

Section 16

Fall Protection and Rope-Access Work

16.1 Fall Protection

A personal fall protection system must be in place to protect employees who work on slopes steeper than 1½:1 (horizontal:vertical), who work on unstable footing, or who could fall from heights greater than 4 feet (ft) for general industry and 6 ft for construction activities (if not protected by fixed scaffolding, guardrails, or safety nets). The fall protection system must meet the requirements of this section. However, these requirements do not apply to rope supported work (high angle work) such as high scaling, geologic mapping, structural inspections, or other operations that require specialized rope equipment or techniques. Refer to Subsection 16.2, "Rope-Access Safety Requirements."

16.1.1 Hierarchy of Controls. Appropriate control measures will be implemented through the hierarchy of controls (i.e., eliminate, substitute, engineering controls, warnings, administrative controls, and personal protective equipment [PPE]) to reduce the hazard of falls to an acceptable level of risk. The use of fall protection PPE in this section will be considered only if the other controls described above are unavailable or infeasible.

16.1.2 Hardware. Connectors must be drop forged, pressed, or formed steel or equivalent materials. Connectors must have a corrosion-resistant finish, and edges must be smooth to prevent damage to interfacing parts of the system. D-rings, O-rings, snap-hooks, and carabiners must be able to sustain a minimum tensile load of 5,000 pounds (lb) (22.2 kilonewton [kN]). Snaphooks and carabiners must be self-closing, self-locking, and capable of being opened only by two or more consecutive, deliberate actions. Only snaphooks and carabiners meeting a gate strength of 3,600 lb (16 kN) in all directions, per American National Standards Institute/American Society of Safety Engineers (ANSI/ASSE) Z359, "Fall Protection Code," will be used.

16.1.3 Full Body Harness. Only full body harnesses that have a label specifying that they meet the requirements of ANSI/ASSE Z359 are acceptable. Full body harnesses labeled to meet the requirements of the ANSI A10.14 will not be used. Load bearing straps will have a minimum width of 1-5/8 inches (41 millimeters [mm]) and develop a breaking strength of not less than 5,000 lb (22.2 kN).

a. Personal Fall Arrest Systems. Personal fall arrest systems require the use of a full body harness. The use of body belts is not acceptable.

b. Attachment Point. The fall arrest attachment point on the full body harness will 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 the 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) as long as the free fall distance does not exceed 2 ft (0.61 meter [m]), and the maximum arresting force does not exceed 900 lb (4 kN).

c. Suspension Trauma Prevention. All full body harnesses will be equipped with suspension trauma preventers such as stirrups, relief steps, or similar components to provide short-term relief from the effects of orthostatic intolerance.

Note: Existing full body harnesses that are capable of being retrofitted with suspension trauma prevention components must be so modified by January 2014 or be replaced with equipment meeting paragraph c. above.

16.1.4 Lanyards and Lifelines. Lanyards and vertical lifelines that tie off one employee must have a minimum breaking strength of 5,000 lb (22.2 kN). Self-retracting lifelines and lanyards that automatically limit free fall distance to 2 ft (0.61 m) or less must have components that can sustain a minimum static load of 3,000 lb (13.3 kN) applied to the device, with the lifeline or lanyard fully extended. Self-retracting lifelines and lanyards that do not limit free fall distance to 2 ft (0.61 m) or less, ripstitch lanyards, and tearing and deforming lanyards must be able to sustain a minimum tensile load of 5,000 lb (22.2 kN), applied to the device with the lifeline or lanyard fully extended. A qualified person must design, install, and supervise the use of horizontal lifelines as part of a complete personal fall arrest system that maintains a safety factor of at least two. Restraint lines must be able to sustain a tensile load of at least 3,000 lb (13.3 kN). Lifelines and carriers must not be made of natural fiber rope.

16.1.5 Anchorages. Anchorages must be able to support at least 5,000 lb (22.2 kN) per employee attached, or must be designed, installed, and used under the supervision of a qualified person as part of a complete fall protection system that maintains a safety factor of at least two.

a. Rebar. Anchorages will not be made from drill steel or reinforcing bar.

b. Mobile Anchorages. Anchorages must not be made to mobile equipment or other items that can move while the anchorage is in use.

c. De-Energized Conductors and Insulators. De-energized conductors, insulators, and nonstructural components in switchyards, on transformers, circuit breakers, or other components will not be used as anchorage points.

16.1.6 Procedures. Use personal fall protection systems and their components only for employee fall protection. Inspect lifelines, lanyards, belts, hardware, and anchorages at the beginning of each day and discard questionable devices. Use and care for fiber lifelines and lanyards will be according to manufacturer's instructions, recommendations contained in the *Rigging Manual* (referenced in Subsection 18.1, "General Requirements"), and the procedures stated within this Section, whichever is more protective.

a. Lifelines. Provide each employee with a separate lifeline when using vertical lifelines.

b. Rescue. Make provisions to promptly rescue employees who fall or provide the means for self-rescue.

c. Protection. Protect lifelines from being cut, abraded, or damaged in any way.

d. Maintenance, Inspection, Testing. All personal fall protection systems must follow the manufacturers' recommendations for maintenance, inspection, and testing.

e. Training. Before using fall protection equipment, each worker who might be exposed to fall hazards from heights must be trained by a competent person who is qualified to deliver fall protection training to the workers. Such training will include the recognition of fall hazards; the application limits of the equipment; proper hookup, anchoring, and tie-off techniques; methods of use; proper methods of equipment inspection and storage; and use of rescue equipment and rescue procedures.

16.1.7 Personal Fall Arrest System. A fall arrest system for an employee who may fall from a working level will consist of an anchorage, connectors, and a body harness. The system may also include a lanyard, deceleration device, lifeline, or a suitable combination of these.

a. Performance Criteria. Personal fall arrest systems must have a label specifying that they meet the appropriate ANSI/ASSE Z359 standard.

b. Use. Rig personal fall arrest systems to prevent an employee from falling more than 6 ft (1.83 m) or contacting any lower level. Employees must wear a personal fall arrest system with the attachment point of the body harness in the center of the back, near the shoulder blades. When connected to a horizontal lifeline that could become vertical, connectors must be able to lock in either direction on the lifeline.

c. Maintenance. Maintenance is a critical element in personal fall arrest systems. Follow manufacturer's recommendations. At least one competent employee must be available to inspect and maintain personal fall arrest systems.

d. Annual Inspection. At least once a year, a competent person will inspect and document all fall arrest systems and components for wear, damage, or deterioration in accordance with the manufacturer's instructions.

e. Impact Loading. When a personal fall arrest system has been subjected to shock loading, immediately remove it from service until a competent person inspects it and determines that it is suitable for reuse.

16.1.8 Positioning Device System. Positioning device systems include equipment or hardware that, when used with its body belt or body harness, supports an employee on an elevated vertical surface (such as a wall or a rebar mat) and allows both hands freedom of movement. Positioning device systems also include devices attached between the employee and an anchorage to prevent an accidental fall from an elevated surface.

a. Performance Criteria. Positioning device systems must withstand, without failure, a 4-ft (1.22-m) drop of a 250-lb (113 kilogram [kg]) weight.

b. Performance Test. Positioning device systems comply with these requirements if they meet the test contained in 29 Code of Federal Regulations [CFR] 1926, subpart M, appendix D. Restraint line systems must be designed to meet the same test requirements as other positioning device systems.

16.1.9 Personal Fall Protection System for Ladder Climbing

Employees will wear, or must be attached to, personal fall protection systems to prevent injuries and falls when climbing a fixed ladder without a cage over 24 ft (7.32 m).

a. Design Criteria for System Components. The system must permit an employee to ascend or descend with both hands free for climbing, without having to hold, push, or pull any part of the system. The connection between the carrier or lifeline and the point of attachment to the body belt or harness must be no more than 9 inches (23 centimeters) long. The system must activate within 2 ft (0.61 m) after a fall.

b. Performance Criteria. Ladder safety devices and their support systems must withstand, without failure, an 18-inch (0.46-m) drop of a 500-lb (226-kg) weight. All other personal fall protection systems for climbing activities must withstand, without failure, a 4-ft (1.22-m) drop of a 250-lb (113-kg) weight.

c. Installation. Attach mountings for rigid carriers at each end of the carrier. Attach intermediate mounting, as necessary, spaced along the entire length of the carrier to provide the strength necessary to stop

employee falls. Attach mounting for flexible carriers at each end of the carrier. When the system is exposed to wind, install cable guides used with a flexible carrier that has a minimum spacing of 25 ft (7.6 m) and a maximum spacing of 40 ft (12.2 m) along the entire length of the carrier to prevent wind damage to the system. The design and installation of mountings and cable guides must not reduce the design strength of the ladder.

16.1.10 Requirements for Linemen's Harnesses and Lifelines

a. Lineman's Equipment (Arc Rated Harnesses). The full body harness used around high voltage equipment or structures will be an industry designed "linemen's arc rated harness" that will resist arc flashing and will have either straps or plastic coated D-rings and positioning side D-rings in lieu of exposed metal D-rings and exposed metal positioning side D-rings. All other exposed metal parts of the linemen's harness will also be plastic coated (i.e., buckles and adjusters).

b. Nonconductive Rope Lifelines. Nonconductive rope lifelines must have a minimum breaking strength of 5,000 lb (22.2 kN) and be able to withstand an alternating current dielectric test of at least 25,000 volts per foot "dry" for 3 minutes without visible deterioration.

16.2 Rope-Access Safety Requirements

The requirements in this subsection apply when an employee performs rope-access work on high-angle slopes or vertical environments where the rope is the primary means of support, and where the employee must manipulate the rope and its attachments while using industrial rope-access techniques to obtain access to the work area. These situations include such work as high scaling, geologic mapping, rock bolting, structural inspections, construction, operations, and maintenance activities. Permit rope-access work only when other means of access are not feasible or when methods other than rope-access work expose employees to greater danger.

16.2.1 Support System. Use two ropes for the support system: (1) a primary working (load) line, and (2) a separate and independently anchored safety (backup) line. The safety must be either self-controlled or controlled by another rope-access employee (attended belay). The standard working line and safety line (backup) must be ropes that meet the minimum strength requirements of this subsection. A safety line may be used alone, if feasible, for jobs where the work surface provides the primary support. When not using an attended belay, use a deceleration device to limit fall forces to less than 1,800 lb (8 kN). The maximum free fall distance must not exceed 6 ft (1.83 m).

16.2.2 Equipment. Use equipment designed for industrial rope-access use. Equipment components must be compatible to ensure proper loading and operation of the support system. Equipment strengths must be certified, listed as meeting, or proven by testing to meet the requirements of ANSI/ASSE Z359 series, the European Union (designated by the "CE" marking), Union Internationale des Associations d'Alpinisme (UIAA), or another recognized certification organization. Knots, friction devices, ascenders, and other hardware will decrease the overall strength of the rope support system. Before use, evaluate the complete support system, with all of its parts, for adequacy.

16.2.3 Anchorage. Use at least two independent anchor points to create two independent anchorage systems: one for the working (primary) line, and one for the safety (backup) line. Each anchorage system must be able to support at least a 5,000-lb (22.2-kN) static load. Failure of one anchor point will not allow for catastrophic failure of either anchorage system. If possible, locate anchors in line with the direction of rope pull; otherwise, take steps to limit the rope extension if one anchor fails. Except in a rescue situation, each set of anchorage systems will only be used by one employee. The anchorage systems will not be used by any auxiliary equipment that may impair the integrity of the anchor. Directional anchors are anchors used to laterally position rope-access personnel who are supported by two anchors that meet the requirements of this paragraph. Directional anchors do not take the place of the main support anchors.

16.2.4 Rope. Working and safety ropes must be synthetic fiber ropes that are specifically designed for rope-access or rescue applications. In addition, they must be capable of supporting a 5,000-lb (22.2-kN) static load without failure. Ropes must be of kernmantle construction with a minimum diameter of 3/8 inch (10 mm). All equipment used with these ropes must be designed by the manufacturer for the diameter of rope used.

16.2.5 Hardware. All connecting hardware used in the support system must be capable of supporting a 5,000-lb (22.2-kN) static load without failure. Use only locking carabiners in the support system, or substitute locking shackles or rated screw links for locking carabiners in anchor and personnel connections.

16.2.6 Body Harnesses. Use only full body harnesses that distribute fall arrest forces over at least the upper thighs, pelvis, waist, chest, and shoulders. Harness connections must be designed for work positioning and fall arrests and be capable of supporting a 5,000-lb (22.2-kN) static load without failure. Separate waist and chest harnesses are permitted if they are designed to be buckled together.

16.2.7 Rope and Equipment Inspection. Thoroughly inspect and document all rope and equipment periodically based on the frequency of use.

Visually inspect all ropes and equipment before and after every use. The employee who performs the inspection must use the manufacturer's recommended procedures for inspection and know the critical inspection points of each piece of equipment. Maintain a rope log for each rope.

16.2.8 Equipment Retirement. If any equipment used for rope-access work is subjected to severe impact or shock loading, immediately remove it from service. Do not use it for employee protection until it has been inspected and determined suitable for reuse. The employee who inspects the equipment must be knowledgeable about equipment specifications. Remove from service any equipment that exceeds manufacturer's recommended wear or shows other defects. Unless expressly stated otherwise by the manufacturer, automatically retire ropes, webbing, accessory cord, and harnesses from service after 5 years, regardless of condition or use history.

16.2.9 Training. Train employees about the equipment and techniques used for rope-access work before assigning them to a job where rope access is required. The training must cover rope-access safety and hazards; the use, limitations, inspection, and maintenance of equipment; and rope-access and self- and team-rescue techniques. A rope-access worker must complete a minimum of 32 hours of rope-access training (e.g., SPRAT or IRATA Level 1) prior to working on ropes.

Beginning rope-access workers will continue on-the-job training under close supervision following completion of basic training. Before starting any job, provide refresher practice or developmental training, as needed. Document all training.

16.2.10 Site Supervision. Each rope-access jobsite will have a supervisor who has sufficient knowledge and experience in the type of work to be performed, ability to analyze and plan rope-access jobs to be safe and efficient, ability to design and implement rescue in all situations, ability to write a Job Hazard Analysis (JHA), and ability to verify the rope-access personnel's experience and physical qualifications. Persons who have been independently certified to SPRAT or IRATA Level 2 or 3 meet these requirements.

16.2.11 Physicals. Rope-access personnel must successfully complete a medical examination annually and be cleared to perform rope-access work.

16.2.12 Rope-Access Team. A rope-access team consists of at least two trained personnel onsite who meet the above requirements, one of which may be a supervisor (as defined above). A third person will remain at the top to ensure that the anchorages remain secure and undisturbed, keep additional personnel away, and help respond to emergencies.

16.2.13 Communications. Maintain reliable voice communications between onsite employees. If distance or background noise interferes with voice communications, use two-way radios.

16.2.14 Rescue. Before starting rope-access work, make arrangements for rescue. Arrangements for rescue include self-rescue, rescue using onsite personnel, and/or rescue requiring offsite personnel.

16.2.15 Job Planning. Before starting a job that requires rope-access work, submit a JHA that is compliant with Subsection 4.2, "Requirements for Job Hazard Analysis," to the Contracting Officer's Representative or the appropriate office head. The JHA must address, at a minimum, the following additional items:

- a. Emergency procedures, including medical assistance.
- b. PPE required, including hand, eye, and head protection. Helmets with a chin strap must be designed for industrial rope-access work.
- c. Descriptions of the equipment to be used for rope-access work. For example, type and sizes of rope to be used, hardware, types of anchorages, communications equipment, and auxiliary equipment.
- d. Descriptions of the rope and hardware inspection process before using such equipment.
- e. Methods for ensuring safe entrance and exit from the worksite.
- f. Procedures for protecting employees and the public from falling material.
- g. Provisions for rescue, including both rescue by onsite personnel and/or arrangements for rescue services by offsite personnel.