(2) * * *

(v) A positioning system or a personal fall arrest system which complies with subpart I of this part shall be worn and attached to the boom or basket when working from an aerial lift.

* * * * *

7. In §1910.68, revise paragraphs (b)(4), (b)(8)(ii), and (b)(12) to read as follows:

§1910.68 Manlifts.

* * * * *

(b) * * *

(8) * * *

(ii) Construction. The rails shall be standard guardrails with toeboards meeting the provisions in subpart D of this part.

* * * * *

(12) Emergency exit ladder. A fixed metal ladder accessible from both the "up" and "down" run of the manlift shall be provided for the entire travel of the manlift. Such escape ladders shall comply with subpart D of this part.

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Subpart I—[Amended]

8. The authority citation for subpart I continues to read as follows:

AUTHORITY**:** Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), 1-90 (55 FR 9033), 5-2002 (67 FR 65008), or 5-2007 (72 FR 31159) as applicable, and 29 CFR 1911.

Sections 29 CFR 1910.133, 1910.135, and 1910.136 also issued under 5 U.S.C. 553.

9. Paragraph (g) of §1910.132 is amended to read as follows:

§1910.132 General requirements.

* * * * *

(g) Paragraphs (d) and (f) of this section apply only to §§1910.133, 1910.135, 1910.136, 1910.138, and 1910.140. Paragraphs (d) and (f) of this section do not apply to §§1910.134 and 1910.137.

10. Add the following heading:

§1910.139 [Reserved].

11. Add new §1910.140 to read as follows:

§1910.140 Personal fall protection systems.

(a) Scope and application. Personal fall protection systems required by part 1910 must comply with the applicable provisions of this section. This section establishes performance, care, and use criteria for all personal fall protection systems covered by this section. Additional requirements for specific types of personal fall protection systems are contained in paragraphs (d) and (e) of this section.

(b) Definitions.

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

Belt terminal means an end attachment of a window cleaner's positioning system used for securing the belt or harness to a window cleaner's belt anchor.

Body belt means a strap with means both for securing about the waist and for attaching to other components such as a lanyard or lifeline, used with positioning systems, travel restraint systems, or ladder safety systems.

Body harness means straps which may be secured about the employee in a manner to 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.

Buckle means any device for holding the body belt or body harness closed around the employee's body.

Carrier means the track of a ladder safety system consisting of a flexible cable or rigid rail which is secured to the ladder or structure by mountings.

Competent person means a person who is capable of identifying hazardous or dangerous conditions in any personal fall protection system or any component thereof, as well as in their application and uses with related equipment.

Connector means a device that is used to couple (connect) parts of the fall protection system together.

D-ring means a connector used integrally in a harness as an attachment element or fall arrest attachment; in a lanyard, energy absorber, lifeline, or anchorage connector as an integral connector; or in a positioning or travel restraint system as an attachment element.

Deceleration device means any mechanism that serves to dissipate energy during a fall.

Deceleration distance means the vertical distance a falling employee travels before stopping, from the point at which the deceleration device begins to operate, excluding lifeline elongation and free fall distance. It is measured as the distance between the location of an employee's body harness attachment point at the moment of activation (at the onset of fall arrest forces) of the deceleration device during a fall, and

location of that attachment point after the employee comes to a full stop.

Equivalent means alternative designs, materials or methods to protect against a hazard, which the employer can demonstrate will provide an equal or greater degree of safety for employees compared to the methods, materials, or designs specified in the standard.

Free fall means the act of falling before the personal fall arrest system begins to apply force to arrest the fall.

Free fall distance means the vertical displacement of the fall arrest attachment point on the employee's body belt or body harness between onset of the fall and just before the system begins to apply force to arrest the fall. This distance excludes deceleration distance, lifeline and lanyard elongation, but includes any deceleration device slide distance or self-retracting lifeline/lanyard extension before the devices operate and fall arrest forces occur.

Lanyard means 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.

Lifeline means a component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline) or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline), and which serves as a means for connecting other components of a personal fall protection system to the anchorage.

Personal fall arrest system means a system used to arrest an employee in a fall from a working level. It consists of an anchorage, connector, and a body harness and may include a lanyard, deceleration device, lifeline, or suitable combinations of these.

Personal fall protection system means a system used to protect an employee from falling, or to safely arrest an employee's fall, should a fall occur. Examples include: a personal fall arrest system, a positioning system, or a travel restraint system.

Positioning system (sometimes called a work positioning system) means a system of equipment and connectors which, when used with its body belt or body harness, allows an employee to be supported on an elevated vertical surface, such as a wall or windowsill, and work with both hands free.

Qualified means a person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project.

Rope grab means a deceleration device that travels on a lifeline and automatically, by friction, engages the lifeline and locks so as to arrest the fall of an employee. A rope grab usually employs the principle of inertial locking, cam/lever locking, or both.

Self-retracting lifeline/lanyard means a deceleration device containing a drum-wound line which can be slowly extracted from, or retracted onto, the drum under slight tension during normal movement by the employee, and after onset of a fall, automatically locks the drum and arrests the fall.

Snaphook means a connector comprised of a hook-shaped body with a normally closed gate or similar arrangement that may be manually opened to permit the hook to receive an object and when released, automatically closes and locks to retain the object. Opening requires two separate actions.

Note: Snaphooks are generally one of two types, namely: (1) Automatic-locking type (permitted) with a self-closing and self-locking gate which remains closed and

locked until intentionally unlocked and opened for connection or disconnection; and (2) non-locking type (prohibited) with a self-closing gate which remains closed, but not locked, until intentionally opened for connection or disconnection.

Travel restraint (tether) line means a rope or wire rope used to transfer forces from a body support to an anchorage or anchorage connector in a travel restraint system.

Travel restraint system means a combination of an anchorage, anchorage connector, lanyard (or other means of connection), and body support intended to be used by an employee to limit travel to prevent exposure to a fall hazard. A travel restraint system is used such that it does not support any portion of the employee's weight; otherwise the system would be a positioning system or a personal fall arrest system.

Window cleaner's belt means a belt that consists of a waist-belt, an integral terminal runner or strap, and belt terminals.

Window cleaner's belt anchor (window anchor) means specifically designed fall-preventing attachment points, permanently affixed to a window frame or to a building part immediately adjacent to the window frame, for direct attachment of the terminal portion of a window cleaner’s belt.

Window cleaner's positioning system means a system which consists of a window cleaner's belt secured to window anchors.

Work positioning system (see “Positioning system” above).

(c) General requirements. The following requirements apply to all personal fall protection systems.

(1) Connectors must be drop forged, pressed or formed steel, or made of equivalent materials.

(2) Connectors must have a corrosion-resistant finish, and all surfaces and edges

must be smooth to prevent damage to interfacing parts of the system.

(3) When vertical lifelines are used, each employee must be attached to a separate lifeline.

(4) Lanyards and vertical lifelines must have a minimum breaking strength of 5,000 pounds (22.2 kN).

Note to paragraph (c)(4) of this section: The use of knots in lanyards and vertical lifelines may significantly reduce the breaking strength.

(5) Self-retracting lifelines and lanyards that automatically limit free fall distance to 2 feet (0.61 m) or less must have components capable of sustaining a minimum tensile load of 3,000 pounds (13.3 kN) applied to the device with the lifeline or lanyard in the fully extended position.

(6) Self-retracting lifelines and lanyards that do not limit free fall distance to 2 feet (0.61 m) or less, ripstitch lanyards, and tearing and deforming lanyards must be capable of sustaining a minimum tensile load of 5,000 pounds (22.2 kN) applied to the device with the lifeline or lanyard in the fully extended position.

(7) D-rings and snaphooks must be capable of sustaining a minimum tensile load of 5,000 pounds (22.2 kN).

(8) D-rings and snaphooks must be proof tested to a minimum tensile load of 3,600 pounds (16 kN) without cracking, breaking, or incurring permanent deformation.

(9) Snaphooks must be the locking type, which require two separate, consecutive movements to open.

(10) Unless designed for the following connections, snaphooks must not be connected:

(i) Directly to webbing, rope, or wire rope;

(ii) To each other;

(iii) To a D-ring to which another snaphook or connector is attached;

(iv) To a horizontal life line; or

(v) To any object that is incompatibly shaped or dimensioned in relation to the snaphook such that unintentional disengagement could occur when the connected object depresses the snaphook gate, allowing the components to separate.

(11) Horizontal lifelines:

(i) Must be designed, installed, and used under the supervision of a qualified person; and

(ii) Must be part of a complete personal fall arrest system that maintains a safety factor of at least two.

(12) Anchorages used for attachment to personal fall protection equipment must be independent of any anchorage being used to support or suspend platforms on which employees work.

(13) Except for window cleaner's belt anchors, which are covered under paragraph (e) of this section, anchorages must be capable of supporting at least 5,000 pounds (22.2 kN) for each employee attached, or must be designed, installed, and used under the supervision of qualified person as part of a complete personal fall protection system that maintains a safety factor of at least two.

(14) Travel restraint lines must be capable of sustaining a tensile load of at least 5,000 pounds (22.2 kN).

(15) Lifelines and carriers must not be made of natural fiber rope. When polypropylene ropes are used, they must contain an ultraviolet (UV) light inhibitor.

(16) Personal fall protection systems and their components must be used exclusively for employee fall protection and not for any other purpose, such as hoisting equipment or materials.

(17) A personal fall protection system or its components subjected to impact loading must be immediately removed from service and must not be used again for employee protection until a competent person inspects it and determines that it is undamaged and suitable for re-use.

(18) Personal fall protection systems must be inspected before each use for mildew, wear, damage, and other deterioration, and defective components must be removed from service.

(19) Ropes, belts, lanyards, and harnesses used for personal fall protection must be compatible with all connectors used.

(20) Ropes, belts, lanyards, lifelines, and harnesses used for personal fall protection must be protected from being cut, abraded, melted, or otherwise damaged.

(21) The employer must provide for prompt rescue of employees in the event of a fall.

(22) Personal fall protection systems must be worn with the attachment point of the body harness located in the center of the wearer's back near shoulder level, or above the wearer's head, except that the attachment point may be located in the pre-sternal position if the free fall distance is limited to 2 feet (0.6 m) or less and the maximum arresting forces are limited to 900 lbs (4 kN).

(d) Personal fall arrest systems.

(1) System performance criteria. In addition to the general requirements in

paragraph (c) of this section, personal fall arrest systems must, when stopping a fall:

(i) Limit maximum arresting force on an employee to 1,800 pounds (8 kN);

(ii) Bring an employee to a complete stop and limit the maximum deceleration distance an employee travels to 3.5 feet (1.1 m); and

(iii) Have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet (1.8 m), or the free fall distance permitted by the system, whichever is less.

Note to paragraph (d)(1) of this section: If the personal fall arrest system meets the criteria and protocols contained in Appendix D to §1910.140, and if the system is being used by an employee having a combined tool and body weight of less than 310 pounds (140 kg), the system will be considered to be in compliance with the provisions of paragraphs (d)(1)(i) through (d)(1)(iii) of this section. If the system is used by an employee having a combined tool and body weight of 310 pounds (140 kg) or more, then the employer must appropriately modify the criteria and protocols of the appendix to provide proper protection for such heavier weights, or the system will not be deemed to be in compliance with the requirements of paragraphs (d)(1)(i) through (d)(1)(iii) of this section.

(2) System use criteria.

(i) On suspended scaffolds or similar work platforms with horizontal lifelines that may become vertical lifelines, the devices used to connect to the horizontal lifeline must be capable of locking in both directions on the lifeline.

(ii) Personal fall arrest systems must be rigged in such a manner that an employee can neither free fall more than 6 feet (1.8 m) nor contact any lower level.

(3) Body belts. Body belts are prohibited as part of a personal fall arrest system.

(e) Positioning systems. In addition to the general requirements in paragraph (c) of this section, positioning systems must meet the following requirements.

(1) System performance requirements. (i) General. All positioning systems, except window cleaner's positioning systems, must be capable of withstanding, without

failure, a drop test consisting of a 4-foot (1.2-m) drop of a 250-pound (113-kg) weight.

(ii) Window cleaner's positioning systems. All window cleaner's positioning systems must:

(A) Be capable of withstanding without failure a drop test consisting of a 6-foot (1.8-m) drop of a 250-pound (113-kg) weight; and,

(B) Limit the initial arresting force to not more than 2,000 pounds (8.9 kN), with a duration not to exceed 2 milliseconds, and must limit any subsequent arresting forces imposed on the falling employee to not more than 1,000 pounds (4.5 kN).

Note to paragraphs (e)(1)(i) and (e)(1)(ii) of this section: Positioning systems meeting the tests contained in Appendix D to 1910.140 are considered to be in compliance with these paragraphs.

(iii) Lineman's body belt and pole strap systems. The following additional test provisions apply to lineman's body belt and pole strap systems:

(A) A dielectric test of 819.7 volts, AC, per centimeter (25000 volts per foot) for 3 minutes without visible deterioration;

(B) A leakage test of 98.4 volts, AC, per centimeter (3000 volts per foot) with a leakage current of no more than 1 mA;

Note to paragraphs (e)(1)(iii)(A) and (B) of this section: Positioning straps that pass direct current tests at equivalent voltages are considered as meeting this requirement.

(2) System use criteria for window cleaners positions systems.

(i) Window cleaner's belts must be designed and constructed so that:

(A) Belt terminals will not pass through their fastenings on the belt or harness should one terminal become loosened from its window anchor; and

(B) The length of the runner from terminal tip to terminal tip is 8 feet (2.44 m) or less.

(ii) The anchors on a building to which the belt is to be fastened must be installed in the side frames of the window or in the mullions at a point not less than 42 inches (106.7 cm) or more than 51 inches (129.5 cm) above the window sill.

(iii) Each anchor, and the structure to which it is attached, must be capable of supporting a minimum load of 6,000 pounds (26.5 kN).

(iv) Rope that has sustained wear or deterioration materially affecting its strength must not be used.

(v) An anchor whose fastenings or supports are damaged or deteriorated must be removed or rendered unusable by detachment of its anchor head.

(vi) The use of an installed window cleaner's belt anchor for any purpose other than attachment of a window cleaner's belt is prohibited.

(vii) Both belt terminals must be attached to separate window cleaner's belt anchors during the cleaning operation.

(viii) Cleaning work is not permitted on a sill or ledge on which there is snow, ice, or any other slippery condition, or on a weakened or rotted sill or ledge.

(ix) A window cleaner may work from a windowsill only if a minimum standing room in relation to slope is provided as follows:

(A) When the sill width is at least 4 inches (10.1 cm), work is permitted with a slope of the sill from horizontal up to 15 degrees;

(B) For slopes between 15 and 30 degrees from horizontal, but in no case greater than 30, the minimum acceptable sill width is four inches (10.1 cm), plus 0.4 inches (1.0 cm) for every degree of slope greater than 15 degrees.

(x) The employer must ensure that the window cleaner attach at least one belt

terminal to a window anchor before climbing through the window opening. The belt must not be completely disconnected from both anchors until the employee is back inside the window opening.

(xi)(A) The employer must ensure the window cleaner does not pass from one window to another while outside the building, but must return inside and repeat the belt terminal attachment procedure for each window as described in paragraph (e)(13) of this section.

(B) Traveling on the outside of the building is permitted if at least one window cleaner's belt terminal is attached at all times and the distance between anchors does not exceed 4 feet (1.2 m) horizontally, unless the sill or ledge is at least 1 foot (0.31 m) wide and the slope is less than 5 degrees, in which case the distance between anchors may be as much as 6 feet (1.8 m). However, this method of traveling shall not be permitted if the sill or ledge is not continuous with at least 6 inches (0.15 m) in front of the mullions or if each window unit is not readily accessible.

12. Add new Appendices C and D to read as follows:

Appendix C to Subpart I of Part 1910 -- Personal Fall Protection Systems Non-Mandatory Guidelines

The following information generally applies to all personal fall protection systems and is intended to assist employers and employees comply with the requirements of §1910.140 for personal fall protection systems.

(a) Planning considerations. It is important for employers to plan prior to using personal fall protection systems. Probably the most overlooked component of planning is locating suitable anchorage points. Such planning should ideally be done before the

structure or building is constructed so that anchorage points can be used later for window cleaning or other building maintenance.

(b) Selection and use considerations. (1) The kind of personal fall protection system selected should be appropriate for the employee's specific work situation. Free fall distances should always be kept to a minimum. Many systems are designed for particular work applications, such as climbing ladders and poles; maintaining and servicing equipment; and window cleaning. Consideration should be given to the environment in which the work will be performed. For example, the presence of acids, dirt, moisture, oil, grease, or other substances, and their potential effects on the system selected, should be evaluated. Hot or cold environments may also affect fall protection systems. Wire rope should not be used where electrical hazards are anticipated. As required by paragraph (c)(21) of the standard, the employer must provide a means for promptly rescuing an employee should a fall occur.

(2) Where lanyards, connectors, and lifelines are subject to damage by work operations, such as welding, chemical cleaning, and sandblasting, the component should be protected, or other securing systems should be used. Unless designed for use in a personal fall protection system, equipment such as linemen's pole straps should not be used as lanyards because such equipment may not meet the strength and performance criteria necessary for a personal fall arrest system. The employer should fully evaluate the work conditions and environment (including seasonal weather changes) before selecting the appropriate personal fall protection system. Once in use, the system's effectiveness should be monitored. A program for cleaning and maintaining the system may be necessary.

(c) Testing considerations. Before purchasing a personal fall protection system, an employer should insist that the supplier provide information about its test performance (using recognized test methods) so the employer will know that the system meets the criteria in this standard. Otherwise, the employer should test the equipment to ensure that it is in compliance. Appendix D contains test methods which are recommended for evaluating the performance of any system. There are some circumstances in which an employer can evaluate a system based on data and calculations derived from the testing of similar systems. Enough information must be available for the employer to demonstrate that its system and the tested system(s) are similar in both function and design.

(d) Component compatibility considerations. Ideally, a personal fall protection system is designed, tested, and supplied as a complete system. However, it is common practice for lanyards, connectors, lifelines, deceleration devices, body belts, and body harnesses to be interchanged since some components wear out before others. Employers and employees should realize that not all components are interchangeable. For instance, a lanyard should not be connected between a body harness and a deceleration device of the self-retracting type (unless specifically allowed by the manufacturer) since this can result in additional free fall for which the system was not designed. In addition, positioning components, such as pole straps, ladder hooks and rebar hooks, should not be used in personal fall arrest systems unless they meet the appropriate requirements of part 1910 (e.g., §§1910.140, .268 and .269). Any substitution or change to a personal fall protection system should be fully evaluated or tested by a competent person to determine that it meets applicable OSHA standards before the modified system is put in use.

(e) Employee training considerations. As required by §1910.30, before an employee uses a fall protection system, the employer must ensure that he or she is trained in the proper use of the system. This may include the following: the limits of the system; proper anchoring and tie-off techniques; estimating freefall distance, including determining elongation and deceleration distance; methods of use; and inspection and storage. Careless or improper use of fall protection equipment can result in serious injury or death. Employers and employees should become familiar with the material in this standard and appendix, as well as manufacturers' recommendations, before a system is used. It is important for employees to be aware that certain tie-offs (such as using knots and tying around sharp edges) can reduce the overall strength of a system. Employees also need to know the maximum permitted free fall distance. Training should stress the importance of inspections prior to use, the limitations of the equipment to be used, and unique conditions at the worksite that may be important. Also, OSHA suggests that rope be used according to manufacturer's recommendations, especially if polypropylene rope is used.

(f) Instruction considerations. Employers should obtain comprehensive instructions from the supplier or a qualified person as to the system's proper use and application, including, where applicable:

1. The force measured during the sample force test;

2. The maximum elongation measured for lanyards during the force test;

3. The deceleration distance measured for deceleration devices during the force test;

4. Caution statements on critical use limitations;

5. Limits of the system;

6. Proper hook-up, anchoring and tie-off techniques, including the proper D-ring or other attachment point to use on the body harness;

7. Proper climbing techniques;

8. Methods of inspection, use, cleaning, and storage; and

9. Specific lifelines that may be used.

(g) Inspection considerations. Personal fall protection systems must be regularly inspected before each use. Any component with a significant defect, such as a cut, tear, abrasion, mold, or evidence of undue stretching, an alteration or addition that might affect its efficiency, damage due to deterioration, fire, acid, or other corrosive damage, distorted hooks or faulty hook springs, tongues that are unfitted to the shoulder of buckles, loose or damaged mountings, non-functioning parts, or wear, or internal deterioration must be removed from service immediately, and should be tagged or marked as unusable, or destroyed.

(h) Rescue considerations. As required by paragraph (c)(21), when personal fall arrest systems are used, special consideration must be given to rescuing an employee should a fall occur. The availability of rescue personnel, ladders or other rescue equipment should be evaluated. In some situations, equipment allowing employees to rescue themselves after the fall has been arrested may be desirable, such as devices that have descent capability.

(i) Tie-off considerations. Employers and employees should at all times be aware that the strength of a personal fall arrest system is based on its being attached to an anchoring system that does not significantly reduce the strength of the system (such as an

eye-bolt/snaphook anchorage). Therefore, if a means of attachment is used that will reduce the strength of the system, that component should be replaced by a stronger one that will also maintain the appropriate maximum deceleration characteristics. The following is a listing of some situations in which employers and employees should be especially cautious.

1. Tie-off using a knot in the lanyard or lifeline (at any location). The strength of the line can be reduced by 50 percent or more if a knot is used. Therefore, a stronger lanyard or lifeline should be used to compensate for the knot, or the lanyard length should be reduced (or the tie-off location raised) to minimize free fall distance, or the lanyard or lifeline should be replaced by one which has an appropriately incorporated connector to eliminate the need for a knot.

2. Tie-off around rough or sharp (e.g. "H" or "I" beams) surfaces. This practice reduces strength drastically. Such tie-offs should be avoided whenever possible. An alternate means should be used such as a snaphook/D-ring connection, a tie-off apparatus (steel cable tie-off), an effective padding of the surfaces, or an abrasion-resistant strap around the supporting member. If these alternative means of tie-off are not available, the employer should try to minimize the potential free fall distance.

3. Knots. Sliding hitch knots should not be used except in emergency situations. The one-and-one sliding hitch knot should never be used because it is unreliable in stopping a fall. The two-and-two, or three-and-three knots (preferable) may be used in emergency situations; however, care should be taken to limit free fall distances because of reduced lifeline/lanyard strength. OSHA recommends that a competent or qualified person oversee the use of knots.

(j) Horizontal lifelines. Horizontal lifelines, depending on their geometry and angle of sag, may be subjected to greater loads than the impact load imposed by an attached component. When the angle of horizontal lifeline sag is less than 30 degrees, the impact force imparted to the lifeline by an attached lanyard is greatly amplified. For example, with a sag angle of 15 degrees the force amplification is about 2:1, and at 5 degrees sag it is about 6:1. Depending on the angle of sag, and the line's elasticity, the strength of the horizontal lifeline, and the anchorages to which it is attached should be increased a number of times over that of the lanyard. Extreme care should be taken in considering a horizontal lifeline for multiple tie-offs. If there are multiple tie-offs to a horizontal lifeline, and one employee falls, the movement of the falling employee and the horizontal lifeline during arrest of the fall may cause other employees to fall. Horizontal lifeline and anchorage strength should be increased for each additional employee to be tied-off. For these and other reasons, the systems using horizontal lifelines must be designed only by qualified persons. OSHA recommends testing installed lifelines and anchors prior to use.

(k) Eye-bolts. It must be recognized that the strength of an eye-bolt is rated along the axis of the bolt, and that its strength is greatly reduced if the force is applied at right angles to this axis (in the direction of its shear strength). Care should also be exercised in selecting the proper diameter of the eye to avoid creating a roll-out hazard (accidental disengagement of the snaphook from the eye-bolt).

(l) Vertical lifeline considerations. As required by paragraph (c)(3) of the standard, each employee must have a separate lifeline when the lifeline is vertical. If multiple tie-offs to a single lifeline are used, and one employee falls, the movement of the

lifeline during the arrest of the fall may pull other employees' lanyards, causing them to fall as well.

(m) Snaphook considerations. As required by paragraph (c)(10) of the standard, the following connections must be avoided unless the locking snaphook has been designed for them because they are conditions that can result in rollout:

(1) Direct connection of a snaphook to a horizontal lifeline;

(2) Two (or more) snaphooks connected to one D-ring;

(3) Two snaphooks connected to each other;

(4) Snaphooks connected directly to webbing, rope, or wire rope; and

(5) Improper dimensions of the D-ring, rebar, or other connection point in relation to the snaphook dimensions which would allow the snaphook gate to be depressed by a turning motion of the snaphook.

(n) Free fall considerations. Employers and employees should always be aware that a system's maximum arresting force is evaluated under normal use conditions established by the manufacturer, and in no case using free fall distance in excess of 6 feet (1.8 m). Even a few additional feet of free fall can significantly increase the arresting force on the employee, possibly to the point of causing injury and possibly exceeding the strength of the system. Because of this, the free fall distance should be kept to a minimum, and, as required by paragraph (d)(2) of the standard, must never be greater than 6 feet (1.8 m). To assure this, the tie-off attachment point to the lifeline or anchor should be located at or above the connection point of the fall arrest equipment to the harness. (Otherwise, additional free fall distance is added to the length of the connecting means (i.e., lanyard)). Tying off to the walking-working surface will often result in a free

fall greater than 6 feet (1.8 m). For instance, if a 6-foot (1.8-m) lanyard is used, the total free fall distance will be the distance from the walking-working level to the harness connection plus the 6 feet (1.8 m) of lanyard.

(o) Elongation and deceleration distance considerations. During fall arrest, a lanyard will stretch or elongate, whereas activation of a deceleration device will result in a certain stopping distance. These distances should be available with the lanyard or device's instructions and must be added to the free fall distance to arrive at the total fall distance before an employee is fully stopped. The additional stopping distance may be significant if the lanyard or deceleration device is attached near or at the end of a long lifeline, which may itself add considerable distance due to its own elongation. As required by paragraph (d)(2) of the standard, sufficient distance to allow for all of these factors must also be maintained between the employee and obstructions below, to prevent an injury due to impact before the system fully arrests the fall. In addition, a minimum of 12 feet (3.7 m) of lifeline should be allowed below the securing point of a rope–grab-type deceleration device, and the end terminated to prevent the device from sliding off the lifeline. Alternatively, the lifeline should extend to the ground or the next working level below. These measures are suggested to prevent the employee from inadvertently moving past the end of the lifeline and having the rope grab become disengaged from the lifeline.

(p) Obstruction considerations. In selecting a location for tie-off, employers and employees should consider obstructions in the potential fall path of the employee. Tie-offs that minimize the possibilities of exaggerated swinging should be considered.

Appendix D to Subpart I -- Test Methods and Procedures for Personal Fall

Protection Systems Non-Mandatory Guidelines

This appendix contains test methods for personal fall protection systems which may be used to determine if they meet the system performance criteria specified in paragraphs (d) and (e) of §1910.140.

Test methods for personal fall arrest systems (paragraph (d)).

(a) General. The following sets forth test procedures for personal fall arrest systems as defined in paragraph (d) of §1910.140.

(b) General test conditions.

(1) Lifelines, lanyards and deceleration devices should be attached to an anchorage and connected to the body harness in the same manner as they would be when used to protect employees.

(2) The fixed anchorage should be rigid, and should not have a deflection greater than 0.04 inches (1 mm) when a force of 2,250 pounds (10 kN) is applied.

(3) The frequency response of the load measuring instrumentation should be 120 Hz.

(4) The test weight used in the strength and force tests should be a rigid, metal cylindrical or torso-shaped object with a girth of 38 inches plus or minus 4 inches (96 cm plus or minus 10 cm).

(5) The lanyard or lifeline used to create the free fall distance should be supplied with the system, or in its absence, the least elastic lanyard or lifeline available should be used with the system.

(6) The test weight for each test should be hoisted to the required level and should be quickly released without having any appreciable motion imparted to it.

(7) The system’s performance should be evaluated, taking into account the range of environmental conditions for which it is designed to be used.

(8) Following the test, the system need not be capable of further operation.

(c) Strength test.

(1) During the testing of all systems, a test weight of 300 pounds plus or minus 3 pounds (136.4 kg plus or minus 1.4 kg) should be used. (See item number 4 of paragraph (b) above.)

(2) The test consists of dropping the test weight once. A new unused system should be used for each test.

(3) For lanyard systems, the lanyard length should be 6 feet plus or minus 2 inches (1.83 plus or minus 5 cm) as measured from the fixed anchorage to the attachment on the body harness.

(4) For rope-grab-type deceleration systems, the length of the lifeline above the centerline of the grabbing mechanism to the lifeline's anchorage point should not exceed 2 feet (0.61 m).

(5) For lanyard systems, for systems with deceleration devices which do not automatically limit free fall distance to 2 feet (0.61 m) or less, and for systems with deceleration devices which have a connection distance in excess of 1 foot (0.3 m) (measured between the centerline of the lifeline and the attachment point to the body harness), the test weight should be rigged to free fall a distance of 7.5 feet (2.3 m) from a point that is 1.5 feet (46 cm) above the anchorage point, to its hanging location (6 feet below the anchorage). The test weight should fall without interference, obstruction, or hitting the floor or ground during the test. In some cases a non-elastic wire lanyard of

sufficient length may need to be added to the system (for test purposes) to create the necessary free fall distance.

(6) For deceleration device systems with integral lifelines or lanyards that automatically limit free fall distance to 2 feet (0.61 m) or less, the test weight should be rigged to free fall a distance of 4 feet (1.22 m).

(7) Any weight that detaches from the harness should constitute failure for the strength test.

(d) Force test.

(1) General. The test consists of dropping the respective test weight specified in (d)(2)(i) or (d)(3)(i) once. A new, unused system should be used for each test.

(2) For lanyard systems. (i) A test weight of 220 pounds plus or minus three pounds (100 kg plus or minus 1.6 kg) should be used. (See item number 4 of paragraph (b) above.)

(ii) Lanyard length should be 6 feet plus or minus 2 inches (1.83 m plus or minus 5 cm) as measured from the fixed anchorage to the attachment on the body harness.

(iii) The test weight should fall free from the anchorage level to its hanging location (a total of 6 feet (1.83 m) free fall distance) without interference, obstruction, or hitting the floor or ground during the test.

(3) For all other systems. (i) A test weight of 220 pounds plus or minus 2 pounds (100 kg plus or minus 1.0 kg) should be used. (See item number 4 of paragraph (b) above.)

(ii) The free fall distance to be used in the test should be the maximum fall distance physically permitted by the system during normal use conditions, up to a

maximum free fall distance for the test weight of 6 feet (1.83 m), except as follows:

(A) For deceleration systems having a connection link or lanyard, the test weight should free fall a distance equal to the connection distance (measured between the centerline of the lifeline and the attachment point to the body harness).

(B) For deceleration device systems with integral lifelines or lanyards that automatically limit free fall distance to 2 feet (0.61 m) or less, the test weight should free fall a distance equal to that permitted by the system in normal use. (For example, to test a system with a self-retracting lifeline or lanyard, the test weight should be supported and the system allowed to retract the lifeline or lanyard as it would in normal use. The test weight would then be released and the force and deceleration distance measured).

(4) Failure. A system fails the force test when the recorded maximum arresting force exceeds 2,520 pounds (11.2 kN) when using a body harness.

(5) Distances. The maximum elongation and deceleration distance should be recorded during the force test.

(e) Deceleration device tests.

(1) General. The device should be evaluated or tested under the environmental conditions (such as rain, ice, grease, dirt, and type of lifeline) for which the device is designed.

(2) Rope-grab-type deceleration devices. (i) Devices should be moved on a lifeline 1,000 times over the same length of line a distance of not less than 1 foot (30.5 cm), and the mechanism should lock each time.

(ii) Unless the device is permanently marked to indicate the type of lifelines that must be used, several types (different diameters and different materials), of lifelines

should be used to test the device.

(3) Other self-activating-type deceleration devices. The locking mechanisms of other self-activating-type deceleration devices designed for more than one arrest should lock each of 1,000 times as they would in normal service.

Test methods for positioning systems (paragraph (e)).

(a) General. The following sets forth test procedures for positioning systems as defined in paragraph (e) of §1910.140. The requirements in this appendix for personal fall arrest systems set forth procedures that may be used, along with the procedures listed below, to determine compliance with the requirements for positioning systems.

(b) Test conditions.

(1) The fixed anchorage should be rigid and should not have a deflection greater than 0.04 inches (1 mm) when a force of 2,250 pounds (10 kN) is applied.

(2) For window cleaner's belts, the complete belt should withstand a drop test consisting of a 250 pound (113 kg) weight falling free for a distance of 6 feet (1.83 m). The weight should be a rigid object with a girth of 38 inches plus or minus 4 inches (96 cm plus or minus 10 cm). The weight should be placed in the waistband with the belt buckle drawn firmly against the weight, as when the belt is worn by a window cleaner. One belt terminal should be attached to a rigid anchor and the other terminal should hang free. The terminals should be adjusted to their maximum span. The weight fastened in the freely suspended belt should then be lifted exactly 6 feet (1.83 m) above its “at rest” position and released so as to permit a free fall of 6 feet (1.83 m) vertically below the point of attachment of the terminal anchor. The belt system should be equipped with devices and instrumentation capable of measuring the duration and magnitude of the

arrest forces. Failure of the test should consist of any breakage or slippage sufficient to permit the weight to fall free of the system. In addition, the initial and subsequent arresting forces should be measured and should not exceed 2,000 pounds (8.5 kN) for more than 2 milliseconds for the initial impact, or exceed 1,000 pounds (4.5 kN) for the remainder of the arrest time.

3. All other positioning systems (except for restraint line systems) should withstand a drop test consisting of a 250 pound (113 kg) weight free falling a distance of 4 feet (1.2 m). The weight shall be a rigid object with a girth of 38 inches plus or minus 4 inches (96 cm plus or minus 10 cm). The body belt or harness should be affixed to the test weight as it would be to an employee. The system should be connected to the rigid anchor in the manner that the system would be connected in normal use. The weight should be lifted exactly 4 feet (1.2 m) above its "at rest" position and released so as to permit a vertical free fall of 4 feet (1.2 m). Failure of the system should be indicated by any breakage or slippage sufficient to permit the weight to fall free to the ground.

Subpart N—[Amended]

13. Revise the authority citation for subpart N of part 1910 to read as follows:

AUTHORITY: Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059) 9-83 (48 FR 35736), 1-90 (55 FR 9033), 6-96 (62 FR 111), 3-2000 (65 FR 50017), 5-2002 (67 FR 65008), or 5-2007 (72 FR 31159), as applicable. Section 1910.178 also amended under section 4 of the Administrative Procedure Act (5 U.S.C.