shall have a minimum tensile strength of 5000 lbs (22.2 kN). Each worker shall be attached to a separate lifeline system.

(b) Horizontal lifeline (HLL). A HLL is a fall arrest sub-system consisting of flexible wire, rope or synthetic cable, spanned horizontally between two end anchorages.

i. Locally manufactured HLLs are not acceptable unless they are custom designed for limited or site specific applications by a

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registered professional engineer who is also qualified in designing HLL systems.

ii. Commercially manufactured HLLs shall be designed, installed, certified and used under the supervision of QP for FP only, as part of a complete fall arrest system. The CP for FP may (if deemed appropriate by QP for FP), supervise the assembly, disassembly, use and inspection of the HLL systems, under the direction of the QP for FP.

iii. The design shall include drawings, required clearance, instructions on proper installation, and use procedures, proof testing reports and inspection requirements.

iv. All HLL anchorages shall be designed by a Registered Professional Engineer (RPE) who is also qualified in designing HLL systems. ***< See ANSI/ASSE Z359.6.***

v. The design of all HLLs shall be reviewed and accepted by the GDA as part of the Fall Protection and Prevention Plan.

21.H.06 Positioning System. Positioning system consists of fall protection equipment including the use of a full body harness configured to allow a worker to be supported on an elevated vertical or inclined surface, and perform work with both hands free (e.g., working on rebar assembly, towers, poles or ladders).

a. A positioning system shall not be used as a primary fall arrest system. Positioning systems use some of the same equipment as a fall protection system (such as a harness), however a positioning system used alone does not constitute fall protection. While positioning (working with both hands free), a person is exposed to a fall hazard and is required under this section to use a separate system that provides backup protection from a fall.

b. System requirements: Positioning System shall:

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(1) Be rigged such that a worker cannot free fall more than 2 ft (0.6 m);

(2) Be secured to an anchorage capable of supporting at least twice the potential impact load of a worker's fall or 3,000 lbs (13.3 kN), whichever is greater;

(3) When necessary, full-body harnesses used in a positioning system shall have two lanyards to ensure that a person is tied-off with at least one lanyard at all times to achieve continuous 100% tie-off; and,

(4) The attachment point on the full body harness used in positioning system shall be located on the sides or on the front of the harness.

21.H.07 Restraint Systems.

a. Fall restraint systems shall prevent the user from reaching an area where a free fall could occur by restricting the length of the lanyard or by other means.

b. The anchorage strength requirement for restraint systems shall be 3,000 lbs (13.3 kN) or designed by a Qualified Person for fall protection for two times the foreseeable force.

c. Restraint systems can be used only on sloped surfaces equal to or less than 18.4^{o} (4:12 slope).

21.I LADDER-CLIMBING DEVICES (LCDS). A LCD is a sleeve or cable/rope attached to a fixed ladder over 20 ft (6 m) in length.

21.I.01 Anchorage strength for LCDs shall be a minimum of 3,000 lbs (13.3 kN).

21.I.02 The connector between the front D-ring of the harness and the ladder cable, rope or sleeve shall be 9 in (20 cm) long.

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21.I.03 The free fall distance when using a LCD shall not exceed 2 ft (0.6 m).

21.I.04 There shall be 100% transition at the top of the LCD for safe access to above work surface or roof.

> Do not install LCDs on ladders that have ¾ in (1.9 cm) rungs (off- the-shelf-ladders) unless the ladders are designed to withstand the fall forces.

21.J SCAFFOLDS, AERIAL LIFT EQUIPMENT, MOVABLE WORK PLATFORMS.

21.J.01 Scaffolds shall be equipped with a standard guardrail per 21.E.01 or other fall protection systems.

21.J.02 For workers erecting and dismantling scaffolds, an evaluation shall be conducted by a Competent Person for fall protection to determine the feasibility and safety of providing fall protection if fall protection is not feasible. An AHA detailing rationale for infeasibility of use of fall protection shall be submitted and accepted by the GDA.

21.J.03 Suspended scaffolds.

a. Single point or two point suspended scaffold: In addition to railings, workers shall also be tied off to an independent vertical lifeline using a full body harness.

b. Other suspended scaffolds (e.g., catenary, float, needle-beam, Boatswain chairs): PFAS is required and workers shall be tied off to an independent vertical lifeline using a full body harness.

c. A risk assessment shall be performed when persons are supported on a multi-point adjustable suspended scaffold to evaluate the effectiveness and feasibility of the use of personal fall protection systems. Results shall be documented in the AHA for the activity being performed. ***> See 21.H.05.***

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21.J.04 Elevating Work Platforms/Scissor Lifts: Scissor lifts shall be equipped with standard guardrails. In addition to the guardrail provided, the scissor lift shall be equipped with anchorages meeting the ANSI Z359, Fall Protection Code. A restraint system shall be used in addition to guardrails: an adjustable energy absorbing lanyard is required for typing off to the anchorage point to prevent the worker from being ejected from the basket due to misuse and to prohibit him from climbing out of the basket. Self-retracting lanyards are not acceptable. Scissor lifts not equipped with anchorages shall not be used.

21.J.05 Aerial Lift Equipment: Workers shall be anchored to the basket or bucket in accordance with manufacturer's specifications and instructions (anchoring to the boom may only be used when allowed by the manufacturer and permitted by the Competent Person for fall protection). An adjustable energy absorbing lanyard is required for typing off to the anchorage point to prevent the worker from being ejected from the basket due to misuse and to prohibit him from climbing out of the basket. Self-retracting lanyards are not acceptable. Tying off to an adjacent pole or structure is not permitted unless a safe device for 100% tie-off is used for the transfer.

21.K WARNING LINE SYSTEM (WLS). A WLS is a barrier erected on a floor, roof, or edge of excavation area to warn workers that they are approaching an unprotected side or edge. A WLS may ONLY be used on floors or flat or low-sloped roofs (between 0-18.4^{o} or 4:12 slope) and shall be erected around all sides of the work area.

21.K.01 A WLS shall consist of wires, rope or chains 34-39 in (0.9-1.0 m) high with supporting stanchions. WLS shall be flagged at not more than 6 ft (1.8 m) intervals with a high visibility material.

21.K.02 The wire, rope or chains shall have a minimum tensile strength of 500 lbs (2.2 kN) and after being attached to the stanchions shall be capable of supporting without braking, the loads applied to the stanchions.

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21.K.03 Stanchions shall be capable of resisting without tipping a force of 16 lbs (71 N) applied horizontally against the stanchions 30 in (76.2 cm) above the walking/working surface, perpendicular to the warning line and in the direction of the roof floor or platform edge. The line consisting of wire rope or chains shall be attached at each stanchion in such a way that the pulling on one section of the line will not result in a slack being taken up in adjacent sections before the stanchion tips over.

21.K.04 Working within the WLS does not require fall protection. No worker shall be allowed in the area between the roof or floor edge and the WLS without fall protection. Fall protection is required when working outside the line.

21.K.05 For roofing work on flat roofs, the WLS shall be erected not less than 6 ft (1.8 m) from the edge of the roof. For low-sloped roofs and/or when using mechanical equipment the WLS shall be erected not less than 15 ft (4.5 m) from the edge of the roof.

21.K.06 Mechanical equipment on roofs shall be used or stored only in areas where workers are protected by a WLS, guardrail or PFAS.

21.L SAFETY MONITORING SYSTEM (SMS). The use of a SMS as a fall protection method is prohibited.

21.M RESCUE PLAN AND PROCEDURES. The employer is required to provide prompt rescue to all fallen workers**.**

21.M.01 A rescue plan (see ANSI Z359.2, Written Rescue Procedures) shall be prepared and maintained when workers are working at heights and using fall protection equipment.

21.M.02 The plan shall contain provisions for self-rescue and assisted rescue of any worker who falls including rescue equipment. If other methods of rescue are planned (i.e. by a jurisdictional public or Government emergency rescue agencies), it shall be indicated in the rescue plan including how to contact and summon the agency to the mishap site.

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21.M.03 Personnel conducting rescue shall be trained accordingly.

21.M.04 If required, anchorages for self-rescue and assisted – rescue shall be identified, selected, and documented in Site-Specific Fall Protection and Prevention Plan. Anchorages selected for rescue shall be capable of withstanding static loads of 3,000 lbs (13.3 kN) or five times the applied loads as designed by Qualified Person for fall protection.

21.M.05 Workers using fall protection equipment shall have an assigned safety person (spotter) also known as the "buddy system", who will be within visual/verbal range to initiate rescue of the fallen worker if required.

21.M.06. Rescue equipment used for self-rescue or assisted-rescue such as SRL with rescue capability shall meet ANS/ASSE Z359 Fall Protection Code.

21.N WORKING OVER OR NEAR WATER (piers, wharves, quay walls, barges, aerial lifts, crane-supported work platforms, etc)**.** PFDs are required for all work over or near water unless detailed below.

> All USACE and contractor workers, to include divers, shall comply with the requirements below.

21.N.01 When continuous fall protection is used without exception to prevent workers from falling into the water, the employer has effectively removed the drowning hazard and PFDs are not required. ***> When using safety nets as fall protection, USCG-approved PFDs are usually required, unless rationale is provided in AHA. See 21.N.05.***

21.N.02 When working over or near water and the distance from walking/working surface to the water's surface is 25 ft (7.6 m) or more, workers shall be protected from falling by the use of a fall protection system and PFDs are not required.

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21.N.03 When working over or near water where the distance from the walking/working surface to the water's surface is less than 25 ft (7.6 m) **and** the water depth is less than 10 ft (3.05 m) fall protection shall be required and PFDs are not required.

21.N.04 When working over water, PFD, lifesaving equipment and safety skiffs meeting the requirements of this EM shall be used.

21.N.05 When working from/in machinery (mechanically operated equipment), aerial lift equipment or other movable work platforms/cranes directly over water AND the depth of the water is at least 10 ft (3 m) deep, fall protection is not required however, PFDs are required.

21.N.06 When there are hazards from currents, intakes, dangerous machinery or equipment, or barges, etc., fall protection shall be required regardless of the fall distance and PFDs are not required.

21.O Other Engineered Fall Protection Systems.

21.O.01 Commercially available engineered systems are recognized as effective fall protection and may be used. These are systems that are not addressed in Paragraph 21.E.

21.O.02 Commercially available engineered systems shall be designed, installed, certified and used under the supervision of QP for FP only. They shall be used per manufacturer instructions and recommendations. The CP for FP may (if deemed appropriate by QP for FP), supervise the assembly, disassembly, use and inspection of the engineered system, under the direction of the QP for FP.

21.O.03 The design shall include drawings, required clearance, instructions on proper installation, use and inspection requirements. These systems shall be reviewed and accepted by the GDA as part of the Fall Protection and Prevention Plan.

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