

**Part Number:** 1926  
• **Part Title:** Safety and Health Regulations for Construction  
• **Subpart:** L  
• **Subpart Title:** Scaffolds  
• **Standard Number:** [1926.450](#)  
• **Title:** Scope, application and definitions applicable to this subpart.

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[1926.450\(a\)](#)

*Scope and application.* This subpart applies to all scaffolds used in workplaces covered by this part. It does not apply to crane or derrick suspended personnel platforms. The criteria for aerial lifts are set out exclusively in § 1926.453.

[1926.450\(b\)](#)

*Definitions.*

*Adjustable suspension scaffold* means a suspension scaffold equipped with a hoist(s) that can be operated by an employee(s) on the scaffold.

*Bearer (putlog)* means a horizontal transverse scaffold member (which may be supported by ledgers or runners) upon which the scaffold platform rests and which joins scaffold uprights, posts, poles, and similar members.

*Boatswains' chair* means a single-point adjustable suspension scaffold consisting of a seat or sling designed to support one employee in a sitting position.

*Body belt (safety belt)* means a strap with means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device.

*Body harness* means a design of 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. *Brace* means a rigid connection that holds one scaffold member in a fixed position with respect to another member, or to a building or structure.

*Bricklayers' square scaffold* means a supported scaffold composed of framed squares which support a platform.

*Carpenters' bracket scaffold* means a supported scaffold consisting of a platform supported by brackets attached to building or structural walls.

*Catenary scaffold* means a suspension scaffold consisting of a platform supported by two essentially horizontal and parallel ropes attached to structural members of a building or other structure. Additional support may be provided by vertical pickups.

*Chimney hoist* means a multi-point adjustable suspension scaffold used to provide access to work inside chimneys. (See "Multi-point adjustable suspension scaffold".)

*Cleat* means a structural block used at the end of a platform to prevent the platform from slipping off its supports. Cleats are also used to provide footing on sloped surfaces such as crawling boards.

*Competent person* means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

*Continuous run scaffold (Run scaffold)* means a two-point or multi-point adjustable suspension scaffold constructed using a series of interconnected braced scaffold members or supporting structures erected to form a continuous scaffold.

*Coupler* means a device for locking together the tubes of a tube and coupler scaffold.

*Crawling board (chicken ladder)* means a supported scaffold consisting of a plank with cleats spaced and secured to provide footing, for use on sloped surfaces such as roofs.

*Deceleration device* means any mechanism, such as a rope grab, rip-stitch lanyard, specially-woven lanyard, tearing or deforming lanyard, or automatic self-retracting lifeline lanyard, which dissipates a substantial amount of energy during a fall arrest or limits the energy imposed on an employee during fall arrest.

*Double pole (independent pole) scaffold* means a supported scaffold consisting of a platform(s) resting on cross beams (bearers) supported by ledgers and a double row of uprights independent of support (except ties, guys, braces) from any structure.

*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 than the methods, materials or designs specified in the standard.

*Exposed power lines* means electrical power lines which are accessible to employees and which are not shielded from contact. Such lines do not include extension cords or power tool cords.

*Eye or Eye splice* means a loop with or without a thimble at the end of a wire rope.

*Fabricated decking and planking* means manufactured platforms made of wood (including laminated wood, and solid sawn wood planks), metal or other materials.

*Fabricated frame scaffold (tubular welded frame scaffold)* means a scaffold consisting of a platform(s) supported on fabricated end frames with integral posts, horizontal bearers, and intermediate members.

*Failure* means load refusal, breakage, or separation of component parts. Load refusal is the point where the ultimate strength is exceeded.

*Float (ship) scaffold* means a suspension scaffold consisting of a braced platform resting on two parallel bearers and hung from overhead supports by ropes of fixed length.

*Form scaffold* means a supported scaffold consisting of a platform supported by brackets attached to formwork.

*Guardrail system* means a vertical barrier, consisting of, but not limited to, top rails, midrails, and posts, erected to prevent employees from falling off a scaffold platform or walkway to lower levels.

*Hoist* means a manual or power-operated mechanical device to raise or lower a suspended scaffold.

*Horse scaffold* means a supported scaffold consisting of a platform supported by construction horses (saw horses). Horse scaffolds constructed of metal are sometimes known as trestle scaffolds.

*Independent pole scaffold* (see "Double pole scaffold").

*Interior hung scaffold* means a suspension scaffold consisting of a platform suspended from the ceiling or roof structure by fixed length supports.

*Ladder jack scaffold* means a supported scaffold consisting of a platform resting on brackets attached to ladders.

*Ladder stand* means a mobile, fixed-size, self-supporting ladder consisting of a wide flat tread ladder in the form of stairs.

*Landing* means a platform at the end of a flight of stairs.

*Large area scaffold* means a pole scaffold, tube and coupler scaffold, systems scaffold, or fabricated frame scaffold erected over substantially the entire work area. For example: a scaffold erected over the entire floor area of a room.

*Lean-to scaffold* means a supported scaffold which is kept erect by tilting it toward and resting it against a building or structure.

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

*Lower levels* means areas below the level where the employee is located and to which an employee can fall. Such areas include, but are not limited to, ground levels, floors, roofs, ramps, runways, excavations, pits, tanks, materials, water, and equipment.

*Masons' adjustable supported scaffold* (see "Self-contained adjustable scaffold").

*Masons' multi-point adjustable suspension scaffold* means a continuous run suspension scaffold designed and used for masonry operations.

*Maximum intended load* means the total load of all persons, equipment, tools, materials, transmitted loads, and other loads reasonably anticipated to be applied to a scaffold or scaffold component at any one time.

*Mobile scaffold* means a powered or unpowered, portable, caster or wheel-mounted supported scaffold.

*Multi-level suspended scaffold* means a two-point or multi-point adjustable suspension scaffold with a series of platforms at various levels resting on common stirrups.

*Multi-point adjustable suspension scaffold* means a suspension scaffold consisting of a platform(s) which is suspended by more than two ropes from overhead supports and equipped with means to raise and lower the platform to desired work levels. Such scaffolds include chimney hoists.

*Needle beam scaffold* means a platform suspended from needle beams.

*Open sides and ends* means the edges of a platform that are more than 14 inches (36 cm) away horizontally from a sturdy, continuous, vertical surface (such as a building wall) or a sturdy, continuous horizontal surface (such as a floor), or a point of access. Exception: For plastering and lathing operations the horizontal threshold distance is 18 inches (46 cm).

*Outrigger* means the structural member of a supported scaffold used to increase the base width of a scaffold in order to provide support for and increased stability of the scaffold.

*Outrigger beam (Thrustout)* means the structural member of a suspension scaffold or outrigger scaffold which provides support for the scaffold by extending the scaffold point of attachment to a point out and away from the structure or building.

*Outrigger scaffold* means a supported scaffold consisting of a platform resting on outrigger beams (thrustouts) projecting beyond the wall or face of the building or structure, the inboard ends of which are secured inside the building or structure.

*Overhand bricklaying* means the process of laying bricks and masonry units such that the surface of the wall to be jointed is on the opposite side of the wall from the mason, requiring the mason to lean over the wall to complete the work. It includes mason tending and electrical installation incorporated into the brick wall during the overhand bricklaying process.

*Personal fall arrest system* means a system used to arrest an employee's fall. It consists of an anchorage, connectors, a body belt or body harness and may include a lanyard, deceleration device, lifeline, or combinations of these.

*Platform* means a work surface elevated above lower levels. Platforms can be constructed using individual wood planks, fabricated planks, fabricated decks, and fabricated platforms.

*Pole scaffold* (see definitions for "Single-pole scaffold" and "Double (independent) pole scaffold").

*Power operated hoist* means a hoist which is powered by other than human energy.

*Pump jack scaffold* means a supported scaffold consisting of a platform supported by vertical poles and movable support brackets.

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

*Rated load* means the manufacturer's specified maximum load to be lifted by a hoist or to be applied to a scaffold or scaffold component.

*Repair bracket scaffold* means a supported scaffold consisting of a platform supported by brackets which are secured in place around the circumference or perimeter of a chimney, stack, tank or other supporting structure by one or more wire ropes placed around the supporting structure.

*Roof bracket scaffold* means a rooftop supported scaffold consisting of a platform resting on angular-shaped supports.

*Runner (ledger or ribbon)* means the lengthwise horizontal spacing or bracing member which may support the bearers.

*Scaffold* means any temporary elevated platform (supported or suspended) and its supporting structure (including points of anchorage), used for supporting employees or materials or both.

*Self-contained adjustable scaffold* means a combination supported and suspension scaffold consisting of an adjustable platform(s) mounted on an independent supporting frame(s) not a part of the object being worked on, and which is equipped with a means to permit the raising and lowering of the platform(s). Such systems include rolling roof rigs, rolling outrigger systems, and some masons' adjustable supported scaffolds.

*Shore scaffold* means a supported scaffold which is placed against a building or structure and held in place with props.

*Single-point adjustable suspension scaffold* means a suspension scaffold consisting of a platform suspended by one rope from an overhead support and equipped with means to permit the movement of the platform to desired work levels.

*Single-pole scaffold* means a supported scaffold consisting of a platform(s) resting on bearers, the outside ends of which are supported on runners secured to a single row of posts or uprights, and the inner ends of which are supported on or in a structure or building wall.

*Stair tower (Scaffold stairway/tower)* means a tower comprised of scaffold components and which contains internal stairway units and rest platforms. These towers are used to provide access to scaffold platforms and other elevated points such as floors and roofs.

*Stall load* means the load at which the prime-mover of a power-operated hoist stalls or the power to the prime-mover is automatically disconnected.

*Step, platform, and trestle ladder scaffold* means a platform resting directly on the rungs of step ladders or trestle ladders.

*Stilts* means a pair of poles or similar supports with raised footrests, used to permit walking above the ground or working surface.

*Stonesetters' multi-point adjustable suspension scaffold* means a continuous run suspension scaffold designed and used for stonemasons' operations.

*Supported scaffold* means one or more platforms supported by outrigger beams, brackets, poles, legs, uprights, posts, frames, or similar rigid support.

*Suspension scaffold* means one or more platforms suspended by ropes or other non-rigid means from an overhead structure(s).

*System scaffold* means a scaffold consisting of posts with fixed connection points that accept runners, bearers, and diagonals that can be interconnected at predetermined levels.

*Tank builders' scaffold* means a supported scaffold consisting of a platform resting on brackets that are either directly attached to a cylindrical tank or attached to devices that are attached to such a tank.

*Top plate bracket scaffold* means a scaffold supported by brackets that hook over or are attached to the top of a wall. This type of scaffold is similar to carpenters' bracket scaffolds and form scaffolds and is used in residential construction for setting trusses.

*Tube and coupler scaffold* means a supported or suspended scaffold consisting of a platform(s) supported by tubing, erected with coupling devices connecting uprights, braces, bearers, and runners.

*Tubular welded frame scaffold* (see "Fabricated frame scaffold").

*Two-point suspension scaffold (swing stage)* means a suspension scaffold consisting of a platform supported by hangers (stirrups) suspended by two ropes from overhead supports and equipped with means to permit the raising and lowering of the platform to desired work levels.

*Unstable objects* means items whose strength, configuration, or lack of stability may allow them to become dislocated and shift and therefore may not properly support the loads imposed on them. Unstable objects do not constitute a safe base support for scaffolds, platforms, or employees. Examples include, but are not limited to, barrels, boxes, loose brick, and concrete blocks.

*Vertical pickup* means a rope used to support the horizontal rope in catenary scaffolds.

*Walkway* means a portion of a scaffold platform used only for access and not as a work level.

*Window jack scaffold* means a platform resting on a bracket or jack which projects through a window opening.

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**Part Number:** 1926  
• **Part Title:** Safety and Health Regulations for Construction  
• **Subpart:** L  
• **Subpart Title:** Scaffolds  
• **Standard Number:** [1926.451](#)  
• **Title:** General requirements.

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This section does not apply to aerial lifts, the criteria for which are set out exclusively in 1926.453.

#### [1926.451\(a\)](#)

"Capacity"

##### [1926.451\(a\)\(1\)](#)

Except as provided in paragraphs (a)(2), (a)(3), (a)(4), (a)(5) and (g) of this section, each scaffold and scaffold component shall be capable of supporting, without failure, its own weight and at least 4 times the maximum intended load applied or transmitted to it.

##### [1926.451\(a\)\(2\)](#)

Direct connections to roofs and floors, and counterweights used to balance adjustable suspension scaffolds, shall be capable of resisting at least 4 times the tipping moment imposed by the scaffold operating at the rated load of the hoist, or 1.5 (minimum) times the tipping moment imposed by the scaffold operating at the stall load of the hoist, whichever is greater.

##### [1926.451\(a\)\(3\)](#)

Each suspension rope, including connecting hardware, used on non-adjustable suspension scaffolds shall be capable of supporting, without failure, at least 6 times the maximum intended load applied or transmitted to that rope.

*..1926.451(a)(4)*

##### [1926.451\(a\)\(4\)](#)

Each suspension rope, including connecting hardware, used on adjustable suspension scaffolds shall be capable of supporting, without failure, at least 6 times the maximum intended load applied or transmitted to that rope with the scaffold operating at either the rated load of the hoist, or 2 (minimum) times the stall load of the hoist, whichever is greater.

##### [1926.451\(a\)\(5\)](#)

The stall load of any scaffold hoist shall not exceed 3 times its rated load.

##### [1926.451\(a\)\(6\)](#)

Scaffolds shall be designed by a qualified person and shall be constructed and loaded in accordance with that design. Non-mandatory Appendix A to this subpart contains examples of criteria that will enable an employer to comply with paragraph (a) of this section.

## **1926.451(b)**

"Scaffold platform construction."

### **1926.451(b)(1)**

Each platform on all working levels of scaffolds shall be fully planked or decked between the front uprights and the guardrail supports as follows:

#### **1926.451(b)(1)(i)**

Each platform unit (e.g., scaffold plank, fabricated plank, fabricated deck, or fabricated platform) shall be installed so that the space between adjacent units and the space between the platform and the uprights is no more than 1 inch (2.5 cm) wide, except where the employer can demonstrate that a wider space is necessary (for example, to fit around uprights when side brackets are used to extend the width of the platform).

#### **..1926.451(b)(1)(ii)**

#### **1926.451(b)(1)(ii)**

Where the employer makes the demonstration provided for in paragraph (b)(1)(i) of this section, the platform shall be planked or decked as fully as possible and the remaining open space between the platform and the uprights shall not exceed 9 1/2 inches (24.1 cm).

Exception to paragraph (b)(1): The requirement in paragraph (b)(1) to provide full planking or decking does not apply to platforms used solely as walkways or solely by employees performing scaffold erection or dismantling. In these situations, only the planking that the employer establishes is necessary to provide safe working conditions is required.

### **1926.451(b)(2)**

Except as provided in paragraphs (b)(2)(i) and (b)(2)(ii) of this section, each scaffold platform and walkway shall be at least 18 inches (46 cm) wide.

#### **1926.451(b)(2)(i)**

Each ladder jack scaffold, top plate bracket scaffold, roof bracket scaffold, and pump jack scaffold shall be at least 12 inches (30 cm) wide. There is no minimum width requirement for boatswains' chairs.

Note to paragraph (b)(2)(i): Pursuant to an administrative stay effective November 29, 1996 and published in the Federal Register on November 25, 1996, the requirement in paragraph (b)(2)(i) that roof bracket scaffolds be at least 12 inches wide is stayed until November 25, 1997 or until rulemaking regarding the minimum width of roof bracket scaffolds has been completed, whichever is later.

#### **1926.451(b)(2)(ii)**

Where scaffolds must be used in areas that the employer can demonstrate are so narrow that platforms and walkways cannot be at least 18 inches (46 cm) wide, such platforms and walkways shall be as wide as feasible, and employees on those platforms and walkways shall be protected from fall hazards by the use of guardrails and/or personal fall arrest systems.



### **1926.451(b)(3)**

Except as provided in paragraphs (b)(3)(i) and (ii) of this section, the front edge of all platforms shall not be more than 14 inches (36 cm) from the face of the work, unless guardrail systems are erected along the front edge and/or personal fall arrest systems are used in accordance with paragraph (g) of this section to protect employees from falling.

#### ***..1926.451(b)(3)(i)***

### **1926.451(b)(3)(i)**

The maximum distance from the face for outrigger scaffolds shall be 3 inches (8 cm);

### **1926.451(b)(3)(ii)**

The maximum distance from the face for plastering and lathing operations shall be 18 inches (46 cm).

### **1926.451(b)(4)**

Each end of a platform, unless cleated or otherwise restrained by hooks or equivalent means, shall extend over the centerline of its support at least 6 inches (15 cm).

### **1926.451(b)(5)**

#### **1926.451(b)(5)(i)**

Each end of a platform 10 feet or less in length shall not extend over its support more than 12 inches (30 cm) unless the platform is designed and installed so that the cantilevered portion of the platform is able to support employees and/or materials without tipping, or has guardrails which block employee access to the cantilevered end.

#### **1926.451(b)(5)(ii)**

Each platform greater than 10 feet in length shall not extend over its support more than 18 inches (46 cm), unless it is designed and installed so that the cantilevered portion of the platform is able to support employees without tipping, or has guardrails which block employee access to the cantilevered end.

#### ***..1926.451(b)(6)***

### **1926.451(b)(6)**

On scaffolds where scaffold planks are abutted to create a long platform, each abutted end shall rest on a separate support surface. This provision does not preclude the use of common support members, such as "T" sections, to support abutting planks, or hook on platforms designed to rest on common supports.

### **1926.451(b)(7)**

On scaffolds where platforms are overlapped to create a long platform, the overlap shall occur only over supports, and shall not be less than 12 inches (30 cm) unless the platforms are nailed together or otherwise restrained to prevent movement.

### **1926.451(b)(8)**

At all points of a scaffold where the platform changes direction, such as turning a corner, any platform that rests on a bearer at an angle other than a right angle shall be laid first, and platforms which rest at right angles over the same bearer shall be laid second, on top of the first platform.

### **1926.451(b)(9)**

Wood platforms shall not be covered with opaque finishes, except that platform edges may be covered or marked for identification. Platforms may be coated periodically with wood preservatives, fire-retardant finishes, and slip-resistant finishes; however, the coating may not obscure the top or bottom wood surfaces.

### **1926.451(b)(10)**

Scaffold components manufactured by different manufacturers shall not be intermixed unless the components fit together without force and the scaffold's structural integrity is maintained by the user. Scaffold components manufactured by different manufacturers shall not be modified in order to intermix them unless a competent person determines the resulting scaffold is structurally sound.

### ***..1926.451(b)(11)***

### **1926.451(b)(11)**

Scaffold components made of dissimilar metals shall not be used together unless a competent person has determined that galvanic action will not reduce the strength of any component to a level below that required by paragraph (a)(1) of this section.

### **1926.451(c)**

"Criteria for supported scaffolds."

### **1926.451(c)(1)**

Supported scaffolds with a height to base width (including outrigger supports, if used) ratio of more than four to one (4:1) shall be restrained from tipping by guying, tying, bracing, or equivalent means, as follows:

### **1926.451(c)(1)(i)**

Guys, ties, and braces shall be installed at locations where horizontal members support both inner and outer legs.

### **1926.451(c)(1)(ii)**

Guys, ties, and braces shall be installed according to the scaffold manufacturer's recommendations or at the closest horizontal member to the 4:1 height and be repeated vertically at locations of horizontal members every 20 feet (6.1 m) or less thereafter for scaffolds 3 feet (0.91 m) wide or less, and every 26 feet (7.9 m) or less thereafter for scaffolds greater than 3 feet (0.91 m) wide. The top guy, tie or brace of completed scaffolds shall be placed no further than the 4:1 height from the top. Such guys, ties and braces shall be installed at each end of the scaffold and at horizontal intervals not to exceed 30 feet (9.1 m) (measured from one end [not both] towards the other).

**1926.451(c)(1)(iii)**

Ties, guys, braces, or outriggers shall be used to prevent the tipping of supported scaffolds in all circumstances where an eccentric load, such as a cantilevered work platform, is applied or is transmitted to the scaffold.

***..1926.451(c)(2)***

**1926.451(c)(2)**

Supported scaffold poles, legs, posts, frames, and uprights shall bear on base plates and mud sills or other adequate firm foundation.

**1926.451(c)(2)(i)**

Footings shall be level, sound, rigid, and capable of supporting the loaded scaffold without settling or displacement.

**1926.451(c)(2)(ii)**

Unstable objects shall not be used to support scaffolds or platform units.

**1926.451(c)(2)(iii)**

Unstable objects shall not be used as working platforms.

**1926.451(c)(2)(iv)**

Front-end loaders and similar pieces of equipment shall not be used to support scaffold platforms unless they have been specifically designed by the manufacturer for such use.

**1926.451(c)(2)(v)**

Fork-lifts shall not be used to support scaffold platforms unless the entire platform is attached to the fork and the fork-lift is not moved horizontally while the platform is occupied.

**1926.451(c)(3)**

Supported scaffold poles, legs, posts, frames, and uprights shall be plumb and braced to prevent swaying and displacement.

***..1926.451(d)***

**1926.451(d)**

"Criteria for suspension scaffolds."

**1926.451(d)(1)**

All suspension scaffold support devices, such as outrigger beams, cornice hooks, parapet clamps, and similar devices, shall rest on surfaces capable of supporting at least 4 times the load imposed on them by the scaffold operating at the rated load of the hoist (or at least 1.5 times the load imposed on them by the scaffold at the stall capacity of the hoist, whichever is greater).

**1926.451(d)(2)**

Suspension scaffold outrigger beams, when used, shall be made of structural metal or equivalent strength material, and shall be restrained to prevent movement.

**1926.451(d)(3)**

The inboard ends of suspension scaffold outrigger beams shall be stabilized by bolts or other direct connections to the floor or roof deck, or they shall have their inboard ends stabilized by counterweights, except masons' multi-point adjustable suspension scaffold outrigger beams shall not be stabilized by counterweights.

**1926.451(d)(3)(i)**

Before the scaffold is used, direct connections shall be evaluated by a competent person who shall confirm, based on the evaluation, that the supporting surfaces are capable of supporting the loads to be imposed. In addition, masons' multi-point adjustable suspension scaffold connections shall be designed by an engineer experienced in such scaffold design.

**1926.451(d)(3)(ii)**

Counterweights shall be made of non-flowable material. Sand, gravel and similar materials that can be easily dislocated shall not be used as counterweights.

***..1926.451(d)(3)(iii)*****1926.451(d)(3)(iii)**

Only those items specifically designed as counterweights shall be used to counterweight scaffold systems. Construction materials such as, but not limited to, masonry units and rolls of roofing felt, shall not be used as counterweights.

**1926.451(d)(3)(iv)**

Counterweights shall be secured by mechanical means to the outrigger beams to prevent accidental displacement.

**1926.451(d)(3)(v)**

Counterweights shall not be removed from an outrigger beam until the scaffold is disassembled.

**1926.451(d)(3)(vi)**

Outrigger beams which are not stabilized by bolts or other direct connections to the floor or roof deck shall be secured by tiebacks.

**1926.451(d)(3)(vii)**

Tiebacks shall be equivalent in strength to the suspension ropes.

**1926.451(d)(3)(viii)**

Outrigger beams shall be placed perpendicular to its bearing support (usually the face of the building or structure). However, where the employer can demonstrate that it is not possible to place an outrigger beam perpendicular to the face of the building or structure because of obstructions that cannot be moved, the outrigger beam may be placed at some other angle, provided opposing angle tiebacks are used.

**..1926.451(d)(3)(ix)**

**1926.451(d)(3)(ix)**

Tiebacks shall be secured to a structurally sound anchorage on the building or structure. Sound anchorages include structural members, but do not include standpipes, vents, other piping systems, or electrical conduit.

**1926.451(d)(3)(x)**

Tiebacks shall be installed perpendicular to the face of the building or structure, or opposing angle tiebacks shall be installed. Single tiebacks installed at an angle are prohibited.

**1926.451(d)(4)**

Suspension scaffold outrigger beams shall be:

**1926.451(d)(4)(i)**

Provided with stop bolts or shackles at both ends;

**1926.451(d)(4)(ii)**

Securely fastened together with the flanges turned out when channel iron beams are used in place of I-beams;

**1926.451(d)(4)(iii)**

Installed with all bearing supports perpendicular to the beam center line;

**1926.451(d)(4)(iv)**

Set and maintained with the web in a vertical position; and

**1926.451(d)(4)(v)**

When an outrigger beam is used, the shackle or clevis with which the rope is attached to the outrigger beam shall be placed directly over the center line of the stirrup.

**1926.451(d)(5)**

Suspension scaffold support devices such as cornice hooks, roof hooks, roof irons, parapet clamps, or similar devices shall be:

**..1926.451(d)(5)(i)**

**1926.451(d)(5)(i)**

Made of steel, wrought iron, or materials of equivalent strength;

**1926.451(d)(5)(ii)**

Supported by bearing blocks; and

**1926.451(d)(5)(iii)**

Secured against movement by tiebacks installed at right angles to the face of the building or structure, or opposing angle tiebacks shall be installed and secured to a structurally sound point of anchorage on the building or structure. Sound points of anchorage include structural members, but do not include standpipes, vents, other piping systems, or electrical conduit.

**1926.451(d)(5)(iv)**

Tiebacks shall be equivalent in strength to the hoisting rope.

**1926.451(d)(6)**

When winding drum hoists are used on a suspension scaffold, they shall contain not less than four wraps of the suspension rope at the lowest point of scaffold travel. When other types of hoists are used, the suspension ropes shall be long enough to allow the scaffold to be lowered to the level below without the rope end passing through the hoist, or the rope end shall be configured or provided with means to prevent the end from passing through the hoist.

**1926.451(d)(7)**

The use of repaired wire rope as suspension rope is prohibited.

**..1926.451(d)(8)**

**1926.451(d)(8)**

Wire suspension ropes shall not be joined together except through the use of eye splice thimbles connected with shackles or coverplates and bolts.

**1926.451(d)(9)**

The load end of wire suspension ropes shall be equipped with proper size thimbles and secured by eyesplicing or equivalent means.

**1926.451(d)(10)**

Ropes shall be inspected for defects by a competent person prior to each workshift and after every occurrence which could affect a rope's integrity. Ropes shall be replaced if any of the following conditions exist:

**1926.451(d)(10)(i)**

Any physical damage which impairs the function and strength of the rope.

**1926.451(d)(10)(ii)**

Kinks that might impair the tracking or wrapping of rope around the drum(s) or sheave(s).

**1926.451(d)(10)(iii)**

Six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay.

**1926.451(d)(10)(iv)**

Abrasion, corrosion, scrubbing, flattening or peening causing loss of more than one-third of the original diameter of the outside wires.

**1926.451(d)(10)(v)**

Heat damage caused by a torch or any damage caused by contact with electrical wires.

**..1926.451(d)(10)(vi)**

**1926.451(d)(10)(vi)**

Evidence that the secondary brake has been activated during an overspeed condition and has engaged the suspension rope.

**1926.451(d)(11)**

Swaged attachments or spliced eyes on wire suspension ropes shall not be used unless they are made by the wire rope manufacturer or a qualified person.

**1926.451(d)(12)**

When wire rope clips are used on suspension scaffolds:

**1926.451(d)(12)(i)**

There shall be a minimum of 3 wire rope clips installed, with the clips a minimum of 6 rope diameters apart;

**1926.451(d)(12)(ii)**

Clips shall be installed according to the manufacturer's recommendations;

**1926.451(d)(12)(iii)**

Clips shall be retightened to the manufacturer's recommendations after the initial loading;

**1926.451(d)(12)(iv)**

Clips shall be inspected and retightened to the manufacturer's recommendations at the start of each workshift thereafter;

**1926.451(d)(12)(v)**

U-bolt clips shall not be used at the point of suspension for any scaffold hoist;

***..1926.451(d)(12)(vi)***

**1926.451(d)(12)(vi)**

When U-bolt clips are used, the U-bolt shall be placed over the dead end of the rope, and the saddle shall be placed over the live end of the rope.

**1926.451(d)(13)**

Suspension scaffold power-operated hoists and manual hoists shall be tested by a qualified testing laboratory.

**1926.451(d)(14)**

Gasoline-powered equipment and hoists shall not be used on suspension scaffolds.

**1926.451(d)(15)**

Gears and brakes of power-operated hoists used on suspension scaffolds shall be enclosed.

**1926.451(d)(16)**

In addition to the normal operating brake, suspension scaffold power-operated hoists and manually operated hoists shall have a braking device or locking pawl which engages automatically when a hoist makes either of the following uncontrolled movements: an instantaneous change in momentum or an accelerated overspeed.

**1926.451(d)(17)**

Manually operated hoists shall require a positive crank force to descend.



### **1926.451(d)(18)**

Two-point and multi-point suspension scaffolds shall be tied or otherwise secured to prevent them from swaying, as determined to be necessary based on an evaluation by a competent person. Window cleaners' anchors shall not be used for this purpose.

### ***..1926.451(d)(19)***

### **1926.451(d)(19)**

Devices whose sole function is to provide emergency escape and rescue shall not be used as working platforms. This provision does not preclude the use of systems which are designed to function both as suspension scaffolds and emergency systems.

### **1926.451(e)**

"Access." This paragraph applies to scaffold access for all employees. Access requirements for employees erecting or dismantling supported scaffolds are specifically addressed in paragraph (e)(9) of this section.

### **1926.451(e)(1)**

When scaffold platforms are more than 2 feet (0.6 m) above or below a point of access, portable ladders, hook-on ladders, attachable ladders, stair towers (scaffold stairways/towers), stairway-type ladders (such as ladder stands), ramps, walkways, integral prefabricated scaffold access, or direct access from another scaffold, structure, personnel hoist, or similar surface shall be used. Crossbraces shall not be used as a means of access.

### **1926.451(e)(2)**

Portable, hook-on, and attachable ladders (Additional requirements for the proper construction and use of portable ladders are contained in subpart X of this part -- Stairways and Ladders):

### **1926.451(e)(2)(i)**

Portable, hook-on, and attachable ladders shall be positioned so as not to tip the scaffold;

### **1926.451(e)(2)(ii)**

Hook-on and attachable ladders shall be positioned so that their bottom rung is not more than 24 inches (61 cm) above the scaffold supporting level;

### ***..1926.451(e)(2)(iii)***

### **1926.451(e)(2)(iii)**

When hook-on and attachable ladders are used on a supported scaffold more than 35 feet (10.7 m) high, they shall have rest platforms at 35-foot (10.7 m) maximum vertical intervals.

### **1926.451(e)(2)(iv)**

Hook-on and attachable ladders shall be specifically designed for use with the type of scaffold used;

**1926.451(e)(2)(v)**

Hook-on and attachable ladders shall have a minimum rung length of 11 1/2 inches (29 cm); and

**1926.451(e)(2)(vi)**

Hook-on and attachable ladders shall have uniformly spaced rungs with a maximum spacing between rungs of 16 3/4 inches.

**1926.451(e)(3)**

Stairway-type ladders shall:

**1926.451(e)(3)(i)**

Be positioned such that their bottom step is not more than 24 inches (61 cm) above the scaffold supporting level;

**1926.451(e)(3)(ii)**

Be provided with rest platforms at 12 foot (3.7 m) maximum vertical intervals;

**1926.451(e)(3)(iii)**

Have a minimum step width of 16 inches (41 cm), except that mobile scaffold stairway-type ladders shall have a minimum step width of 11 1/2 inches (30 cm); and

**1926.451(e)(3)(iv)**

Have slip-resistant treads on all steps and landings.

***..1926.451(e)(4)***

**1926.451(e)(4)**

Stairtowers (scaffold stairway/towers) shall be positioned such that their bottom step is not more than 24 inches (61 cm.) above the scaffold supporting level.

**1926.451(e)(4)(i)**

A stairrail consisting of a toprail and a midrail shall be provided on each side of each scaffold stairway.

**1926.451(e)(4)(ii)**

The toprail of each stairrail system shall also be capable of serving as a handrail, unless a separate handrail is provided.

**1926.451(e)(4)(iii)**

Handrails, and top rails that serve as handrails, shall provide an adequate handhold for employees grasping them to avoid falling.

**1926.451(e)(4)(iv)**

Stairrail systems and handrails shall be surfaced to prevent injury to employees from punctures or lacerations, and to prevent snagging of clothing.

**1926.451(e)(4)(v)**

The ends of stairrail systems and handrails shall be constructed so that they do not constitute a projection hazard.

**1926.451(e)(4)(vi)**

Handrails, and top rails that are used as handrails, shall be at least 3 inches (7.6 cm) from other objects.

**..1926.451(e)(4)(vii)**

**1926.451(e)(4)(vii)**

Stairrails shall be not less than 28 inches (71 cm) nor more than 37 inches (94 cm) from the upper surface of the stairrail to the surface of the tread, in line with the face of the riser at the forward edge of the tread.

**1926.451(e)(4)(viii)**

A landing platform at least 18 inches (45.7 cm) wide by at least 18 inches (45.7 cm) long shall be provided at each level.

**1926.451(e)(4)(ix)**

Each scaffold stairway shall be at least 18 inches (45.7 cm) wide between stairrails.

**1926.451(e)(4)(x)**

Treads and landings shall have slip-resistant surfaces.

**1926.451(e)(4)(xi)**

Stairways shall be installed between 40 degrees and 60 degrees from the horizontal.

**1926.451(e)(4)(xii)**

Guardrails meeting the requirements of paragraph (g)(4) of this section shall be provided on the open sides and ends of each landing.

**1926.451(e)(4)(xiii)**

Riser height shall be uniform, within 1/4 inch, (0.6 cm) for each flight of stairs. Greater variations in riser height are allowed for the top and bottom steps of the entire system, not for each flight of stairs.

**1926.451(e)(4)(xiv)**

Tread depth shall be uniform, within 1/4 inch, for each flight of stairs.

**..1926.451(e)(5)**

**1926.451(e)(5)**

Ramps and walkways.

**1926.451(e)(5)(i)**

Ramps and walkways 6 feet (1.8 m) or more above lower levels shall have guardrail systems which comply with subpart M of this part -- Fall Protection;

**1926.451(e)(5)(ii)**

No ramp or walkway shall be inclined more than a slope of one (1) vertical to three (3) horizontal (20 degrees above the horizontal).

**1926.451(e)(5)(iii)**

If the slope of a ramp or a walkway is steeper than one (1) vertical in eight (8) horizontal, the ramp or walkway shall have cleats not more than fourteen (14) inches (35 cm) apart which are securely fastened to the planks to provide footing.

**1926.451(e)(6)**

Integral prefabricated scaffold access frames shall:

**1926.451(e)(6)(i)**

Be specifically designed and constructed for use as ladder rungs;

**1926.451(e)(6)(ii)**

Have a rung length of at least 8 inches (20 cm);

**1926.451(e)(6)(iii)**

Not be used as work platforms when rungs are less than 11 1/2 inches in length, unless each affected employee uses fall protection, or a positioning device, which complies with 1926.502;

**1926.451(e)(6)(iv)**

Be uniformly spaced within each frame section;

***..1926.451(e)(6)(v)***

**1926.451(e)(6)(v)**

Be provided with rest platforms at 35-foot (10.7 m) maximum vertical intervals on all supported scaffolds more than 35 feet (10.7 m) high; and

**1926.451(e)(6)(vi)**

Have a maximum spacing between rungs of 16 3/4 inches (43 cm). Non-uniform rung spacing caused by joining end frames together is allowed, provided the resulting spacing does not exceed 16 3/4 inches (43 cm).

**1926.451(e)(7)**

Steps and rungs of ladder and stairway type access shall line up vertically with each other between rest platforms.

**1926.451(e)(8)**

Direct access to or from another surface shall be used only when the scaffold is not more than 14 inches (36 cm) horizontally and not more than 24 inches (61 cm) vertically from the other surface.

**1926.451(e)(9)**

Effective September 2, 1997, access for employees erecting or dismantling supported scaffolds shall be in accordance with the following:

***..1926.451(e)(9)(i)***

**1926.451(e)(9)(i)**

The employer shall provide safe means of access for each employee erecting or dismantling a scaffold where the provision of safe access is feasible and does not create a greater hazard. The employer shall have a competent person determine whether it is feasible or would pose a greater hazard to provide, and have employees use a safe means of access. This determination shall be based on site conditions and the type of scaffold being erected or dismantled.

**1926.451(e)(9)(ii)**

Hook-on or attachable ladders shall be installed as soon as scaffold erection has progressed to a point that permits safe installation and use.

**1926.451(e)(9)(iii)**

When erecting or dismantling tubular welded frame scaffolds, (end) frames, with horizontal members that are parallel, level and are not more than 22 inches apart vertically may be used as climbing devices for access, provided they are erected in a manner that creates a usable ladder and provides good hand hold and foot space.

**1926.451(e)(9)(iv)**

Cross braces on tubular welded frame scaffolds shall not be used as a means of access or egress.

**1926.451(f)**

"Use."

**1926.451(f)(1)**

Scaffolds and scaffold components shall not be loaded in excess of their maximum intended loads or rated capacities, whichever is less.

**1926.451(f)(2)**

The use of shore or lean-to scaffolds is prohibited.

**..1926.451(f)(3)**

**1926.451(f)(3)**

Scaffolds and scaffold components shall be inspected for visible defects by a competent person before each work shift, and after any occurrence which could affect a scaffold's structural integrity.

**1926.451(f)(4)**

Any part of a scaffold damaged or weakened such that its strength is less than that required by paragraph (a) of this section shall be immediately repaired or replaced, braced to meet those provisions, or removed from service until repaired.

**1926.451(f)(5)**

Scaffolds shall not be moved horizontally while employees are on them, unless they have been designed by a registered professional engineer specifically for such movement or, for mobile scaffolds, where the provisions of 1926.452(w) are followed.

**1926.451(f)(6)**

The clearance between scaffolds and power lines shall be as follows: Scaffolds shall not be erected, used, dismantled, altered, or moved such that they or any conductive material handled on them might come closer to exposed and energized power lines than as follows:

\*Insulated Lines

Voltage	Minimum distance	Alternatives
Less than 300 volts.	3 feet (0.9 m)	
300 volts to 50 kv.	10 feet (3.1 m)	
More than 50 kv.....	10 feet (3.1 m) plus 0.4 inches (1.0 cm) for each 1 kv over 50 kv.	2 times the length of the line insulator, but never less than 10 feet (3.1 m).

\*Uninsulated lines

Voltage	Minimum distance	Alternatives
Less than 50 kv.....	10 feet (3.1 m).	
More than 50 kv.....	10 feet (3.1 m) plus 0.4 inches (1.0 cm) for each 1 kv over 50 kv.	2 times the length of the line insulator, but never less than 10 feet (3.1 m).

Exception to paragraph (f)(6): Scaffolds and materials may be closer to power lines than specified above where such clearance is necessary for performance of work, and only after the utility company, or electrical system operator, has been notified of the need to work closer and the utility company, or electrical system operator, has deenergized the lines, relocated the lines, or installed protective coverings to prevent accidental contact with the lines.

**1926.451(f)(7)**

Scaffolds shall be erected, moved, dismantled, or altered only under the supervision and direction of a competent person qualified in scaffold erection, moving, dismantling or alteration. Such activities shall be performed only by experienced and trained employees selected for such work by the competent person.

***..1926.451(f)(8)***

**1926.451(f)(8)**

Employees shall be prohibited from working on scaffolds covered with snow, ice, or other slippery material except as necessary for removal of such materials.

**1926.451(f)(9)**

Where swinging loads are being hoisted onto or near scaffolds such that the loads might contact the scaffold, tag lines or equivalent measures to control the loads shall be used.

**1926.451(f)(10)**

Suspension ropes supporting adjustable suspension scaffolds shall be of a diameter large enough to provide sufficient surface area for the functioning of brake and hoist mechanisms.

**1926.451(f)(11)**

Suspension ropes shall be shielded from heat-producing processes. When acids or other corrosive substances are used on a scaffold, the ropes shall be shielded, treated to protect against the corrosive substances, or shall be of a material that will not be damaged by the substance being used.

**1926.451(f)(12)**

Work on or from scaffolds is prohibited during storms or high winds unless a competent person has determined that it is safe for employees to be on the scaffold and those employees are protected by a personal fall arrest system or wind screens. Wind screens shall not be used unless the scaffold is secured against the anticipated wind forces imposed.

**1926.451(f)(13)**

Debris shall not be allowed to accumulate on platforms.

***..1926.451(f)(14)***

**1926.451(f)(14)**

Makeshift devices, such as but not limited to boxes and barrels, shall not be used on top of scaffold platforms to increase the working level height of employees.

**1926.451(f)(15)**

Ladders shall not be used on scaffolds to increase the working level height of employees, except on large area scaffolds where employers have satisfied the following criteria:

**1926.451(f)(15)(i)**

When the ladder is placed against a structure which is not a part of the scaffold, the scaffold shall be secured against the sideways thrust exerted by the ladder;

**1926.451(f)(15)(ii)**

The platform units shall be secured to the scaffold to prevent their movement;

**1926.451(f)(15)(iii)**

The ladder legs shall be on the same platform or other means shall be provided to stabilize the ladder against unequal platform deflection, and



**1926.451(f)(15)(iv)**

The ladder legs shall be secured to prevent them from slipping or being pushed off the platform.

**1926.451(f)(16)**

Platforms shall not deflect more than 1/60 of the span when loaded.

**1926.451(f)(17)**

To reduce the possibility of welding current arcing through the suspension wire rope when performing welding from suspended scaffolds, the following precautions shall be taken, as applicable:

***..1926.451(f)(17)(i)***

**1926.451(f)(17)(i)**

An insulated thimble shall be used to attach each suspension wire rope to its hanging support (such as cornice hook or outrigger). Excess suspension wire rope and any additional independent lines from grounding shall be insulated;

**1926.451(f)(17)(ii)**

The suspension wire rope shall be covered with insulating material extending at least 4 feet (1.2 m) above the hoist. If there is a tail line below the hoist, it shall be insulated to prevent contact with the platform. The portion of the tail line that hangs free below the scaffold shall be guided or retained, or both, so that it does not become grounded;

**1926.451(f)(17)(iii)**

Each hoist shall be covered with insulated protective covers;

**1926.451(f)(17)(iv)**

In addition to a work lead attachment required by the welding process, a grounding conductor shall be connected from the scaffold to the structure. The size of this conductor shall be at least the size of the welding process work lead, and this conductor shall not be in series with the welding process or the work piece;

**1926.451(f)(17)(v)**

If the scaffold grounding lead is disconnected at any time, the welding machine shall be shut off; and

**1926.451(f)(17)(vi)**

An active welding rod or uninsulated welding lead shall not be allowed to contact the scaffold or its suspension system.

**1926.451(g)**

"Fall protection."

### **1926.451(g)(1)**

Each employee on a scaffold more than 10 feet (3.1 m) above a lower level shall be protected from falling to that lower level. Paragraphs (g)(1)(i) through (vii) of this section establish the types of fall protection to be provided to the employees on each type of scaffold. Paragraph (g)(2) of this section addresses fall protection for scaffold erectors and dismantlers.

Note to paragraph (g)(1): The fall protection requirements for employees installing suspension scaffold support systems on floors, roofs, and other elevated surfaces are set forth in subpart M of this part.

### **1926.451(g)(1)(i)**

Each employee on a boatswains' chair, catenary scaffold, float scaffold, needle beam scaffold, or ladder jack scaffold shall be protected by a personal fall arrest system;

### **1926.451(g)(1)(ii)**

Each employee on a single-point or two-point adjustable suspension scaffold shall be protected by both a personal fall arrest system and guardrail system;

### **1926.451(g)(1)(iii)**

Each employee on a crawling board (chicken ladder) shall be protected by a personal fall arrest system, a guardrail system (with minimum 200 pound toprail capacity), or by a three-fourth inch (1.9 cm) diameter grabline or equivalent handhold securely fastened beside each crawling board;

### **1926.451(g)(1)(iv)**

Each employee on a self-contained adjustable scaffold shall be protected by a guardrail system (with minimum 200 pound toprail capacity) when the platform is supported by the frame structure, and by both a personal fall arrest system and a guardrail system (with minimum 200 pound toprail capacity) when the platform is supported by ropes;

### **1926.451(g)(1)(v)**

Each employee on a walkway located within a scaffold shall be protected by a guardrail system (with minimum 200 pound toprail capacity) installed within 9 1/2 inches (24.1 cm) of and along at least one side of the walkway.

### **1926.451(g)(1)(vi)**

Each employee performing overhand bricklaying operations from a supported scaffold shall be protected from falling from all open sides and ends of the scaffold (except at the side next to the wall being laid) by the use of a personal fall arrest system or guardrail system (with minimum 200 pound toprail capacity).

### **1926.451(g)(1)(vii)**

For all scaffolds not otherwise specified in paragraphs (g)(1)(i) through (g)(1)(vi) of this section, each employee shall be protected by the use of personal fall arrest systems or guardrail systems meeting the requirements of paragraph (g)(4) of this section.

### **1926.451(g)(2)**

Effective September 2, 1997, the employer shall have a competent person determine the feasibility and safety of providing fall protection for employees erecting or dismantling supported scaffolds. Employers are required to provide fall protection for employees erecting or dismantling supported scaffolds where the installation and use of such protection is feasible and does not create a greater hazard.

### **1926.451(g)(3)**

In addition to meeting the requirements of 1926.502(d), personal fall arrest systems used on scaffolds shall be attached by lanyard to a vertical lifeline, horizontal lifeline, or scaffold structural member. Vertical lifelines shall not be used when overhead components, such as overhead protection or additional platform levels, are part of a single-point or two-point adjustable suspension scaffold.

#### **1926.451(g)(3)(i)**

When vertical lifelines are used, they shall be fastened to a fixed safe point of anchorage, shall be independent of the scaffold, and shall be protected from sharp edges and abrasion. Safe points of anchorage include structural members of buildings, but do not include standpipes, vents, other piping systems, electrical conduit, outrigger beams, or counterweights.

#### **1926.451(g)(3)(ii)**

When horizontal lifelines are used, they shall be secured to two or more structural members of the scaffold, or they may be looped around both suspension and independent suspension lines (on scaffolds so equipped) above the hoist and brake attached to the end of the scaffold. Horizontal lifelines shall not be attached only to the suspension ropes.

#### **1926.451(g)(3)(iii)**

When lanyards are connected to horizontal lifelines or structural members on a single-point or two-point adjustable suspension scaffold, the scaffold shall be equipped with additional independent support lines and automatic locking devices capable of stopping the fall of the scaffold in the event one or both of the suspension ropes fail. The independent support lines shall be equal in number and strength to the suspension ropes.

#### **1926.451(g)(3)(iv)**

Vertical lifelines, independent support lines, and suspension ropes shall not be attached to each other, nor shall they be attached to or use the same point of anchorage, nor shall they be attached to the same point on the scaffold or personal fall arrest system.

### **1926.451(g)(4)**

Guardrail systems installed to meet the requirements of this section shall comply with the following provisions (guardrail systems built in accordance with Appendix A to this subpart will be deemed to meet the requirements of paragraphs (g)(4)(vii), (viii), and (ix) of this section):

#### **1926.451(g)(4)(i)**

Guardrail systems shall be installed along all open sides and ends of platforms. Guardrail systems shall be installed before the scaffold is released for use by employees other than erection/dismantling crews.

#### **1926.451(g)(4)(ii)**

The top edge height of top rails or equivalent member on supported scaffolds manufactured or placed in service after January 1, 2000 shall be installed between 38 inches (0.97 m) and 45 inches (1.2 m) above the platform surface. The top edge height on supported scaffolds manufactured and placed in service before January 1, 2000, and on all suspended scaffolds where both a guardrail and a personal fall arrest system are required shall be between 36 inches (0.9 m) and 45 inches (1.2 m). When conditions warrant, the height of the top edge may exceed the 45-inch height, provided the guardrail system meets all other criteria of paragraph (g)(4).

#### **1926.451(g)(4)(iii)**

When midrails, screens, mesh, intermediate vertical members, solid panels, or equivalent structural members are used, they shall be installed between the top edge of the guardrail system and the scaffold platform.

#### **1926.451(g)(4)(iv)**

When midrails are used, they shall be installed at a height approximately midway between the top edge of the guardrail system and the platform surface.

#### **1926.451(g)(4)(v)**

When screens and mesh are used, they shall extend from the top edge of the guardrail system to the scaffold platform, and along the entire opening between the supports.

#### **1926.451(g)(4)(vi)**

When intermediate members (such as balusters or additional rails) are used, they shall not be more than 19 inches (48 cm) apart.

#### **1926.451(g)(4)(vii)**

Each top rail or equivalent member of a guardrail system shall be capable of withstanding, without failure, a force applied in any downward or horizontal direction at any point along its top edge of at least 100 pounds (445 n) for guardrail systems installed on single-point adjustable suspension scaffolds or two-point adjustable suspension scaffolds, and at least 200 pounds (890 n) for guardrail systems installed on all other scaffolds.

#### **1926.451(g)(4)(viii)**

When the loads specified in paragraph (g)(4)(vii) of this section are applied in a downward direction, the top edge shall not drop below the height above the platform surface that is prescribed in paragraph (g)(4)(ii) of this section.

#### **1926.451(g)(4)(ix)**

Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members of a guardrail system shall be capable of withstanding, without failure, a force applied in any downward or

horizontal direction at any point along the midrail or other member of at least 75 pounds (333 n) for guardrail systems with a minimum 100 pound toprail capacity, and at least 150 pounds (666 n) for guardrail systems with a minimum 200 pound toprail capacity.

**1926.451(g)(4)(x)**

Suspension scaffold hoists and non-walk-through stirrups may be used as end guardrails, if the space between the hoist or stirrup and the side guardrail or structure does not allow passage of an employee to the end of the scaffold.

**1926.451(g)(4)(xi)**

Guardrails shall be surfaced to prevent injury to an employee from punctures or lacerations, and to prevent snagging of clothing.

**1926.451(g)(4)(xii)**

The ends of all rails shall not overhang the terminal posts except when such overhang does not constitute a projection hazard to employees.

**1926.451(g)(4)(xiii)**

Steel or plastic banding shall not be used as a toprail or midrail.

**1926.451(g)(4)(xiv)**

Manila or plastic (or other synthetic) rope being used for toprails or midrails shall be inspected by a competent person as frequently as necessary to ensure that it continues to meet the strength requirements of paragraph (g) of this section.

**1926.451(g)(4)(xv)**

Crossbracing is acceptable in place of a midrail when the crossing point of two braces is between 20 inches (0.5 m) and 30 inches (0.8 m) above the work platform or as a toprail when the crossing point of two braces is between 38 inches (0.97 m) and 48 inches (1.3 m) above the work platform. The end points at each upright shall be no more than 48 inches (1.3 m) apart.

**1926.451(h)**

"Falling object protection."

**1926.451(h)(1)**

In addition to wearing hardhats each employee on a scaffold shall be provided with additional protection from falling hand tools, debris, and other small objects through the installation of toeboards, screens, or guardrail systems, or through the erection of debris nets, catch platforms, or canopy structures that contain or deflect the falling objects. When the falling objects are too large, heavy or massive to be contained or deflected by any of the above-listed measures, the employer shall place such potential falling objects away from the edge of the surface from which they could fall and shall secure those materials as necessary to prevent their falling.

## **1926.451(h)(2)**

Where there is a danger of tools, materials, or equipment falling from a scaffold and striking employees below, the following provisions apply:

### **1926.451(h)(2)(i)**

The area below the scaffold to which objects can fall shall be barricaded, and employees shall not be permitted to enter the hazard area; or

### **1926.451(h)(2)(ii)**

A toeboard shall be erected along the edge of platforms more than 10 feet (3.1 m) above lower levels for a distance sufficient to protect employees below, except on float (ship) scaffolds where an edging of 3/4 x 1 1/2 inch (2 x 4 cm) wood or equivalent may be used in lieu of toeboards;

### **1926.451(h)(2)(iii)**

Where tools, materials, or equipment are piled to a height higher than the top edge of the toeboard, paneling or screening extending from the toeboard or platform to the top of the guardrail shall be erected for a distance sufficient to protect employees below; or

### **1926.451(h)(2)(iv)**

A guardrail system shall be installed with openings small enough to prevent passage of potential falling objects; or

### **1926.451(h)(2)(v)**

A canopy structure, debris net, or catch platform strong enough to withstand the impact forces of the potential falling objects shall be erected over the employees below.

## **1926.451(h)(3)**

Canopies, when used for falling object protection, shall comply with the following criteria:

### **1926.451(h)(3)(i)**

Canopies shall be installed between the falling object hazard and the employees.

### **1926.451(h)(3)(ii)**

When canopies are used on suspension scaffolds for falling object protection, the scaffold shall be equipped with additional independent support lines equal in number to the number of points supported, and equivalent in strength to the strength of the suspension ropes.

### **1926.451(h)(3)(iii)**

Independent support lines and suspension ropes shall not be attached to the same points of anchorage.

**1926.451(h)(4)**

Where used, toeboards shall be:

**1926.451(h)(4)(i)**

Capable of withstanding, without failure, a force of at least 50 pounds (222 n) applied in any downward or horizontal direction at any point along the toeboard (toeboards built in accordance with Appendix A to this subpart will be deemed to meet this requirement); and

**1926.451(h)(4)(ii)**

At least three and one-half inches (9 cm) high from the top edge of the toeboard to the level of the walking/working surface. Toeboards shall be securely fastened in place at the outermost edge of the platform and have not more than 1/4 inch (0.7 cm) clearance above the walking/working surface. Toeboards shall be solid or with openings not over one inch (2.5 cm) in the greatest dimension.

[44 FR 8577, Feb. 9, 1979; 44 FR 20940, Apr. 6, 1979, as amended at 58 FR 35182 and 35310, June 30, 1993; 61 FR 46025, Aug. 30 1996; 61 FR 59831, Nov. 25, 1996]

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<b>Part Number:</b>	<b>1926</b>
<b>• Part Title:</b>	<b>Safety and Health Regulations for Construction</b>
<b>• Subpart:</b>	<b>L</b>
<b>• Subpart Title:</b>	<b>Scaffolds</b>
<b>• Standard Number:</b>	<b><a href="#">1926.452</a></b>
<b>• Title:</b>	<b>Additional requirements applicable to specific types of scaffolds.</b>

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In addition to the applicable requirements of 1926.451, the following requirements apply to the specific types of scaffolds indicated. Scaffolds not specifically addressed by 1926.452, such as but not limited to systems scaffolds, must meet the requirements of 1926.451.

**1926.452(a)**

"Pole scaffolds."

**1926.452(a)(1)**

When platforms are being moved to the next level, the existing platform shall be left undisturbed until the new bearers have been set in place and braced, prior to receiving the new platforms.

**1926.452(a)(2)**

Crossbracing shall be installed between the inner and outer sets of poles on double pole scaffolds.

**1926.452(a)(3)**

Diagonal bracing in both directions shall be installed across the entire inside face of double-pole scaffolds used to support loads equivalent to a uniformly distributed load of 50 pounds (222 kg) or more per square foot (929 square cm).

**1926.452(a)(4)**

Diagonal bracing in both directions shall be installed across the entire outside face of all double- and single-pole scaffolds.

**1926.452(a)(5)**

Runners and bearers shall be installed on edge.

**1926.452(a)(6)**

Bearers shall extend a minimum of 3 inches (7.6 cm) over the outside edges of runners.



**1926.452(a)(7)**

Runners shall extend over a minimum of two poles, and shall be supported by bearing blocks securely attached to the poles.

**1926.452(a)(8)**

Braces, bearers, and runners shall not be spliced between poles.

**1926.452(a)(9)**

Where wooden poles are spliced, the ends shall be squared and the upper section shall rest squarely on the lower section. Wood splice plates shall be provided on at least two adjacent sides, and shall extend at least 2 feet (0.6 m) on either side of the splice, overlap the abutted ends equally, and have at least the same cross-sectional areas as the pole. Splice plates of other materials of equivalent strength may be used.

**1926.452(a)(10)**

Pole scaffolds over 60 feet in height shall be designed by a registered professional engineer, and shall be constructed and loaded in accordance with that design. Non-mandatory Appendix A to this subpart contains examples of criteria that will enable an employer to comply with design and loading requirements for pole scaffolds under 60 feet in height.

**1926.452(b)**

"Tube and coupler scaffolds."

**1926.452(b)(1)**

When platforms are being moved to the next level, the existing platform shall be left undisturbed until the new bearers have been set in place and braced prior to receiving the new platforms.

**1926.452(b)(2)**

Transverse bracing forming an "X" across the width of the scaffold shall be installed at the scaffold ends and at least at every third set of posts horizontally (measured from only one end) and every fourth runner vertically. Bracing shall extend diagonally from the inner or outer posts or runners upward to the next outer or inner posts or runners. Building ties shall be installed at the bearer levels between the transverse bracing and shall conform to the requirements of 1926.451(c)(1).

**1926.452(b)(3)**

On straight run scaffolds, longitudinal bracing across the inner and outer rows of posts shall be installed diagonally in both directions, and shall extend from the base of the end posts upward to the top of the scaffold at approximately a 45 degree angle. On scaffolds whose length is greater than their height, such bracing shall be repeated beginning at least at every fifth post. On scaffolds whose length is less than their height, such bracing shall be installed from the base of the end posts upward to the opposite end posts, and then in alternating directions until reaching the top of the scaffold. Bracing shall be installed as close as possible to the intersection of the bearer and post or runner and post.

**1926.452(b)(4)**

Where conditions preclude the attachment of bracing to posts, bracing shall be attached to the runners as close to the post as possible.

**1926.452(b)(5)**

Bearers shall be installed transversely between posts, and when coupled to the posts, shall have the inboard coupler bear directly on the runner coupler. When the bearers are coupled to the runners, the couplers shall be as close to the posts as possible.

**1926.452(b)(6)**

Bearers shall extend beyond the posts and runners, and shall provide full contact with the coupler.

**1926.452(b)(7)**

Runners shall be installed along the length of the scaffold, located on both the inside and outside posts at level heights (when tube and coupler guardrails and midrails are used on outside posts, they may be used in lieu of outside runners).

**1926.452(b)(8)**

Runners shall be interlocked on straight runs to form continuous lengths, and shall be coupled to each post. The bottom runners and bearers shall be located as close to the base as possible.

**1926.452(b)(9)**

Couplers shall be of a structural metal, such as drop-forged steel, malleable iron, or structural grade aluminum. The use of gray cast iron is prohibited.

**1926.452(b)(10)**

Tube and coupler scaffolds over 125 feet in height shall be designed by a registered professional engineer, and shall be constructed and loaded in accordance with such design. Non-mandatory Appendix A to this subpart contains examples of criteria that will enable an employer to comply with design and loading requirements for tube and coupler scaffolds under 125 feet in height.

**1926.452(c)**

"Fabricated frame scaffolds" (tubular welded frame scaffolds).

**1926.452(c)(1)**

When moving platforms to the next level, the existing platform shall be left undisturbed until the new end frames have been set in place and braced prior to receiving the new platforms.

**1926.452(c)(2)**

Frames and panels shall be braced by cross, horizontal, or diagonal braces, or combination thereof, which secure vertical members together laterally. The cross braces shall be of such length as will automatically square and align vertical members so that the erected scaffold is always plumb, level, and square. All brace connections shall be secured.

**1926.452(c)(3)**

Frames and panels shall be joined together vertically by coupling or stacking pins or equivalent means.

**1926.452(c)(4)**

Where uplift can occur which would displace scaffold end frames or panels, the frames or panels shall be locked together vertically by pins or equivalent means.

**1926.452(c)(5)**

Brackets used to support cantilevered loads shall:

**1926.452(c)(5)(i)**

Be seated with side-brackets parallel to the frames and end-brackets at 90 degrees to the frames;

**1926.452(c)(5)(ii)**

Not be bent or twisted from these positions; and

**1926.452(c)(5)(iii)**

Be used only to support personnel, unless the scaffold has been designed for other loads by a qualified engineer and built to withstand the tipping forces caused by those other loads being placed on the bracket-supported section of the scaffold.

**1926.452(c)(6)**

Scaffolds over 125 feet (38.0 m) in height above their base plates shall be designed by a registered professional engineer, and shall be constructed and loaded in accordance with such design.

**1926.452(d)**

"Plasterers', decorators', and large area scaffolds." Scaffolds shall be constructed in accordance with paragraphs (a), (b), or (c) of this section, as appropriate.

**1926.452(e)**

"Bricklayers' square scaffolds (squares)."

**1926.452(e)(1)**

Scaffolds made of wood shall be reinforced with gussets on both sides of each corner.

**1926.452(e)(2)**

Diagonal braces shall be installed on all sides of each square.

**1926.452(e)(3)**

Diagonal braces shall be installed between squares on the rear and front sides of the scaffold, and shall extend from the bottom of each square to the top of the next square.

**1926.452(e)(4)**

Scaffolds shall not exceed three tiers in height, and shall be so constructed and arranged that one square rests directly above the other. The upper tiers shall stand on a continuous row of planks laid across the next lower tier, and shall be nailed down or otherwise secured to prevent displacement.

**1926.452(f)**

"Horse scaffolds."

**1926.452(f)(1)**

Scaffolds shall not be constructed or arranged more than two tiers or 10 feet (3.0 m) in height, whichever is less.

**1926.452(f)(2)**

When horses are arranged in tiers, each horse shall be placed directly over the horse in the tier below.

**1926.452(f)(3)**

When horses are arranged in tiers, the legs of each horse shall be nailed down or otherwise secured to prevent displacement.

**1926.452(f)(4)**

When horses are arranged in tiers, each tier shall be crossbraced.

**1926.452(g)**

"Form scaffolds and carpenters' bracket scaffolds."

**1926.452(g)(1)**

Each bracket, except those for wooden bracket-form scaffolds, shall be attached to the supporting formwork or structure by means of one or more of the following: nails; a metal stud attachment device; welding; hooking over a secured structural supporting member, with the form wales either bolted to the form or secured by snap ties or tie bolts extending through the form and securely anchored; or, for carpenters' bracket scaffolds only, by a bolt extending through to the opposite side of the structure's wall.

**1926.452(g)(2)**

Wooden bracket-form scaffolds shall be an integral part of the form panel.

**1926.452(g)(3)**

Folding type metal brackets, when extended for use, shall be either bolted or secured with a locking-type pin.

**1926.452(h)**

"Roof bracket scaffolds."

**1926.452(h)(1)**

Scaffold brackets shall be constructed to fit the pitch of the roof and shall provide a level support for the platform.

**1926.452(h)(2)**

Brackets (including those provided with pointed metal projections) shall be anchored in place by nails unless it is impractical to use nails. When nails are not used, brackets shall be secured in place with first-grade manila rope of at least three-fourth inch (1.9 cm) diameter, or equivalent.

**1926.452(i)**

"Outrigger scaffolds."

**1926.452(i)(1)**

The inboard end of outrigger beams, measured from the fulcrum point to the extreme point of anchorage, shall be not less than one and one-half times the outboard end in length.

**1926.452(i)(2)**

Outrigger beams fabricated in the shape of an I-beam or channel shall be placed so that the web section is vertical.

**1926.452(i)(3)**

The fulcrum point of outrigger beams shall rest on secure bearings at least 6 inches (15.2 cm) in each horizontal dimension.

**1926.452(i)(4)**

Outrigger beams shall be secured in place against movement, and shall be securely braced at the fulcrum point against tipping.

**1926.452(i)(5)**

The inboard ends of outrigger beams shall be securely anchored either by means of braced struts bearing against sills in contact with the overhead beams or ceiling, or by means of tension members secured to the floor joists underfoot, or by both.

**1926.452(i)(6)**

The entire supporting structure shall be securely braced to prevent any horizontal movement.

**1926.452(i)(7)**

To prevent their displacement, platform units shall be nailed, bolted, or otherwise secured to outriggers.

**1926.452(i)(8)**

Scaffolds and scaffold components shall be designed by a registered professional engineer and shall be constructed and loaded in accordance with such design.

**1926.452(j)**

"Pump jack scaffolds."

**1926.452(j)(1)**

Pump jack brackets, braces, and accessories shall be fabricated from metal plates and angles. Each pump jack bracket shall have two positive gripping mechanisms to prevent any failure or slippage.

**1926.452(j)(2)**

Poles shall be secured to the structure by rigid triangular bracing or equivalent at the bottom, top, and other points as necessary. When the pump jack has to pass bracing already installed, an additional brace shall be installed approximately 4 feet (1.2 m) above the brace to be passed, and shall be left in place until the pump jack has been moved and the original brace reinstalled.

**1926.452(j)(3)**

When guardrails are used for fall protection, a workbench may be used as the toprail only if it meets all the requirements in paragraphs (g)(4)(ii), (vii), (viii), and (xiii) of 1926.451.

**1926.452(j)(4)**

Work benches shall not be used as scaffold platforms.

**1926.452(j)(5)**

When poles are made of wood, the pole lumber shall be straight-grained, free of shakes, large loose or dead knots, and other defects which might impair strength.

**1926.452(j)(6)**

When wood poles are constructed of two continuous lengths, they shall be joined together with the seam parallel to the bracket.

**1926.452(j)(7)**

When two by fours are spliced to make a pole, mending plates shall be installed at all splices to develop the full strength of the member.

**1926.452(k)**

"Ladder jack scaffolds."

**1926.452(k)(1)**

Platforms shall not exceed a height of 20 feet (6.1 m).

**1926.452(k)(2)**

All ladders used to support ladder jack scaffolds shall meet the requirements of subpart X of this part -- Stairways and Ladders, except that job-made ladders shall not be used to support ladder jack scaffolds.

**1926.452(k)(3)**

The ladder jack shall be so designed and constructed that it will bear on the side rails and ladder rungs or on the ladder rungs alone. If bearing on rungs only, the bearing area shall include a length of at least 10 inches (25.4 cm) on each rung.

**1926.452(k)(4)**

Ladders used to support ladder jacks shall be placed, fastened, or equipped with devices to prevent slipping.

**1926.452(k)(5)**

Scaffold platforms shall not be bridged one to another.

**1926.452(l)**

"Window jack scaffolds."

**1926.452(l)(1)**

Scaffolds shall be securely attached to the window opening.

**1926.452(1)(2)**

Scaffolds shall be used only for the purpose of working at the window opening through which the jack is placed.

**1926.452(1)(3)**

Window jacks shall not be used to support planks placed between one window jack and another, or for other elements of scaffolding.

**1926.452(m)**

"Crawling boards (chicken ladders)."

**1926.452(m)(1)**

Crawling boards shall extend from the roof peak to the eaves when used in connection with roof construction, repair, or maintenance.

**1926.452(m)(2)**

Crawling boards shall be secured to the roof by ridge hooks or by means that meet equivalent criteria (e.g., strength and durability).

**1926.452(n)**

"Step, platform, and trestle ladder scaffolds."

**1926.452(n)(1)**

Scaffold platforms shall not be placed any higher than the second highest rung or step of the ladder supporting the platform.

**1926.452(n)(2)**

All ladders used in conjunction with step, platform and trestle ladder scaffolds shall meet the pertinent requirements of subpart X of this part -- Stairways and Ladders, except that job-made ladders shall not be used to support such scaffolds.

**1926.452(n)(3)**

Ladders used to support step, platform, and trestle ladder scaffolds shall be placed, fastened, or equipped with devices to prevent slipping.

**1926.452(n)(4)**

Scaffolds shall not be bridged one to another.



### **1926.452(o)**

"Single-point adjustable suspension scaffolds."

#### **1926.452(o)(1)**

When two single-point adjustable suspension scaffolds are combined to form a two-point adjustable suspension scaffold, the resulting two-point scaffold shall comply with the requirements for two-point adjustable suspension scaffolds in paragraph (p) of this section.

#### **1926.452(o)(2)**

The supporting rope between the scaffold and the suspension device shall be kept vertical unless all of the following conditions are met:

##### **1926.452(o)(2)(i)**

The rigging has been designed by a qualified person, and

##### **1926.452(o)(2)(ii)**

The scaffold is accessible to rescuers, and

##### **1926.452(o)(2)(iii)**

The supporting rope is protected to ensure that it will not chafe at any point where a change in direction occurs, and

##### **1926.452(o)(2)(iv)**

The scaffold is positioned so that swinging cannot bring the scaffold into contact with another surface.

### **1926.452(o)(3)**

Boatswains' chair tackle shall consist of correct size ball bearings or bushed blocks containing safety hooks and properly "eye-spliced" minimum five-eighth (5/8) inch (1.6 cm) diameter first-grade manila rope, or other rope which will satisfy the criteria (e.g., strength and durability) of manila rope.

#### **1926.452(o)(4)**

Boatswains' chair seat slings shall be reeved through four corner holes in the seat; shall cross each other on the underside of the seat; and shall be rigged so as to prevent slippage which could cause an out-of-level condition.

#### **1926.452(o)(5)**

Boatswains' chair seat slings shall be a minimum of five-eighth (5/8) inch (1.6 cm) diameter fiber, synthetic, or other rope which will satisfy the criteria (e.g., strength, slip resistance, durability, etc.) of first grade manila rope.

**1926.452(o)(6)**

When a heat-producing process such as gas or arc welding is being conducted, boatswains' chair seat slings shall be a minimum of three-eighth (3/8) inch (1.0 cm) wire rope.

**1926.452(o)(7)**

Non-cross-laminated wood boatswains' chairs shall be reinforced on their underside by cleats securely fastened to prevent the board from splitting.

**1926.452(p)**

"Two-point adjustable suspension scaffolds (swing stages)." The following requirements do not apply to two-point adjustable suspension scaffolds used as masons' or stonemasons' scaffolds. Such scaffolds are covered by paragraph (q) of this section.

**1926.452(p)(1)**

Platforms shall not be more than 36 inches (0.9 m) wide unless designed by a qualified person to prevent unstable conditions.

**1926.452(p)(2)**

The platform shall be securely fastened to hangers (stirrups) by U-bolts or by other means which satisfy the requirements of 1926.451(a).

**1926.452(p)(3)**

The blocks for fiber or synthetic ropes shall consist of at least one double and one single block. The sheaves of all blocks shall fit the size of the rope used.

***..1926.452(p)(4)***

**1926.452(p)(4)**

Platforms shall be of the ladder-type, plank-type, beam-type, or light-metal type. Light metal-type platforms having a rated capacity of 750 pounds or less and platforms 40 feet (12.2 m) or less in length shall be tested and listed by a nationally recognized testing laboratory.

**1926.452(p)(5)**

Two-point scaffolds shall not be bridged or otherwise connected one to another during raising and lowering operations unless the bridge connections are articulated (attached), and the hoists properly sized.

**1926.452(p)(6)**

Passage may be made from one platform to another only when the platforms are at the same height, are abutting, and walk-through stirrups specifically designed for this purpose are used.

**1926.452(q)**

"Multi-point adjustable suspension scaffolds, stonemasons' multi-point adjustable suspension scaffolds, and masons' multi-point adjustable suspension scaffolds."

**1926.452(q)(1)**

When two or more scaffolds are used they shall not be bridged one to another unless they are designed to be bridged, the bridge connections are articulated, and the hoists are properly sized.

**1926.452(q)(2)**

If bridges are not used, passage may be made from one platform to another only when the platforms are at the same height and are abutting.

**1926.452(q)(3)**

Scaffolds shall be suspended from metal outriggers, brackets, wire rope slings, hooks, or means that meet equivalent criteria (e.g., strength, durability).

**1926.452(r)**

"Catenary scaffolds."

**1926.452(r)(1)**

No more than one platform shall be placed between consecutive vertical pickups, and no more than two platforms shall be used on a catenary scaffold.

**1926.452(r)(2)**

Platforms supported by wire ropes shall have hook-shaped stops on each end of the platforms to prevent them from slipping off the wire ropes. These hooks shall be so placed that they will prevent the platform from falling if one of the horizontal wire ropes breaks.

**1926.452(r)(3)**

Wire ropes shall not be tightened to the extent that the application of a scaffold load will overstress them.

**1926.452(r)(4)**

Wire ropes shall be continuous and without splices between anchors.

**1926.452(s)**

"Float (ship) scaffolds."

**1926.452(s)(1)**

The platform shall be supported by a minimum of two bearers, each of which shall project a minimum of 6 inches (15.2 cm) beyond the platform on both sides. Each bearer shall be securely fastened to the platform.

**1926.452(s)(2)**

Rope connections shall be such that the platform cannot shift or slip.)

**1926.452(s)(3)**

When only two ropes are used with each float:

**1926.452(s)(3)(i)**

They shall be arranged so as to provide four ends which are securely fastened to overhead supports.

**1926.452(s)(3)(ii)**

Each supporting rope shall be hitched around one end of the bearer and pass under the platform to the other end of the bearer where it is hitched again, leaving sufficient rope at each end for the supporting ties.

**1926.452(t)**

"Interior hung scaffolds."

**1926.452(t)(1)**

Scaffolds shall be suspended only from the roof structure or other structural member such as ceiling beams.

**1926.452(t)(2)**

Overhead supporting members (roof structure, ceiling beams, or other structural members) shall be inspected and checked for strength before the scaffold is erected.

**1926.452(t)(3)**

Suspension ropes and cables shall be connected to the overhead supporting members by shackles, clips, thimbles, or other means that meet equivalent criteria (e.g., strength, durability).

**1926.452(u)**

"Needle beam scaffolds."

**1926.452(u)(1)**

Scaffold support beams shall be installed on edge.

**1926.452(u)(2)**

Ropes or hangers shall be used for supports, except that one end of a needle beam scaffold may be supported by a permanent structural member.

**1926.452(u)(3)**

The ropes shall be securely attached to the needle beams.

**1926.452(u)(4)**

The support connection shall be arranged so as to prevent the needle beam from rolling or becoming displaced.

**1926.452(u)(5)**

Platform units shall be securely attached to the needle beams by bolts or equivalent means. Cleats and overhang are not considered to be adequate means of attachment.

**1926.452(v)**

"Multi-level suspended scaffolds."

**1926.452(v)(1)**

Scaffolds shall be equipped with additional independent support lines, equal in number to the number of points supported, and of equivalent strength to the suspension ropes, and rigged to support the scaffold in the event the suspension rope(s) fail.

**1926.452(v)(2)**

Independent support lines and suspension ropes shall not be attached to the same points of anchorage.

**1926.452(v)(3)**

Supports for platforms shall be attached directly to the support stirrup and not to any other platform.

**1926.452(w)**

"Mobile scaffolds."

**1926.452(w)(1)**

Scaffolds shall be braced by cross, horizontal, or diagonal braces, or combination thereof, to prevent racking or collapse of the scaffold and to secure vertical members together laterally so as to automatically square and align the vertical members. Scaffolds shall be plumb, level, and squared. All brace connections shall be secured.

**1926.452(w)(1)(i)**

Scaffolds constructed of tube and coupler components shall also comply with the requirements of paragraph (b) of this section;

**1926.452(w)(1)(ii)**

Scaffolds constructed of fabricated frame components shall also comply with the requirements of paragraph (c) of this section.

**1926.452(w)(2)**

Scaffold casters and wheels shall be locked with positive wheel and/or wheel and swivel locks, or equivalent means, to prevent movement of the scaffold while the scaffold is used in a stationary manner.

**1926.452(w)(3)**

Manual force used to move the scaffold shall be applied as close to the base as practicable, but not more than 5 feet (1.5 m) above the supporting surface.

**1926.452(w)(4)**

Power systems used to propel mobile scaffolds shall be designed for such use. Forklifts, trucks, similar motor vehicles or add-on motors shall not be used to propel scaffolds unless the scaffold is designed for such propulsion systems.

**1926.452(w)(5)**

Scaffolds shall be stabilized to prevent tipping during movement.

**1926.452(w)(6)**

Employees shall not be allowed to ride on scaffolds unless the following conditions exist:

**1926.452(w)(6)(i)**

The surface on which the scaffold is being moved is within 3 degrees of level, and free of pits, holes, and obstructions;

**1926.452(w)(6)(ii)**

The height to base width ratio of the scaffold during movement is two to one or less, unless the scaffold is designed and constructed to meet or exceed nationally recognized stability test requirements such as those listed in paragraph (x) of Appendix A to this subpart (ANSI/SIA A92.5 and A92.6);

**1926.452(w)(6)(iii)**

Outrigger frames, when used, are installed on both sides of the scaffold;

**1926.452(w)(6)(iv)**

When power systems are used, the propelling force is applied directly to the wheels, and does not produce a speed in excess of 1 foot per second (.3 mps); and

**1926.452(w)(6)(v)**

No employee is on any part of the scaffold which extends outward beyond the wheels, casters, or other supports.

**1926.452(w)(7)**

Platforms shall not extend outward beyond the base supports of the scaffold unless outrigger frames or equivalent devices are used to ensure stability.

**1926.452(w)(8)**

Where leveling of the scaffold is necessary, screw jacks or equivalent means shall be used.

**1926.452(w)(9)**

Caster stems and wheel stems shall be pinned or otherwise secured in scaffold legs or adjustment screws.

**1926.452(w)(10)**

Before a scaffold is moved, each employee on the scaffold shall be made aware of the move.

**1926.452(x)**

"Repair bracket scaffolds."

**1926.452(x)(1)**

Brackets shall be secured in place by at least one wire rope at least 1/2 inch (1.27 cm) in diameter.

**1926.452(x)(2)**

Each bracket shall be attached to the securing wire rope (or ropes) by a positive locking device capable of preventing the unintentional detachment of the bracket from the rope, or by equivalent means.

**1926.452(x)(3)**

Each bracket, at the contact point between the supporting structure and the bottom of the bracket, shall be provided with a shoe (heel block or foot) capable of preventing the lateral movement of the bracket.

**1926.452(x)(4)**

Platforms shall be secured to the brackets in a manner that will prevent the separation of the platforms from the brackets and the movement of the platforms or the brackets on a completed scaffold.

**1926.452(x)(5)**

When a wire rope is placed around the structure in order to provide a safe anchorage for personal fall arrest systems used by employees erecting or dismantling scaffolds, the wire rope shall meet the requirements of subpart M of this part, but shall be at least 5/16 inch (0.8 cm) in diameter.

**1926.452(x)(6)**

Each wire rope used for securing brackets in place or as an anchorage for personal fall arrest systems shall be protected from damage due to contact with edges, corners, protrusions, or other discontinuities of the supporting structure or scaffold components.

**1926.452(x)(7)**

Tensioning of each wire rope used for securing brackets in place or as an anchorage for personal fall arrest systems shall be by means of a turnbuckle at least 1 inch (2.54 cm) in diameter, or by equivalent means.

**1926.452(x)(8)**

Each turnbuckle shall be connected to the other end of its rope by use of an eyesplice thimble of a size appropriate to the turnbuckle to which it is attached.

**1926.452(x)(9)**

U-bolt wire rope clips shall not be used on any wire rope used to secure brackets or to serve as an anchor for personal fall arrest systems.

**1926.452(x)(10)**

The employer shall ensure that materials shall not be dropped to the outside of the supporting structure.

**1926.452(x)(11)**

Scaffold erection shall progress in only one direction around any structure.

**1926.452(y)**

"Stilts." Stilts, when used, shall be used in accordance with the following requirements:

**1926.452(y)(1)**

An employee may wear stilts on a scaffold only if it is a large area scaffold.

**1926.452(y)(2)**

When an employee is using stilts on a large area scaffold where a guardrail system is used to provide fall protection, the guardrail system shall be increased in height by an amount equal to the height of the stilts being used by the employee.

**1926.452(y)(3)**

Surfaces on which stilts are used shall be flat and free of pits, holes and obstructions, such as debris, as well as other tripping and falling hazards.



**1926.452(y)(4)**

Stilts shall be properly maintained. Any alteration of the original equipment shall be approved by the manufacturer.

[44 FR 8577, Feb. 9, 1979; 44 FR 20940, Apr. 6, 1979, as amended at 55 FR 47687, Nov. 14, 1990; 61 FR 46025, Aug. 30, 1996]

<b>Part Number:</b>	<b>1926</b>
• <b>Part Title:</b>	<b>Safety and Health Regulations for Construction</b>
• <b>Subpart:</b>	<b>L</b>
• <b>Subpart Title:</b>	<b>Scaffolds</b>
• <b>Standard Number:</b>	<b><u>1926.453</u></b>
• <b>Title:</b>	<b>Aerial lifts.</b>

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### **1926.453(a)**

"General requirements."

### **1926.453(a)(1)**

Unless otherwise provided in this section, aerial lifts acquired for use on or after January 22, 1973 shall be designed and constructed in conformance with the applicable requirements of the American National Standards for "Vehicle Mounted Elevating and Rotating Work Platforms," ANSI A92.2-1969, including appendix. Aerial lifts acquired before January 22, 1973 which do not meet the requirements of ANSI A92.2-1969, may not be used after January 1, 1976, unless they shall have been modified so as to conform with the applicable design and construction requirements of ANSI A92.2-1969. Aerial lifts include the following types of vehicle-mounted aerial devices used to elevate personnel to job-sites above ground:

#### **1926.453(a)(1)(i)**

Extensible boom platforms;

#### **1926.453(a)(1)(ii)**

Aerial ladders;

#### **1926.453(a)(1)(iii)**

Articulating boom platforms;

#### **1926.453(a)(1)(iv)**

Vertical towers; and

#### **1926.453(a)(1)(v)**

A combination of any such devices. Aerial equipment may be made of metal, wood, fiberglass reinforced plastic (FRP), or other material; may be powered or manually operated; and are deemed to be aerial lifts whether or not they are capable of rotating about a substantially vertical axis.

### **1926.453(a)(2)**

Aerial lifts may be "field modified" for uses other than those intended by the manufacturer provided the modification has been certified in writing by the manufacturer or by any other equivalent entity, such as a nationally recognized testing laboratory, to be in conformity with all applicable provisions of ANSI A92.2-1969 and this section and to be at least as safe as the equipment was before modification.

**1926.453(b)**

"Specific requirements."

**1926.453(b)(1)**

Ladder trucks and tower trucks. Aerial ladders shall be secured in the lower traveling position by the locking device on top of the truck cab, and the manually operated device at the base of the ladder before the truck is moved for highway travel.

**1926.453(b)(2)**

Extensible and articulating boom platforms.

**1926.453(b)(2)(i)**

Lift controls shall be tested each day prior to use to determine that such controls are in safe working condition.

**1926.453(b)(2)(ii)**

Only authorized persons shall operate an aerial lift.

**1926.453(b)(2)(iii)**

Belting off to an adjacent pole, structure, or equipment while working from an aerial lift shall not be permitted.

**1926.453(b)(2)(iv)**

Employees shall always stand firmly on the floor of the basket, and shall not sit or climb on the edge of the basket or use planks, ladders, or other devices for a work position.

**1926.453(b)(2)(v)**

A body belt shall be worn and a lanyard attached to the boom or basket when working from an aerial lift.

Note to paragraph (b)(2)(v): As of January 1, 1998, subpart M of this part (1926.502(d)) provides that body belts are not acceptable as part of a personal fall arrest system. The use of a body belt in a tethering system or in a restraint system is acceptable and is regulated under 1926.502(e).

**1926.453(b)(2)(vi)**

Boom and basket load limits specified by the manufacturer shall not be exceeded.

**1926.453(b)(2)(vii)**

The brakes shall be set and when outriggers are used, they shall be positioned on pads or a solid surface. Wheel chocks shall be installed before using an aerial lift on an incline, provided they can be safely installed.

### **1926.453(b)(2)(viii)**

An aerial lift truck shall not be moved when the boom is elevated in a working position with men in the basket, except for equipment which is specifically designed for this type of operation in accordance with the provisions of paragraphs (a)(1) and (2) of this section.

### **1926.453(b)(2)(ix)**

Articulating boom and extensible boom platforms, primarily designed as personnel carriers, shall have both platform (upper) and lower controls. Upper controls shall be in or beside the platform within easy reach of the operator. Lower controls shall provide for overriding the upper controls. Controls shall be plainly marked as to their function. Lower level controls shall not be operated unless permission has been obtained from the employee in the lift, except in case of emergency.

### **1926.453(b)(2)(x)**

Climbers shall not be worn while performing work from an aerial lift.

### **1926.453(b)(2)(xi)**

The insulated portion of an aerial lift shall not be altered in any manner that might reduce its insulating value.

### **1926.453(b)(2)(xii)**

Before moving an aerial lift for travel, the boom(s) shall be inspected to see that it is properly cradled and outriggers are in stowed position except as provided in paragraph (b)(2)(viii) of this section.

### **1926.453(b)(3)**

Electrical tests. All electrical tests shall conform to the requirements of ANSI A92.2-1969 section 5. However equivalent d.c.; voltage tests may be used in lieu of the a.c. voltage specified in A92.2-1969; d.c. voltage tests which are approved by the equipment manufacturer or equivalent entity shall be considered an equivalent test for the purpose of this paragraph (b)(3).

### **1926.453(b)(4)**

Bursting safety factor. The provisions of the American National Standards Institute standard ANSI A92.2-1969, section 4.9 Bursting Safety Factor shall apply to all critical hydraulic and pneumatic components. Critical components are those in which a failure would result in a free fall or free rotation of the boom. All noncritical components shall have a bursting safety factor of at least 2 to 1.

### **1926.453(b)(5)**

Welding standards. All welding shall conform to the following standards as applicable:

#### **1926.453(b)(5)(i)**

Standard Qualification Procedure, AWS B3.0-41.

**1926.453(b)(5)(ii)**

Recommended Practices for Automotive Welding Design, AWS D8.4-61.

**1926.453(b)(5)(iii)**

Standard Qualification of Welding Procedures and Welders for Piping and Tubing, AWS D10.9-69.

**1926.453(b)(5)(iv)**

Specifications for Welding Highway and Railway Bridges, AWS D2.0-69.

Note to 1926.453: Non-mandatory Appendix C to this subpart lists examples of national consensus standards that are considered to provide employee protection equivalent to that provided through the application of ANSI A92.2-1969, where appropriate. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies may be obtained from the American National Standards Institute. Copies may be inspected at the Docket Office, Occupational Safety and Health Administration, U.S. Department of Labor, 200 Constitution Avenue, NW., room N2634, Washington, DC or at the Office of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC.

[58 FR 35182, June 30, 1993; 61 FR 46025, Aug. 30, 1996; 61 FR 59831, Nov. 25, 1996]

<b>Part Number:</b>	<b>1926</b>
<b>• Part Title:</b>	<b>Safety and Health Regulations for Construction</b>
<b>• Subpart:</b>	<b>L</b>
<b>• Subpart Title:</b>	<b>Scaffolds</b>
<b>• Standard Number:</b>	<b><u>1926.454</u></b>
<b>• Title:</b>	<b>Training requirements.</b>

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This section supplements and clarifies the requirements of 1926.21(b)(2) as these relate to the hazards of work on scaffolds.

#### **1926.454(a)**

The employer shall have each employee who performs work while on a scaffold trained by a person qualified in the subject matter to recognize the hazards associated with the type of scaffold being used and to understand the procedures to control or minimize those hazards. The training shall include the following areas, as applicable:

##### **1926.454(a)(1)**

The nature of any electrical hazards, fall hazards and falling object hazards in the work area;

##### **1926.454(a)(2)**

The correct procedures for dealing with electrical hazards and for erecting, maintaining, and disassembling the fall protection systems and falling object protection systems being used;

##### **1926.454(a)(3)**

The proper use of the scaffold, and the proper handling of materials on the scaffold;

##### **1926.454(a)(4)**

The maximum intended load and the load-carrying capacities of the scaffolds used; and

##### **1926.454(a)(5)**

Any other pertinent requirements of this subpart.

#### **1926.454(b)**

The employer shall have each employee who is involved in erecting, disassembling, moving, operating, repairing, maintaining, or inspecting a scaffold trained by a competent person to recognize any hazards associated with the work in question. The training shall include the following topics, as applicable:

##### **1926.454(b)(1)**

The nature of scaffold hazards;

##### **1926.454(b)(2)**

The correct procedures for erecting, disassembling, moving, operating, repairing, inspecting, and maintaining the type of scaffold in question;

**1926.454(b)(3)**

The design criteria, maximum intended load-carrying capacity and intended use of the scaffold;

**1926.454(b)(4)**

Any other pertinent requirements of this subpart.

**1926.454(c)**

When the employer has reason to believe that an employee lacks the skill or understanding needed for safe work involving the erection, use or dismantling of scaffolds, the employer shall retrain each such employee so that the requisite proficiency is regained. Retraining is required in at least the following situations:

**1926.454(c)(1)**

Where changes at the worksite present a hazard about which an employee has not been previously trained; or

**1926.454(c)(2)**

Where changes in the types of scaffolds, fall protection, falling object protection, or other equipment present a hazard about which an employee has not been previously trained; or

**1926.454(c)(3)**

Where inadequacies in an affected employee's work involving scaffolds indicate that the employee has not retained the requisite proficiency.

[61 FR 46025, Aug. 30, 1996]

<b>Part Number:</b>	<b>1926</b>
<b>• Part Title:</b>	<b>Safety and Health Regulations for Construction</b>
<b>• Subpart:</b>	<b>L</b>
<b>• Subpart Title:</b>	<b>Scaffolds</b>
<b>• Standard Number:</b>	<b><u><a href="#">1926 Subpart L App A</a></u></b>
<b>• Title:</b>	<b>Scaffold Specifications</b>

This Appendix provides non-mandatory guidelines to assist employers in complying with the requirements of subpart L of this part. An employer may use these guidelines and tables as a starting point for designing scaffold systems. However, the guidelines do not provide all the information necessary to build a complete system, and the employer is still responsible for designing and assembling these components in such a way that the completed system will meet the requirements of 1926.451(a). Scaffold components which are not selected and loaded in accordance with this Appendix, and components for which no specific guidelines or tables are given in this Appendix (e.g., joints, ties, components for wood pole scaffolds more than 60 feet in height, components for heavy-duty horse scaffolds, components made with other materials, and components with other dimensions, etc.) must be designed and constructed in accordance with the capacity requirements of 1926.451(a), and loaded in accordance with 1926.451(d)(1).

Index to Appendix A for Subpart L

1. General guidelines and tables.
2. Specific guidelines and tables.
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  - (b) Tube and coupler scaffolds.
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  - (g) Form scaffolds and carpenters' bracket scaffolds.
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  - (j) Pump jack scaffolds.
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  - (o) Single-point adjustable suspension scaffolds.
  - (p) Two-point adjustable suspension scaffolds.
  - (q) (1) Stonesetters' multi-point adjustable suspension scaffolds.
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  - (v) Multi-level suspension scaffolds.
  - (w) Mobile scaffolds.
  - (x) Repair bracket scaffolds.
  - (y) Stilts.
  - (z) Tank builders' scaffolds.

### 1. General Guidelines and Tables

(a) The following tables, and the tables in Part 2 -- Specific guidelines and tables, assume that all load-carrying timber members (except planks) of the scaffold are a minimum of 1,500 lb-f/in(2) (stress grade) construction grade lumber. All dimensions are nominal sizes as provided in the American Softwood Lumber Standards, dated January 1970, except that, where rough sizes are noted, only rough or



undressed lumber of the size specified will satisfy minimum requirements.

(b) Solid sawn wood used as scaffold planks shall be selected for such use following the grading rules established by a recognized lumber grading association or by an independent lumber grading inspection agency. Such planks shall be identified by the grade stamp of such association or agency. The association or agency and the grading rules under which the wood is graded shall be certified by the Board of Review, American Lumber Standard Committee, as set forth in the American Softwood Lumber Standard of the U.S. Department of Commerce.

(i) Allowable spans shall be determined in compliance with the National Design Specification for Wood Construction published by the National Forest Products Association; paragraph 5 of ANSI A10.8-1988 Scaffolding-Safety Requirements published by the American National Standards Institute; or for 2 x 10 inch (nominal) or 2 x 9 inch (rough) solid sawn wood planks, as shown in the following table:

Maximum intended nominal load (lb/ft (2))	Maximum permissible span using full thickness undressed lumber (ft)	Maximum permissible span using nominal thickness lumber (ft)
25.....	10	8
50.....	8	6
75.....	6	

(ii) The maximum permissible span for 1 1/4 x 9-inch or wider wood plank of full thickness with a maximum intended load of 50 lb/ft.(2) shall be 4 feet.

(c) Fabricated planks and platforms may be used in lieu of solid sawn wood planks. Maximum spans for such units shall be as recommended by the manufacturer based on the maximum intended load being calculated as follows:

Rated load capacity	Intended load
Light-duty.....	* 25 pounds per square foot applied uniformly over the entire span area.
Medium-duty... ..	* 50 pounds per square foot applied uniformly over the entire span area.
Heavy-duty.....	* 75 pounds per square foot applied uniformly over the entire span area.
One-person.....	* 250 pounds placed at the center of the span (total 250 pounds).
Two-person.....	* 250 pounds placed 18 inches to the left and right of the center of the span (total 500 pounds).
Three-person.....	* 250 pounds placed at the center of the span and 250 pounds placed 18 inches to the left and right of the center of the span (total 750 pounds).

Note: Platform units used to make scaffold platforms intended for light-duty use shall be capable of supporting at least 25 pounds per square foot applied uniformly over the entire unit-span area, or a 250-pound point load placed on the unit at the center of the span, whichever load produces the greater shear force.

(d) Guardrails shall be as follows:

(i) Toprails shall be equivalent in strength to 2 inch by 4 inch lumber; or  
 1 1/4 inch x 1/8 inch structural angle iron; or  
 1 inch x .070 inch wall steel tubing; or 1.990 inch x .058  
 inch wall aluminum tubing.

(ii) Midrails shall be equivalent in strength to 1 inch by 6 inch lumber; or  
 1 1/4 inch x 1 1/4 inch x 1/8 inch structural angle iron; or  
 1 inch x .070 inch wall steel tubing; or  
 1.990 inch x .058 inch wall aluminum tubing.

(iii) Toeboards shall be equivalent in strength to 1 inch by 4 inch lumber; or  
 1 1/4 inch x 1 1/4 inch structural angle iron; or  
 1 inch x .070 inch wall steel tubing; or  
 1.990 inch x .058 inch wall aluminum tubing.

(iv) Posts shall be equivalent in strength to 2 inch by 4 inch lumber; or  
 1 1/4 inch x 1 1/4 inch x 1/8 structural angle iron; or  
 1 inch x .070 inch wall steel tubing; or  
 1.990 inch x .058 inch wall aluminum tubing.

(v) Distance between posts shall not exceed 8 feet.

(e) Overhead protection shall consist of 2 inch nominal planking laid tight, or 3/4-inch plywood.

(f) Screen installed between toeboards and midrails or top rails shall consist of No. 18 gauge U.S. Standard wire one inch mesh.

2. Specific guidelines and tables.

(a) Pole Scaffolds.

Single Pole Wood Pole Scaffolds

	Light duty up to 20 feet high	Light duty up to 60 feet high	Medium duty up to 60 feet high	Heavy duty up to 60 feet high
Maximum intended load (lbs/ft(2)).....	25.....	25.....	50.....	75
Poles or uprights	2 x 4 in...	4 x 4 in...	4 x 4 in....	4 x 6 in.
Maximum pole spacing (longitudinal)...	6 feet.....	10 feet....	8 feet.....	6 feet
Maximum pole spacing (transverse).....	5 feet.....	5 feet.....	5 feet.....	5 feet
Runners.....	1 x 4 in...	1 1/4 x 9 in	2 x 10 in...	2 x 10 in.
Bearers and maximum spacing of bearers:				
3 feet.....	2 x 4 in...	2 x 4 in...	2 x 10 in.. or 3 x 4 in.	2 x 10 in. or 3 x 5 in.
5 feet.....	2 x 6 in. or 3 x 4 in...	2 x 6 in. or 3 x 4 in.. (rough).	2 x 10 in. or 3 x 4 in....	2 x 10 in. or 3 x 5 in.
6 feet.....	.....	.....	2 x 10 in. or 3 x 4 in....	2 x 10 in. or 3 x 5 in.

8 feet.....	.....	.....	2 x 10 in. or	.....
			3 x 4 in....	.....
Planking.....	1 1/4 x 9 in	2 x 10 in..	2 x 10 in....	2 x 10 in.
Maximum vertical spacing of horizontal members.				
	7 feet.....	9 feet.....	7 feet.....	6 ft. 6 in.
Bracing horizontal....	1 x 4 in....	1 x 4 in....	1 x 6 in. or	2 x 4 in.
			1 1/4 x 4 in	
Bracing diagonal..	1 x 4 in....	1 x 4 in....	1 x 4 in....	2 x 4 in.
Tie-ins.....	1 x 4 in....	1 x 4 in....	1 x 4 in....	1 x 4 in.

Note: All members except planking are used on edge. All wood bearers shall be reinforced with 3/16 x 2 inch steel strip, or the equivalent, secured to the lower edges for the entire length of the bearer.

Independent Wood Pole Scaffolds

	Light duty up to 20 feet high	Light duty up to 60 feet high	Medium duty up to 60 feet high	Heavy duty up to 60 feet high
Maximum intended load.....	25 lbs/ft(2)	25 lbs/ft(2)	50 lbs/ft(2)	75 lbs/ft(2).
Poles or uprights	2 x 4 in....	4 x 4 in....	4 x 4 in....	4 x 4 in.
Maximum pole spacing (longitudinal).	6 feet.....	10 feet.....	8 feet.....	6 feet.
Maximum (transverse)..	6 feet.....	10 feet.....	8 feet.....	8 feet.
Runners.....	1 1/4 x 4 in	1 1/4 x 9 in	2 x 10 in....	2 x 10 in.
Bearers and maximum spacing of bearers:				
3 feet.....	2 x 4 in....	2 x 4 in....	2 x 10 in....	2 x 10 in. (rough).
6 feet.....	2 x 6 in. or	2 x 10 in..	2 x 10 in....	2 x 10 in. (rough).
	3 x 4 in...	(rough) or		
		3 x 8 in.		
8 feet.....	2 x 6 in. or	2 x 10 in..	2 x 10 in....	.....
	3 x 4 in...	(rough) or		
		3 x 8 in.		
10 feet.....	2 x 6 in. or	2 x 10 in..		
	3 x 4 in...	(rough) or		
		3 x 3 in..	.....	.....
Planking.....	1 1/4 x 9 in	2 x 10 in....	2 x 10 in....	2 x 10 in.
Maximum vertical				

spacing of horizontal members.	7 feet.....	7 feet.....	6 feet.....	6 feet.
Bracing horizontal....	1 x 4 in....	1 x 4 in....	1 x 6 in. or 1 1/4 x 4 in.	2 x 4 in.
Bracing diagonal.	1 x 4 in....	1 x 4 in....	1 x 4 in....	2 x 4 in.
Tie-ins.....	1 x 4 in....	1 x 4 in....	1 x 4 in....	1 x 4 in.

Note: All members except planking are used on edge. All wood bearers shall be reinforced with 3/16 x 2 inch steel strip, or the equivalent, secured to the lower edges for the entire length of the bearer.

(b) Tube and coupler scaffolds.

Minimum Size of Members

	Light duty	Medium duty	Heavy duty
Maximum intended load.....	25 lbs/ft(2)	50 lbs/ft(2)...	75 lbs/ft(2).
Posts, runners and braces.....	Nominal 2 in. (1.90 inches) OD steel tube or pipe.	Nominal 2 in. (1.90 inches) OD steel tube or pipe.	Nominal 2 in. (1.90 inches) OD steel tube or pipe.
Bearers.....	Nominal 2 in. (1.90 inches) OD steel tube or pipe and a maximum post spacing of 4 ft. x 10 ft.	Nominal 2 in. (1.90 inches) OD steel tube or pipe and a maximum post spacing of 4 ft. x 7 ft. or Nominal 2 1/2 in. (2.375 in.) OD steel tube or pipe and a maximum post spacing of 6 ft. x 8 ft. (*)	Nominal 2 1/2 in. (2.375 in.) OD steel tube or pipe and a maximum post spacing of 6 ft. x 6 ft.
Maximum runner spacing vertically.....	6 ft. 6 in..	6 ft. 6 in.....	6 ft. 6 in.

Footnote(\*) Bearers shall be installed in the direction of the shorter dimension.

Note: Longitudinal diagonal bracing shall be installed at an angle of 45 deg. (+/- 5 deg.).

Maximum Number of Planked Levels

	Light	Medium	Heavy	Maximum height of scaffold
Maximum number of additional planked levels				

	duty	duty	duty	(in feet)
Number of Working Levels:				
1.....	16	11	6	125
2.....	11	1	0	125
3.....	6	0	0	125
4.....	1	0	0	125

(c) "Fabricated frame scaffolds." Because of their prefabricated nature, no additional guidelines or tables for these scaffolds are being adopted in this Appendix.

(d) "Plasterers', decorators', and large area scaffolds." The guidelines for pole scaffolds or tube and coupler scaffolds (Appendix A (a) and (b)) may be applied.

(e) "Bricklayers' square scaffolds."

Maximum intended load: 50 lb/ft.(2)(\*)

Footnote(\*) The squares shall be set not more than 8 feet apart for light duty scaffolds and not more than 5 feet apart for medium duty scaffolds.

Maximum width: 5 ft.

Maximum height: 5 ft.

Gussets: 1 x 6 in.

Braces: 1 x 8 in.

Legs: 2 x 6 in.

Bearers (horizontal members): 2 x 6 in.

(f) Horse scaffolds.

Maximum intended load (light duty): 25 lb/ft.(2)(\*\*)

Footnote(\*\*) Horses shall be spaced not more than 8 feet apart for light duty loads, and not more than 5 feet apart for medium duty loads.

Maximum intended load (medium duty): 50 lb/ft.(2)(\*\*)

Footnote(\*\*) Horses shall be spaced not more than 8 feet apart for light duty loads, and not more than 5 feet apart for medium duty loads.

Horizontal members or bearers:

Light duty: 2 x 4 in.

Medium duty: 3 x 4 in.

Legs: 2 x 4 in.

Longitudinal brace between legs: 1 x 6 in.

Gusset brace at top of legs: 1 x 8 in.

Half diagonal braces: 2 x 4 in.

(g) "Form scaffolds and carpenters' bracket scaffolds."

(1) Brackets shall consist of a triangular-shaped frame made of wood with a cross-section not less than 2 inches by 3 inches, or of 1 1/4 inch x 1 1/4 inch x 1/8 inch structural angle iron.

(2) Bolts used to attach brackets to structures shall not be less than 5/8 inches in diameter.

(3) Maximum bracket spacing shall be 8 feet on centers.

(4) No more than two employees shall occupy any given 8 feet of a bracket or form scaffold at any one

time. Tools and materials shall not exceed 75 pounds in addition to the occupancy.

(5) Wooden figure-four scaffolds:

Maximum intended load: 25 lb/ft.(2)

Uprights: 2 x 4 in. or 2 x 6 in.

Bearers (two): 1 x 6 in.

Braces: 1 x 6 in.

Maximum length of bearers (unsupported): 3 ft. 6 in.

(i) Outrigger bearers shall consist of two pieces of 1 x 6 inch lumber nailed on opposite sides of the vertical support.

(ii) Bearers for wood figure-four brackets shall project not more than 3 feet 6 inches from the outside of the form support, and shall be braced and secured to prevent tipping or turning. The knee or angle brace shall intersect the bearer at least 3 feet from the form at an angle of approximately 45 degrees, and the lower end shall be nailed to a vertical support.

(6) Metal bracket scaffolds:

Maximum intended load: 25 lb/ft.(2)

Uprights: 2 x 4 inch

Bearers: As designed.

Braces: As designed.

(7) Wood bracket scaffolds:

Maximum intended load: 25 lb/ft.(2)

Uprights: 2 x 4 in or 2 x 6 in

Bearers: 2 x 6 in

Maximum scaffold width: 3 ft 6 in

Braces: 1 x 6 in

(h) "Roof bracket scaffolds." No specific guidelines or tables are given.

(i) "Outrigger scaffolds (single level)." No specific guidelines tables are given.

(j) "Pump jack scaffolds." Wood poles shall not exceed 30 feet in height. Maximum intended load -- 500 lbs between poles; applied at the center of the span. Not more than two employees shall be on a pump jack scaffold at one time between any two supports. When 2 x 4's are spliced together to make a 4 x 4 inch wood pole, they shall be spliced with "10 penny" common nails no more than 12 inches center to center, staggered uniformly from the opposite outside edges.

(k) "Ladder jack scaffolds." Maximum intended load -- 25 lb/ft(2). However, not more than two employees shall occupy any platform at any one time. Maximum span between supports shall be 8 feet.

(l) "Window jack scaffolds." Not more than one employee shall occupy a window jack scaffold at any one time.

(m) "Crawling boards (chicken ladders)." Crawling boards shall be not less than 10 inches wide and 1 inch thick, with cleats having a minimum 1 x 1 1/2 inch cross-sectional area. The cleats shall be equal in length to the width of the board and spaced at equal intervals not to exceed 24 inches.

(n) "Step, platform, and trestle ladder scaffolds." No additional guidelines or tables are given.

(o) "Single-point adjustable suspension scaffolds." Maximum intended load -- 250 lbs. Wood seats for boatswains' chairs shall be not less than 1 inch thick if made of non-laminated wood, or 5/8 inches thick if made of marine quality plywood.

(p) "Two-point adjustable suspension scaffolds." (1) In addition to direct connections to buildings (except window cleaners' anchors) acceptable ways to prevent scaffold sway include angulated roping and static lines. Angulated roping is a system of platform suspension in which the upper wire rope sheaves or suspension points are closer to the plane of the building face than the corresponding attachment points on the platform, thus causing the platform to press against the face of the building. Static lines are separate ropes secured at their top and bottom ends closer to the plane of the building face than the outermost edge of the platform. By drawing the static line taut, the platform is drawn against the face of the building.

(2) On suspension scaffolds designed for a working load of 500 pounds, no more than two employees

shall be permitted on the scaffold at one time. On suspension scaffolds with a working load of 750 pounds, no more than three employees shall be permitted on the scaffold at one time.

(3) Ladder-type platforms. The side stringer shall be of clear straight-grained spruce. The rungs shall be of straight-grained oak, ash, or hickory, at least 1 1/8 inches in diameter, with 7/8 inch tenons mortised into the side stringers at least 7/8 inch. The stringers shall be tied together with tie rods not less than 1/4 inch in diameter, passing through the stringers and riveted up tight against washers on both ends. The flooring strips shall be spaced not more than 5/8 inch apart, except at the side rails where the space may be 1 inch. Ladder-type platforms shall be constructed in accordance with the following table:

Schedule for Ladder-Type Platforms

Length of Platform.	12 feet.....	14 & 16 feet.....	18 & 20 feet.
Side stringers, minimum cross section (finished sizes):			
At ends.....	1 3/4 x 2 3/4 in.	1 3/4 x 2 3/4 in.	1 3/4 x 3 in.
At middle.....	1 3/4 x 3 3/4 in.	1 3/4 x 3 3/4 in.	1 3/4 x 4 in.
Reinforcing strip (minimum).....	A 1/8 x 7/8 inch steel reinforcing strip shall be attached to the side or underside, full length.		
Rungs.....	Rungs shall be 1 1/8 inch minimum diameter with at least 7/8 inch in diameter tenons, and the maximum spacing shall be 12 inches to center.		
Tie rods:			
Number (minimum).	3.....	4.....	4
Diameter (minimum).....	1/4 inch.....	1/4 inch.....	1/4 inch
Flooring, minimum finished size....	1/2 x 2 3/4 in...	1/2 x 2 3/4 in...	1/2 x 2 3/4 in.

Schedule for Ladder-Type Platforms

Length of Platform.....	22 & 24 ft.....	28 & 30 ft.
Side stringers, minimum cross section (finished sizes):		
At ends.....	1 3/4 x 3 in.....	1 3/4 x 3 1/2 in.
At middle.....	1 3/4 x 4 1/4 in....	1 3/4 x 5 in.
Reinforcing strip (minimum)	A 1/8 x 7/8-inch steel reinforcing strip shall be attached to the side or underside, full length.	
Rungs.....	Rungs shall be 1 1/8 inch minimum diameter with at least 7/8 inch in diameter tenons, and the maximum spacing shall be 12 inches to center.	
	Tie rods.	
Number (minimum).....	5.....	6.
Diameter (minimum).....	1/4 in.....	1/4 in.
Flooring, minimum finished size.....	1/2 x 2 3/4 in.....	1/2 x 2 3/4 in.

(4) Plank-Type Platforms. Plank-type platforms shall be composed of not less than nominal 2 x 8 inch unspliced planks, connected together on the underside with cleats at intervals not exceeding 4 feet, starting 6 inches from each end. A bar or other effective means shall be securely fastened to the platform

at each end to prevent the platform from slipping off the hanger. The span between hangers for plank-type platforms shall not exceed 10 feet.

(5) Beam-Type Platforms. Beam platforms shall have side stringers of lumber not less than 2 x 6 inches set on edge. The span between hangers shall not exceed 12 feet when beam platforms are used. The flooring shall be supported on 2 x 6 inch cross beams, laid flat and set into the upper edge of the stringers with a snug fit, at intervals of not more than 4 feet, securely nailed to the cross beams. Floorboards shall not be spaced more than 1/2 inch apart.

(q)(1) "Multi-point adjustable suspension scaffolds and stonemasons' multi-point adjustable suspension scaffolds." No specific guidelines or tables are given for these scaffolds.

(q)(2) "Masons' multi-point adjustable suspension scaffolds." Maximum intended load -- 50 lb/ft(2). Each outrigger beam shall be at least a standard 7 inch, 15.3 pound steel I-beam, at least 15 feet long. Such beams shall not project more than 6 feet 6 inches beyond the bearing point. Where the overhang exceeds 6 feet 6 inches, outrigger beams shall be composed of stronger beams or multiple beams.

(r) "Catenary scaffolds." (1) Maximum intended load -- 500 lbs.

(2) Not more than two employees shall be permitted on the scaffold at one time.

(3) Maximum capacity of come-along shall be 2,000 lbs.

(4) Vertical pickups shall be spaced not more than 50 feet apart.

(5) Ropes shall be equivalent in strength to at least 1/2 inch (1.3 cm) diameter improved plow steel wire rope.

(s) "Float (ship) scaffolds." (1) Maximum intended load -- 750 lbs.

(2) Platforms shall be made of 3/4 inch plywood, equivalent in rating to American Plywood Association Grade B-B, Group I, Exterior.

(3) Bearers shall be made from 2 x 4 inch, or 1 x 10 inch rough lumber. They shall be free of knots and other flaws.

(4) Ropes shall be equivalent in strength to at least 1 inch (2.5 cm) diameter first grade manila rope.

(t) Interior hung scaffolds.

Bearers (use on edge): 2 x 10 in.

Maximum intended load: Maximum span

25 lb/ft.(2): 10 ft.

50 lb/ft.(2): 10 ft.

75 lb/ft.(2): 7 ft.

(u) "Needle beam scaffolds."

Maximum intended load: 25 lb/ft.(2)

Beams: 4 x 6 in.

Maximum platform span: 8 ft.

Maximum beam span: 10 ft.

(1) Ropes shall be attached to the needle beams by a scaffold hitch or an eye splice. The loose end of the rope shall be tied by a bowline knot or by a round turn and a half hitch.

(2) Ropes shall be equivalent in strength to at least 1 inch (2.5 cm) diameter first grade manila rope.

(v) "Multi-level suspension scaffolds." No additional guidelines or tables are being given for these scaffolds.

(w) "Mobile Scaffolds." Stability test as described in the ANSI A92 series documents, as appropriate for the type of scaffold, can be used to establish stability for the purpose of 1926.452(w)(6).

(x) "Repair bracket scaffolds." No additional guidelines or tables are being given for these scaffolds.

(y) "Stilts." No specific guidelines or tables are given.

(z) "Tank builder's scaffold."

(1) The maximum distance between brackets to which scaffolding and guardrail supports are attached shall be no more than 10 feet 6 inches.

(2) Not more than three employees shall occupy a 10 feet 6 inch span of scaffold planking at any time.

(3) A taut wire or synthetic rope supported on the scaffold brackets shall be installed at the scaffold plank level between the innermost edge of the scaffold platform and the curved plate structure of the



tank shell to serve as a safety line in lieu of an inner guardrail assembly where the space between the scaffold platform and the tank exceeds 12 inches (30.48 cm). In the event the open space on either side of the rope exceeds 12 inches (30.48 cm), a second wire or synthetic rope appropriately placed, or guardrails in accordance with § 1926.451(g)(4), shall be installed in order to reduce that open space to less than 12 inches (30.48 cm).

(4) Scaffold planks of rough full-dimensioned 2-inch (5.1 cm) x 12-inch (30.5 cm) Douglas Fir or Southern Yellow Pine of Select Structural Grade shall be used. Douglas Fir planks shall have a fiber stress of at least 1900 lb/in(2) (130,929 n/cm(2)) and a modulus of elasticity of at least 1,900,000 lb/in(2) (130,929,000 n/cm(2)), while Yellow Pine planks shall have a fiber stress of at least 2500 lb/in(2) (172,275 n/cm(2)) and a modulus of elasticity of at least 2,000,000 lb/in(2) (137,820,000 n/cm(2)).

(5) Guardrails shall be constructed of a taut wire or synthetic rope, and shall be supported by angle irons attached to brackets welded to the steel plates. These guardrails shall comply with Sec. 1926.451(g)(4). Guardrail supports shall be located at no greater than 10 feet 6 inch intervals.

[61 FR 46025, Aug. 30, 1996; 77 FR 46950, Aug. 7, 2012]

**Part Number: 1926**

• **Part Title: Safety and Health Regulations for Construction**

• **Subpart: L**

• **Subpart Title: Scaffolds**

• **Standard Number: 1926 Subpart L App B**

• **Title: Criteria for Determining the Feasibility of Providing Safe Access and Fall Protection for Scaffold Erectors and Dismantlers**

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[Reserved]

[61 FR 46025, Aug. 30, 1996]

**Part Number: 1926**

• **Part Title: Safety and Health Regulations for Construction**

• **Subpart: L**

• **Subpart Title: Scaffolds**

• **Standard Number: 1926 Subpart L App C**

• **Title: List of National Consensus Standards.**

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ANSI/SIA A92.2-1990 Vehicle-Mounted Elevating and Rotating Aerial  
Devices

ANSI/SIA A92.3-1990 Manually Propelled Elevating Aerial Platforms

ANSI/SIA A92.5-1990 Boom Supported Elevating Work Platforms

ANSI/SIA A92.6-1990 Self-Propelled Elevating Work Platforms

ANSI/SIA A92.7-1990 Airline Ground Support Vehicle-Mounted Vertical  
Lift Devices

ANSI/SIA A92.8-1993 Vehicle-Mounted Bridge Inspection and  
Maintenance Devices

ANSI/SIA A92.9-1993 Mast-Climbing Work Platforms

[61 FR 46025, Aug. 30, 1996]

**Part Number: 1926**  
**• Part Title: Safety and Health Regulations for Construction**  
**• Subpart: L**  
**• Subpart Title: Scaffolds**  
**• Standard Number: 1926 Subpart L App D**  
**• Title: List of Training Topics for Scaffold Erectors and Dismantlers.**

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This Appendix D is provided to serve as a guide to assist employers when evaluating the training needs of employees erecting or dismantling supported scaffolds.

The Agency believes that employees erecting or dismantling scaffolds should be trained in the following topics:

- \* General Overview of Scaffolding
  - \* regulations and standards
  - \* erection/dismantling planning
  - \* PPE and proper procedures
  - \* fall protection
  - \* materials handling
  - \* access
  - \* working platforms
  - \* foundations
  - \* guys, ties and braces
- \* Tubular Welded Frame Scaffolds
  - \* specific regulations and standards
  - \* components
  - \* parts inspection
  - \* erection/dismantling planning
  - \* guys, ties and braces
  - \* fall protection
  - \* general safety
  - \* access and platforms
  - \* erection/dismantling procedures
  - \* rolling scaffold assembly
  - \* putlogs
- \* Tube and Clamp Scaffolds
  - \* specific regulations and standards
  - \* components
  - \* parts inspection
  - \* erection/dismantling planning
  - \* guys, ties and braces
  - \* fall protection
  - \* general safety
  - \* access and platforms
  - \* erection/dismantling procedures
  - \* buttresses, cantilevers, & bridges
- \* System Scaffolds
  - \* specific regulations and standards
  - \* components
  - \* parts inspection
  - \* erection/dismantling planning
  - \* guys, ties and braces
  - \* fall protection
  - \* general safety
  - \* access and platforms

- \* erection/dismantling procedures
- \* buttresses, cantilevers, & bridges

Scaffold erectors and dismantlers should all receive the general overview, and, in addition, specific training for the type of supported scaffold being erected or dismantled.

[61 FR 46025, Aug. 30, 1996]

<b>Part Number:</b>	<b>1926</b>
<b>• Part Title:</b>	<b>Safety and Health Regulations for Construction</b>
<b>• Subpart:</b>	<b>L</b>
<b>• Subpart Title:</b>	<b>Scaffolds</b>
<b>• Standard Number:</b>	<b>1926 Subpart L App E</b>
<b>• Title:</b>	<b>Drawings and Illustrations.</b>

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This Appendix provides drawings of particular types of scaffolds and scaffold components, and graphic illustrations of bracing patterns and tie spacing patterns.

This Appendix is intended to provide visual guidance to assist the user in complying with the requirements of subpart L, part 1926.

(For Figure 1, [Click Here](#))

(For Figure 2, [Click Here](#))

(For Figure 3, [Click Here](#))

(For Figure 4, [Click Here](#))

(For Figure 5, [Click Here](#))

(For Figure 6, [Click Here](#))

(For Figure 7, [Click Here](#))

(For Figure 8, [Click Here](#))

(For Figure 9, [Click Here](#))

[61 FR 46025, Aug. 30, 1996; 61 FR 59831, Nov. 25, 1996]

**Part Number:** 1926  
• **Part Title:** Safety and Health Regulations for Construction  
• **Subpart:** M  
• **Subpart Title:** Fall Protection  
• **Standard Number:** [1926 Subpart M](#)  
• **Title:** Authority for 1926 Subpart M  
• **Appendix:** [A](#), [B](#), [C](#), [D](#), [E](#)

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**Authority:** Section 3704 of the Contract Work Hours and Safety Standards Act (Construction Safety Act) (40 U.S.C. 3701); 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 Nos. 1-90 (55 FR 9033), 6-96 (62 FR 111), 3-2000 (65 FR 50017), and 5-2007 (72 FR 31159); and 29 CFR part 1911.

[59 FR 40730, Aug. 9, 1994; 60 FR 5131, Jan. 26, 1995; 60 FR 39254, Aug. 2, 1995; 66 FR 5265, Jan. 18, 2001; 75 FR 48133, Aug. 9, 2010]

**Part Number:** 1926  
• **Part Title:** Safety and Health Regulations for Construction  
• **Subpart:** M  
• **Subpart Title:** Fall Protection  
• **Standard Number:** [1926.500](#)  
• **Title:** Scope, application, and definitions applicable to this subpart.

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### [1926.500\(a\)](#)

*Scope and application.*

#### [1926.500\(a\)\(1\)](#)

This subpart sets forth requirements and criteria for fall protection in construction workplaces covered under 29 CFR part 1926. Exception: The provisions of this subpart do not apply when employees are making an inspection, investigation, or assessment of workplace conditions prior to the actual start of construction work or after all construction work has been completed.

#### [1926.500\(a\)\(2\)](#)

Section 1926.501 sets forth those workplaces, conditions, operations, and circumstances for which fall protection shall be provided except as follows:

##### [1926.500\(a\)\(2\)\(i\)](#)

Requirements relating to fall protection for employees working on scaffolds are provided in subpart L of this part.

**1926.500(a)(2)(ii)**

Requirements relating to fall protection for employees working on cranes and derricks are provided in subpart CC of this part.

**1926.500(a)(2)(iii)**

Fall protection requirements for employees performing steel erection work (except for towers and tanks) are provided in subpart R of this part.

**1926.500(a)(2)(iv)**

Requirements relating to fall protection for employees working on certain types of equipment used in tunneling operations are provided in subpart S of this part.

**1926.500(a)(2)(v)**

Requirements relating to fall protection for employees engaged in the erection of tanks and communication and broadcast towers are provided in § 1926.105.

**1926.500(a)(2)(vi)**

Requirements relating to fall protection for employees engaged in the construction of electric transmission and distribution lines and equipment are provided in subpart V of this part.

**1926.500(a)(2)(vii)**

Requirements relating to fall protection for employees working on stairways and ladders are provided in subpart X of this part.

**1926.500(a)(3)**

Section 1926.502 sets forth the requirements for the installation, construction, and proper use of fall protection required by part 1926, except as follows:

**1926.500(a)(3)(i)**

Performance requirements for guardrail systems used on scaffolds and performance requirements for falling object protection used on scaffolds are provided in subpart L of this part.

**1926.500(a)(3)(ii)**

Performance requirements for stairways, stairrail systems, and handrails are provided in subpart X of this part.

**1926.500(a)(3)(iii)**

Additional performance requirements for personal climbing equipment, lineman's body belts, safety straps, and lanyards are provided in Subpart V of this part.

### **1926.500(a)(3)(iv)**

Section 1926.502 does not apply to the erection of tanks and communication and broadcast towers. (Note: Section 1926.104 sets the criteria for body belts, lanyards and lifelines used for fall protection during tank and communication and broadcast tower erection. Paragraphs (b),(c) and (f) of § 1926.107 provide definitions for the pertinent terms.)

### **1926.500(a)(3)(v)**

Criteria for steps, handholds, ladders, and grabrails/guardrails/railings required by subpart CC are provided in subpart CC. Sections 1926.502(a), (c) through (e), and (i) apply to activities covered under subpart CC unless otherwise stated in subpart CC. No other paragraphs of § 1926.502 apply to subpart CC.

### **1926.500(a)(4)**

Section 1926.503 sets forth requirements for training in the installation and use of fall protection systems, except in relation to steel erection activities and the use of equipment covered by subpart CC.

### **1926.500(b)**

*Definitions.*

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

*Body belt (safety belt)* means a strap with means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device.

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

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

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

*Controlled access zone (CAZ)* means an area in which certain work (e.g., overhand bricklaying) may take place without the use of guardrail systems, personal fall arrest systems, or safety net systems and access to the zone is controlled.

*Dangerous equipment* means equipment (such as pickling or galvanizing tanks, degreasing units, machinery, electrical equipment, and other units) which, as a result of form or function, may be hazardous to employees who fall onto or into such equipment.

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

*Deceleration distance* means the additional vertical distance a falling employee travels, excluding



lifeline elongation and free fall distance, before stopping, from the point at which the deceleration device begins to operate. It is measured as the distance between the location of an employee's body belt or body harness attachment point at the moment of activation (at the onset of fall arrest forces) of the deceleration device during a fall, and the location of that attachment point after the 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 than the methods, materials or designs specified in the standard.

*Failure* means load refusal, breakage, or separation of component parts. Load refusal is the point where the ultimate strength is exceeded.

*Free fall* means the act of falling before a 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, and lifeline/lanyard elongation, but includes any deceleration device slide distance or self-retracting lifeline/lanyard extension before they operate and fall arrest forces occur.

*Guardrail system* means a barrier erected to prevent employees from falling to lower levels.

*Hole* means a gap or void 2 inches (5.1 cm) or more in its least dimension, in a floor, roof, or other walking/working surface.

*Infeasible* means that it is impossible to perform the construction work using a conventional fall protection system (i.e., guardrail system, safety net system, or personal fall arrest system) or that it is technologically impossible to use any one of these systems to provide fall protection.

*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.

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

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

*Low-slope roof* means a roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

*Lower levels* means those areas or surfaces to which an employee can fall. Such areas or surfaces include, but are not limited to, ground levels, floors, platforms, ramps, runways, excavations, pits, tanks, material, water, equipment, structures, or portions thereof.

*Mechanical equipment* means all motor or human propelled wheeled equipment used for roofing work, except wheelbarrows and mopcars.

*Opening* means a gap or void 30 inches (76 cm) or more high and 18 inches (48 cm) or more wide, in a wall or partition, through which employees can fall to a lower level.

*Overhand bricklaying and related work* means the process of laying bricks and masonry units such that the surface of the wall to be jointed is on the opposite side of the wall from the mason, requiring the mason to lean over the wall to complete the work. Related work includes mason tending and electrical installation incorporated into the brick wall during the overhand bricklaying process.

*Personal fall arrest system* means a system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, a body belt or body harness and may include a lanyard, deceleration device, lifeline, or suitable combinations of these. As of January 1, 1998, the use of a body belt for fall arrest is prohibited.

*Positioning device system* means a body belt or body harness system rigged to allow an employee to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning.

*Rope grab* means a deceleration device which 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/level locking, or both.

*Roof* means the exterior surface on the top of a building. This does not include floors or formwork which, because a building has not been completed, temporarily become the top surface of a building.

*Roofing work* means the hoisting, storage, application, and removal of roofing materials and equipment, including related insulation, sheet metal, and vapor barrier work, but not including the construction of the roof deck.

*Safety-monitoring system* means a safety system in which a competent person is responsible for recognizing and warning employees of fall hazards.

*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 employee movement, and which, after onset of a fall, automatically locks the drum and arrests the fall.

*Snaphook* means a connector comprised of a hook-shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released, automatically closes to retain the object. Snaphooks are generally one of two types:

#### **1926.500(b)(1)**

The locking type with a self-closing, self-locking keeper which remains closed and locked until unlocked and pressed open for connection or disconnection; or

#### **1926.500(b)(2)**

The non-locking type with a self-closing keeper which remains closed until pressed open for connection or disconnection. As of January 1, 1998, the use of a non-locking snaphook as part of personal fall arrest systems and positioning device systems is prohibited.

*Steep roof* means a roof having a slope greater than 4 in 12 (vertical to horizontal).

*Toeboard* means a low protective barrier that will prevent the fall of materials and equipment to lower levels and provide protection from falls for personnel.

*Unprotected sides and edges* means any side or edge (except at entrances to points of access) of a walking/working surface, e.g., floor, roof, ramp, or runway where there is no wall or guardrail system at least 39 inches (1.0 m) high.

*Walking/working surface* means any surface, whether horizontal or vertical on which an employee walks or works, including, but not limited to, floors, roofs, ramps, bridges, runways, formwork and concrete reinforcing steel but not including ladders, vehicles, or trailers, on which employees must be located in order to perform their job duties.

*Warning line system* means a barrier erected on a roof to warn employees that they are approaching an unprotected roof side or edge, and which designates an area in which roofing work may take place without the use of guardrail, body belt, or safety net systems to protect employees in the area.

*Work area* means that portion of a walking/working surface where job duties are being performed.

[44 FR 8577, Feb. 9, 1979; 44 FR 20940, Apr. 6, 1979, as amended at 45 FR 75625, Nov. 14, 1980; 55 FR 47687, Nov. 14, 1990; 59 FR 40730, Aug. 9, 1994; 60 FR 5131, Jan. 26, 1995; 60 FR 39254, Aug. 2, 1995; 66 FR 5265, Jan. 18, 2001; 75 FR 48133, Aug. 9, 2010]

<b>Part Number:</b>	<b>1926</b>
<b>• Part Title:</b>	<b>Safety and Health Regulations for Construction</b>
<b>• Subpart:</b>	<b>M</b>
<b>• Subpart Title:</b>	<b>Fall Protection</b>
<b>• Standard Number:</b>	<b><u>1926.501</u></b>
<b>• Title:</b>	<b>Duty to have fall protection.</b>

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### **1926.501(a)**

"General."

#### **1926.501(a)(1)**

This section sets forth requirements for employers to provide fall protection systems. All fall protection required by this section shall conform to the criteria set forth in 1926.502 of this subpart.

#### **1926.501(a)(2)**

The employer shall determine if the walking/working surfaces on which its employees are to work have the strength and structural integrity to support employees safely. Employees shall be allowed to work on those surfaces only when the surfaces have the requisite strength and structural integrity.

#### **1926.501(b)**

##### **1926.501(b)(1)**

"Unprotected sides and edges." Each employee on a walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet (1.8 m) or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems.

##### **1926.501(b)(2)**

"Leading edges."

##### **1926.501(b)(2)(i)**

Each employee who is constructing a leading edge 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems, safety net systems, or personal fall arrest systems. Exception: When the employer can demonstrate that it is infeasible or creates a greater hazard to use these systems, the employer shall develop and implement a fall protection plan which meets the requirements of paragraph (k) of 1926.502.

Note: There is a presumption that it is feasible and will not create a greater hazard to implement at least one of the above-listed fall protection systems. Accordingly, the employer has the burden of establishing that it is appropriate to implement a fall protection plan which complies with 1926.502(k) for a particular workplace situation, in lieu of implementing any of those systems.

### **1926.501(b)(2)(ii)**

Each employee on a walking/working surface 6 feet (1.8 m) or more above a lower level where leading edges are under construction, but who is not engaged in the leading edge work, shall be protected from falling by a guardrail system, safety net system, or personal fall arrest system. If a guardrail system is chosen to provide the fall protection, and a controlled access zone has already been established for leading edge work, the control line may be used in lieu of a guardrail along the edge that parallels the leading edge.

### **1926.501(b)(3)**

"Hoist areas." Each employee in a hoist area shall be protected from falling 6 feet (1.8 m) or more to lower levels by guardrail systems or personal fall arrest systems. If guardrail systems, [or chain, gate, or guardrail] or portions thereof, are removed to facilitate the hoisting operation (e.g., during landing of materials), and an employee must lean through the access opening or out over the edge of the access opening (to receive or guide equipment and materials, for example), that employee shall be protected from fall hazards by a personal fall arrest system.

### **1926.501(b)(4)**

"Holes."

#### **1926.501(b)(4)(i)**

Each employee on walking/working surfaces shall be protected from falling through holes (including skylights) more than 6 feet (1.8 m) above lower levels, by personal fall arrest systems, covers, or guardrail systems erected around such holes.

#### **1926.501(b)(4)(ii)**

Each employee on a walking/working surface shall be protected from tripping in or stepping into or through holes (including skylights) by covers.

#### **1926.501(b)(4)(iii)**

Each employee on a walking/working surface shall be protected from objects falling through holes (including skylights) by covers.

### **1926.501(b)(5)**

"Formwork and reinforcing steel." Each employee on the face of formwork or reinforcing steel shall be protected from falling 6 feet (1.8 m) or more to lower levels by personal fall arrest systems, safety net systems, or positioning device systems.

### **1926.501(b)(6)**

"Ramps, runways, and other walkways." Each employee on ramps, runways, and other walkways shall be protected from falling 6 feet (1.8 m) or more to lower levels by guardrail systems.

### **1926.501(b)(7)**

"Excavations."

**1926.501(b)(7)(i)**

Each employee at the edge of an excavation 6 feet (1.8 m) or more in depth shall be protected from falling by guardrail systems, fences, or barricades when the excavations are not readily seen because of plant growth or other visual barrier;

**1926.501(b)(7)(ii)**

Each employee at the edge of a well, pit, shaft, and similar excavation 6 feet (1.8 m) or more in depth shall be protected from falling by guardrail systems, fences, barricades, or covers.

**1926.501(b)(8)**

"Dangerous equipment."

**1926.501(b)(8)(i)**

Each employee less than 6 feet (1.8 m) above dangerous equipment shall be protected from falling into or onto the dangerous equipment by guardrail systems or by equipment guards.

**1926.501(b)(8)(ii)**

Each employee 6 feet (1.8 m) or more above dangerous equipment shall be protected from fall hazards by guardrail systems, personal fall arrest systems, or safety net systems.

**1926.501(b)(9)**

"Overhand bricklaying and related work."

**1926.501(b)(9)(i)**

Except as otherwise provided in paragraph (b) of this section, each employee performing overhand bricklaying and related work 6 feet (1.8 m) or more above lower levels, shall be protected from falling by guardrail systems, safety net systems, personal fall arrest systems, or shall work in a controlled access zone.

**1926.501(b)(9)(ii)**

Each employee reaching more than 10 inches (25 cm) below the level of the walking/working surface on which they are working, shall be protected from falling by a guardrail system, safety net system, or personal fall arrest system.

Note: Bricklaying operations performed on scaffolds are regulated by subpart L - Scaffolds of this part.

**1926.501(b)(10)**

"Roofing work on Low-slope roofs." Except as otherwise provided in paragraph (b) of this section, each employee engaged in roofing activities on low-slope roofs, with unprotected sides and edges 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems, safety net systems, personal fall arrest systems, or a combination of warning line system and guardrail system, warning line system and safety net system, or warning line system and personal fall arrest system, or warning line system and safety monitoring system. Or, on roofs 50-feet (15.25 m) or less in width (see Appendix A to subpart M of this part), the use of a safety monitoring system alone [i.e. without the warning line system] is permitted.

#### **1926.501(b)(11)**

"Steep roofs." Each employee on a steep roof with unprotected sides and edges 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems with toeboards, safety net systems, or personal fall arrest systems.

#### **1926.501(b)(12)**

"Precast concrete erection." Each employee engaged in the erection of precast concrete members (including, but not limited to the erection of wall panels, columns, beams, and floor and roof "tees") and related operations such as grouting of precast concrete members, who is 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems, safety net systems, or personal fall arrest systems, unless another provision in paragraph (b) of this section provides for an alternative fall protection measure. Exception: When the employer can demonstrate that it is infeasible or creates a greater hazard to use these systems, the employer shall develop and implement a fall protection plan which meets the requirements of paragraph (k) of 1926.502.

Note: There is a presumption that it is feasible and will not create a greater hazard to implement at least one of the above-listed fall protection systems. Accordingly, the employer has the burden of establishing that it is appropriate to implement a fall protection plan which complies with 1926.502(k) for a particular workplace situation, in lieu of implementing any of those systems.

#### **1926.501(b)(13)**

"Residential construction." Each employee engaged in residential construction activities 6 feet (1.8 m) or more above lower levels shall be protected by guardrail systems, safety net system, or personal fall arrest system unless another provision in paragraph (b) of this section provides for an alternative fall protection measure. Exception: When the employer can demonstrate that it is infeasible or creates a greater hazard to use these systems, the employer shall develop and implement a fall protection plan which meets the requirements of paragraph (k) of 1926.502.

Note: There is a presumption that it is feasible and will not create a greater hazard to implement at least one of the above-listed fall protection systems. Accordingly, the employer has the burden of establishing that it is appropriate to implement a fall protection plan which complies with 1926.502(k) for a particular workplace situation, in lieu of implementing any of those systems.

#### **1926.501(b)(14)**

"Wall openings." Each employee working on, at, above, or near wall openings (including those with chutes attached) where the outside bottom edge of the wall opening is 6 feet (1.8 m) or more above lower levels and the inside bottom edge of the wall opening is less than 39 inches (1.0 m) above the walking/working surface, shall be protected from falling by the use of a guardrail system, a safety net system, or a personal fall arrest system.

#### **1926.501(b)(15)**

"Walking/working surfaces not otherwise addressed." Except as provided in 1926.500(a)(2) or in 1926.501 (b)(1) through (b)(14), each employee on a walking/working surface 6 feet (1.8 m) or more above lower levels shall be protected from falling by a guardrail system, safety net system, or personal fall arrest system.

**1926.501(c)**

"Protection from falling objects." When an employee is exposed to falling objects, the employer shall have each employee wear a hard hat and shall implement one of the following measures:

**1926.501(c)(1)**

Erect toeboards, screens, or guardrail systems to prevent objects from falling from higher levels; or,

**1926.501(c)(2)**

Erect a canopy structure and keep potential fall objects far enough from the edge of the higher level so that those objects would not go over the edge if they were accidentally displaced; or,

**1926.501(c)(3)**

Barricade the area to which objects could fall, prohibit employees from entering the barricaded area, and keep objects that may fall far enough away from the edge of a higher level so that those objects would not go over the edge if they were accidentally displaced.

[59 FR 40732, Aug. 9, 1994; 60 FR 5131, Jan. 26, 1995]



<b>Part Number:</b>	<b>1926</b>
• <b>Part Title:</b>	<b>Safety and Health Regulations for Construction</b>
• <b>Subpart:</b>	<b>M</b>
• <b>Subpart Title:</b>	<b>Fall Protection</b>
• <b>Standard Number:</b>	<b><u>1926.502</u></b>
• <b>Title:</b>	<b>Fall protection systems criteria and practices.</b>

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#### **1926.502(a)**

"General."

#### **1926.502(a)(1)**

Fall protection systems required by this part shall comply with the applicable provisions of this section.

#### **1926.502(a)(2)**

Employers shall provide and install all fall protection systems required by this subpart for an employee, and shall comply with all other pertinent requirements of this subpart before that employee begins the work that necessitates the fall protection.

#### **1926.502(b)**

"Guardrail systems." Guardrail systems and their use shall comply with the following provisions:

#### **1926.502(b)(1)**

Top edge height of top rails, or equivalent guardrail system members, shall be 42 inches (1.1 m) plus or minus 3 inches (8 cm) above the walking/working level. When conditions warrant, the height of the top edge may exceed the 45-inch height, provided the guardrail system meets all other criteria of this paragraph.

Note: When employees are using stilts, the top edge height of the top rail, or equivalent member, shall be increased an amount equal to the height of the stilts.

#### **1926.502(b)(2)**

Midrails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members shall be installed between the top edge of the guardrail system and the walking/working surface when there is no wall or parapet wall at least 21 inches (53 cm) high.

#### **1926.502(b)(2)(i)**

Midrails, when used, shall be installed at a height midway between the top edge of the guardrail system and the walking/working level.

#### **1926.502(b)(2)(ii)**

Screens and mesh, when used, shall extend from the top rail to the walking/working level and along the entire opening between top rail supports.

**1926.502(b)(2)(iii)**

Intermediate members (such as balusters), when used between posts, shall be not more than 19 inches (48 cm) apart.

**1926.502(b)(2)(iv)**

Other structural members (such as additional midrails and architectural panels) shall be installed such that there are no openings in the guardrail system that are more than 19 inches (.5 m) wide.

**1926.502(b)(3)**

Guardrail systems shall be capable of withstanding, without failure, a force of at least 200 pounds (890 N) applied within 2 inches (5.1 cm) of the top edge, in any outward or downward direction, at any point along the top edge.

**1926.502(b)(4)**

When the 200 pound (890 N) test load specified in paragraph (b)(3) of this section is applied in a downward direction, the top edge of the guardrail shall not deflect to a height less than 39 inches (1.0 m) above the walking/working level. Guardrail system components selected and constructed in accordance with the Appendix B to subpart M of this part will be deemed to meet this requirement.

**1926.502(b)(5)**

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 pounds (666 N) applied in any downward or outward direction at any point along the midrail or other member.

**1926.502(b)(6)**

Guardrail systems shall be so surfaced as to prevent injury to an employee from punctures or lacerations, and to prevent snagging of clothing.

**1926.502(b)(7)**

The ends of all top rails and midrails shall not overhang the terminal posts, except where such overhang does not constitute a projection hazard.

**1926.502(b)(8)**

Steel banding and plastic banding shall not be used as top rails or midrails.

**1926.502(b)(9)**

Top rails and midrails shall be at least one-quarter inch (0.6 cm) nominal diameter or thickness to prevent cuts and lacerations. If wire rope is used for top rails, it shall be flagged at not more than 6-foot intervals with high-visibility material.

**1926.502(b)(10)**

When guardrail systems are used at hoisting areas, a chain, gate or removable guardrail section shall be placed across the access opening between guardrail sections when hoisting operations are not taking place.

**1926.502(b)(11)**

When guardrail systems are used at holes, they shall be erected on all unprotected sides or edges of the hole.

**1926.502(b)(12)**

When guardrail systems are used around holes used for the passage of materials, the hole shall have not more than two sides provided with removable guardrail sections to allow the passage of materials. When the hole is not in use, it shall be closed over with a cover, or a guardrail system shall be provided along all unprotected sides or edges.

**1926.502(b)(13)**

When guardrail systems are used around holes which are used as points of access (such as ladderways), they shall be provided with a gate, or be so offset that a person cannot walk directly into the hole.

**1926.502(b)(14)**

Guardrail systems used on ramps and runways shall be erected along each unprotected side or edge.

**1926.502(b)(15)**

Manila, plastic or synthetic rope being used for top rails or midrails shall be inspected as frequently as necessary to ensure that it continues to meet the strength requirements of paragraph (b)(3) of this section.

**1926.502(c)**

"Safety net systems." Safety net systems and their use shall comply with the following provisions:

**1926.502(c)(1)**

Safety nets shall be installed as close as practicable under the walking/working surface on which employees are working, but in no case more than 30 feet (9.1 m) below such level. When nets are used on bridges, the potential fall area from the walking/working surface to the net shall be unobstructed.

**1926.502(c)(2)**

Safety nets shall extend outward from the outermost projection of the work surface as follows:

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Vertical distance from working level to horizontal plane of net		Minimum required horizontal distance of outer edge of net from the edge of the working surface
<hr/>		
Up to 5 feet .....		8 feet.
More than 5 feet up to 10 feet .....		10 feet.
More than 10 feet .....		13 feet.

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**1926.502(c)(3)**

Safety nets shall be installed with sufficient clearance under them to prevent contact with the surface or structures below when subjected to an impact force equal to the drop test specified in paragraph (c)(4) of this section.

**1926.502(c)(4)**

Safety nets and their installations shall be capable of absorbing an impact force equal to that produced by the drop test specified in paragraph (c)(4)(i) of this section.

**1926.502(c)(4)(i)**

Except as provided in paragraph (c)(4)(ii) of this section, safety nets and safety net installations shall be drop-tested at the jobsite after initial installation and before being used as a fall protection system, whenever relocated, after major repair, and at 6-month intervals if left in one place. The drop-test shall consist of a 400 pound (180 kg) bag of sand 30 + or - 2 inches (76 + or - 5 cm) in diameter dropped into the net from the highest walking/working surface at which employees are exposed to fall hazards, but not from less than 42 inches (1.1 m) above that level.

#### **1926.502(c)(4)(ii)**

When the employer can demonstrate that it is unreasonable to perform the drop-test required by paragraph (c)(4)(i) of this section, the employer (or a designated competent person) shall certify that the net and net installation is in compliance with the provisions of paragraphs (c)(3) and (c)(4)(i) of this section by preparing a certification record prior to the net being used as a fall protection system. The certification record must include an identification of the net and net installation for which the certification record is being prepared; the date that it was determined that the identified net and net installation were in compliance with paragraph (c)(3) of this section and the signature of the person making the determination and certification. The most recent certification record for each net and net installation shall be available at the jobsite for inspection.

#### **1926.502(c)(5)**

Defective nets shall not be used. Safety nets shall be inspected at least once a week for wear, damage, and other deterioration. Defective components shall be removed from service. Safety nets shall also be inspected after any occurrence which could affect the integrity of the safety net system.

#### **1926.502(c)(6)**

Materials, scrap pieces, equipment, and tools which have fallen into the safety net shall be removed as soon as possible from the net and at least before the next work shift.

#### **1926.502(c)(7)**

The maximum size of each safety net mesh opening shall not exceed 36 square inches (230 cm) nor be longer than 6 inches (15 cm) on any side, and the opening, measured center-to-center of mesh ropes or webbing, shall not be longer than 6 inches (15 cm). All mesh crossings shall be secured to prevent enlargement of the mesh opening.

#### **1926.502(c)(8)**

Each safety net (or section of it) shall have a border rope for webbing with a minimum breaking strength of 5,000 pounds (22.2 kN).

#### **1926.502(c)(9)**

Connections between safety net panels shall be as strong as integral net components and shall be spaced not more than 6 inches (15 cm) apart.

#### **1926.502(d)**

"Personal fall arrest systems." Personal fall arrest systems and their use shall comply with the provisions set forth below. Effective January 1, 1998, body belts are not acceptable as part of a personal fall arrest system. Note: The use of a body belt in a positioning device system is acceptable and is regulated under paragraph (e) of this section.

#### **1926.502(d)(1)**

Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials.

**1926.502(d)(2)**

Connectors shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of the system.

**1926.502(d)(3)**

Dee-rings and snaphooks shall have a minimum tensile strength of 5,000 pounds (22.2 kN).

**1926.502(d)(4)**

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

**1926.502(d)(5)**

Snaphooks shall be sized to be compatible with the member to which they are connected to prevent unintentional disengagement of the snaphook by depression of the snaphook keeper by the connected member, or shall be a locking type snaphook designed and used to prevent disengagement of the snaphook by the contact of the snaphook keeper by the connected member. Effective January 1, 1998, only locking type snaphooks shall be used.

**1926.502(d)(6)**

Unless the snaphook is a locking type and designed for the following connections, snaphooks shall not be engaged:

**1926.502(d)(6)(i)**

directly to webbing, rope or wire rope;

**1926.502(d)(6)(ii)**

to each other;

**1926.502(d)(6)(iii)**

to a dee-ring to which another snaphook or other connector is attached;

**1926.502(d)(6)(iv)**

to a horizontal lifeline; or

**1926.502(d)(6)(v)**

to any object which is incompatibly shaped or dimensioned in relation to the snaphook such that unintentional disengagement could occur by the connected object being able to depress the snaphook keeper and release itself.

**1926.502(d)(7)**

On suspended scaffolds or similar work platforms with horizontal lifelines which may become vertical lifelines, the devices used to connect to a horizontal lifeline shall be capable of locking in both directions on the lifeline.

#### **1926.502(d)(8)**

Horizontal lifelines shall be designed, installed, and used, under the supervision of a qualified person, as part of a complete personal fall arrest system, which maintains a safety factor of at least two.

#### **1926.502(d)(9)**

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

#### **1926.502(d)(10) 1926.502(d)(10)(i)**

Except as provided in paragraph (d)(10)(ii) of this section, when vertical lifelines are used, each employee shall be attached to a separate lifeline.

#### **1926.502(d)(10)(ii)**

During the construction of elevator shafts, two employees may be attached to the same lifeline in the hoistway, provided both employees are working atop a false car that is equipped with guardrails; the strength of the lifeline is 10,000 pounds [5,000 pounds per employee attached] (44.4 kN); and all other criteria specified in this paragraph for lifelines have been met.

#### **1926.502(d)(11)**

Lifelines shall be protected against being cut or abraded.

#### **1926.502(d)(12)**

Self-retracting lifelines and lanyards which automatically limit free fall distance to 2 feet (0.61 m) or less shall be 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.

#### **1926.502(d)(13)**

Self-retracting lifelines and lanyards which do not limit free fall distance to 2 feet (0.61 m) or less, ripstitch lanyards, and tearing and deforming lanyards shall 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.

#### **1926.502(d)(14)**

Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses shall be made from synthetic fibers.

#### **1926.502(d)(15)**

Anchorage used for attachment of personal fall arrest equipment shall be independent of any anchorage being used to support or suspend platforms and capable of supporting at least 5,000 pounds (22.2 kN) per employee attached, or shall be designed, installed, and used as follows:

**1926.502(d)(15)(i)**

as part of a complete personal fall arrest system which maintains a safety factor of at least two; and

**1926.502(d)(15)(ii)**

under the supervision of a qualified person.

**1926.502(d)(16)**

Personal fall arrest systems, when stopping a fall, shall:

**1926.502(d)(16)(i)**

limit maximum arresting force on an employee to 900 pounds (4 kN) when used with a body belt;

**1926.502(d)(16)(ii)**

limit maximum arresting force on an employee to 1,800 pounds (8 kN) when used with a body harness;

**1926.502(d)(16)(iii)**

be rigged such that an employee can neither free fall more than 6 feet (1.8 m), nor contact any lower level;

**1926.502(d)(16)(iv)**

bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet (1.07 m); and,

**1926.502(d)(16)(v)**

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: If the personal fall arrest system meets the criteria and protocols contained in Appendix C to subpart M, and if the system is being used by an employee having a combined person and tool weight of less than 310 pounds (140 kg), the system will be considered to be in compliance with the provisions of paragraph (d)(16) 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 paragraph (d)(16) of this section.

**1926.502(d)(17)**

The attachment point of the body belt shall be located in the center of the wearer's back. The attachment point of the body harness shall be located in the center of the wearer's back near shoulder level, or above the wearer's head.

**1926.502(d)(18)**

Body belts, harnesses, and components shall be used only for employee protection (as part of a personal fall arrest system or positioning device system) and not to hoist materials.



**1926.502(d)(19)**

Personal fall arrest systems and components subjected to impact loading shall be immediately removed from service and shall not be used again for employee protection until inspected and determined by a competent person to be undamaged and suitable for reuse.

**1926.502(d)(20)**

The employer shall provide for prompt rescue of employees in the event of a fall or shall assure that employees are able to rescue themselves.

**1926.502(d)(21)**

Personal fall arrest systems shall be inspected prior to each use for wear, damage and other deterioration, and defective components shall be removed from service.

**1926.502(d)(22)**

Body belts shall be at least one and five-eighths (1 5/8) inches (4.1 cm) wide.

**1926.502(d)(23)**

Personal fall arrest systems shall not be attached to guardrail systems, nor shall they be attached to hoists except as specified in other subparts of this Part.

**1926.502(d)(24)**

When a personal fall arrest system is used at hoist areas, it shall be rigged to allow the movement of the employee only as far as the edge of the walking/working surface.

**1926.502(e)**

"Positioning device systems." Positioning device systems and their use shall conform to the following provisions:

**1926.502(e)(1)**

Positioning devices shall be rigged such that an employee cannot free fall more than 2 feet (.6m).

**1926.502(e)(2)**

Positioning devices shall be secured to an anchorage capable of supporting at least twice the potential impact load of an employee's fall or 3,000 pounds (13.3 kN), whichever is greater.

**1926.502(e)(3)**

Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials.

**1926.502(e)(4)**

Connectors shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of this system.

**1926.502(e)(5)**

Connecting assemblies shall have a minimum tensile strength of 5,000 pounds (22.2 kN)

**1926.502(e)(6)**

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

**1926.502(e)(7)**

Snaphooks shall be sized to be compatible with the member to which they are connected to prevent unintentional disengagement of the snaphook by depression of the snaphook keeper by the connected member, or shall be a locking type snaphook designed and used to prevent disengagement of the snaphook by the contact of the snaphook keeper by the connected member. As of January 1, 1998, only locking type snaphooks shall be used.

**1926.502(e)(8)**

Unless the snaphook is a locking type and designed for the following connections, snaphooks shall not be engaged:

**1926.502(e)(8)(i)**

directly to webbing, rope or wire rope;

**1926.502(e)(8)(ii)**

to each other;

**1926.502(e)(8)(iii)**

to a dee-ring to which another snaphook or other connector is attached;

**1926.502(e)(8)(iv)**

to a horizontal lifeline; or

**1926.502(e)(8)(v)**

to any object which is incompatibly shaped or dimensioned in relation to the snaphook such that unintentional disengagement could occur by the connected object being able to depress the snaphook keeper and release itself.

**1926.502(e)(9)**

Positioning device systems shall be inspected prior to each use for wear, damage, and other deterioration, and defective components shall be removed from service.

**1926.502(e)(10)**

Body belts, harnesses, and components shall be used only for employee protection (as part of a personal fall arrest system or positioning device system) and not to hoist materials.

## **1926.502(f)**

"Warning line systems." Warning line systems [See 1926.501(b)(10)] and their use shall comply with the following provisions:

### **1926.502(f)(1)**

The warning line shall be erected around all sides of the roof work area.

#### **1926.502(f)(1)(i)**

When mechanical equipment is not being used, the warning line shall be erected not less than 6 feet (1.8 m) from the roof edge.

#### **1926.502(f)(1)(ii)**

When mechanical equipment is being used, the warning line shall be erected not less than 6 feet (1.8 m) from the roof edge which is parallel to the direction of mechanical equipment operation, and not less than 10 feet (3.1 m) from the roof edge which is perpendicular to the direction of mechanical equipment operation.

#### **1926.502(f)(1)(iii)**

Points of access, materials handling areas, storage areas, and hoisting areas shall be connected to the work area by an access path formed by two warning lines.

#### **1926.502(f)(1)(iv)**

When the path to a point of access is not in use, a rope, wire, chain, or other barricade, equivalent in strength and height to the warning line, shall be placed across the path at the point where the path intersects the warning line erected around the work area, or the path shall be offset such that a person cannot walk directly into the work area.

## **1926.502(f)(2)**

Warning lines shall consist of ropes, wires, or chains, and supporting stanchions erected as follows:

### **1926.502(f)(2)(i)**

The rope, wire, or chain shall be flagged at not more than 6-foot (1.8 m) intervals with high-visibility material;

### **1926.502(f)(2)(ii)**

The rope, wire, or chain shall be rigged and supported in such a way that its lowest point (including sag) is no less than 34 inches (.9 m) from the walking/working surface and its highest point is no more than 39 inches (1.0 m) from the walking/working surface;

**1926.502(f)(2)(iii)**

After being erected, with the rope, wire, or chain attached, stanchions shall be capable of resisting, without tipping over, a force of at least 16 pounds (71 N) applied horizontally against the stanchion, 30 inches (.8 m) above the walking/working surface, perpendicular to the warning line, and in the direction of the floor, roof, or platform edge;

**1926.502(f)(2)(iv)**

The rope, wire, or chain shall have a minimum tensile strength of 500 pounds (2.22 kN), and after being attached to the stanchions, shall be capable of supporting, without breaking, the loads applied to the stanchions as prescribed in paragraph (f)(2)(iii) of this section; and

**1926.502(f)(2)(v)**

The line shall be attached at each stanchion in such a way that pulling on one section of the line between stanchions will not result in slack being taken up in adjacent sections before the stanchion tips over.

**1926.502(f)(3)**

No employee shall be allowed in the area between a roof edge and a warning line unless the employee is performing roofing work in that area.

**1926.502(f)(4)**

Mechanical equipment on roofs shall be used or stored only in areas where employees are protected by a warning line system, guardrail system, or personal fall arrest system.

**1926.502(g)**

"Controlled access zones." Controlled access zones [See 1926.501(b)(9) and 1926.502(k)] and their use shall conform to the following provisions.

**1926.502(g)(1)**

When used to control access to areas where leading edge and other operations are taking place the controlled access zone shall be defined by a control line or by any other means that restricts access.

**1926.502(g)(1)(i)**

When control lines are used, they shall be erected not less than 6 feet (1.8 m) nor more than 25 feet (7.7 m) from the unprotected or leading edge, except when erecting precast concrete members.

**1926.502(g)(1)(ii)**

When erecting precast concrete members, the control line shall be erected not less than 6 feet (1.8 m) nor more than 60 feet (18 m) or half the length of the member being erected, whichever is less, from the leading edge.

**1926.502(g)(1)(iii)**

The control line shall extend along the entire length of the unprotected or leading edge and shall be approximately parallel to the unprotected or leading edge.

**1926.502(g)(1)(iv)**

The control line shall be connected on each side to a guardrail system or wall.

**1926.502(g)(2)**

When used to control access to areas where overhand bricklaying and related work are taking place:

**1926.502(g)(2)(i)**

The controlled access zone shall be defined by a control line erected not less than 10 feet (3.1 m) nor more than 15 feet (4.5 m) from the working edge.

**1926.502(g)(2)(ii)**

The control line shall extend for a distance sufficient for the controlled access zone to enclose all employees performing overhand bricklaying and related work at the working edge and shall be approximately parallel to the working edge.

**1926.502(g)(2)(iii)**

Additional control lines shall be erected at each end to enclose the controlled access zone.

**1926.502(g)(2)(iv)**

Only employees engaged in overhand bricklaying or related work shall be permitted in the controlled access zone.

**1926.502(g)(3)**

Control lines shall consist of ropes, wires, tapes, or equivalent materials, and supporting stanchions as follows:

**1926.502(g)(3)(i)**

Each line shall be flagged or otherwise clearly marked at not more than 6-foot (1.8 m) intervals with high-visibility material.

**1926.502(g)(3)(ii)**

Each line shall be rigged and supported in such a way that its lowest point (including sag) is not less than 39 inches (1 m) from the walking/working surface and its highest point is not more than 45 inches (1.3 m) [50 inches (1.3 m) when overhand bricklaying operations are being performed] from the walking/working surface.

**1926.502(g)(3)(iii)**

Each line shall have a minimum breaking strength of 200 pounds (.88 kN).

**1926.502(g)(4)**

On floors and roofs where guardrail systems are not in place prior to the beginning of overhand bricklaying operations, controlled access zones shall be enlarged, as necessary, to enclose all points of access, material handling areas, and storage areas.

### **1926.502(g)(5)**

On floors and roofs where guardrail systems are in place, but need to be removed to allow overhead bricklaying work or leading edge work to take place, only that portion of the guardrail necessary to accomplish that day's work shall be removed.

### **1926.502(h)**

"Safety monitoring systems." Safety monitoring systems [See 1926.501(b)(10) and 1926.502(k)] and their use shall comply with the following provisions:

#### **1926.502(h)(1)**

The employer shall designate a competent person to monitor the safety of other employees and the employer shall ensure that the safety monitor complies with the following requirements:

##### **1926.502(h)(1)(i)**

The safety monitor shall be competent to recognize fall hazards;

##### **1926.502(h)(1)(ii)**

The safety monitor shall warn the employee when it appears that the employee is unaware of a fall hazard or is acting in an unsafe manner;

##### **1926.502(h)(1)(iii)**

The safety monitor shall be on the same walking/working surface and within visual sighting distance of the employee being monitored;

##### **1926.502(h)(1)(iv)**

The safety monitor shall be close enough to communicate orally with the employee; and

##### **1926.502(h)(1)(v)**

The safety monitor shall not have other responsibilities which could take the monitor's attention from the monitoring function.

#### **1926.502(h)(2)**

Mechanical equipment shall not be used or stored in areas where safety monitoring systems are being used to monitor employees engaged in roofing operations on low-slope roofs.

#### **1926.502(h)(3)**

No employee, other than an employee engaged in roofing work [on low-sloped roofs] or an employee covered by a fall protection plan, shall be allowed in an area where an employee is being protected by a safety monitoring system.

#### **1926.502(h)(4)**

Each employee working in a controlled access zone shall be directed to comply promptly with fall hazard warnings from safety monitors.

### **1926.502(i)**

"Covers." Covers for holes in floors, roofs, and other walking/working surfaces shall meet the following requirements:

#### **1926.502(i)(1)**

Covers located in roadways and vehicular aisles shall be capable of supporting, without failure, at least twice the maximum axle load of the largest vehicle expected to cross over the cover.

#### **1926.502(i)(2)**

All other covers shall be capable of supporting, without failure, at least twice the weight of employees, equipment, and materials that may be imposed on the cover at any one time.

#### **1926.502(i)(3)**

All covers shall be secured when installed so as to prevent accidental displacement by the wind, equipment, or employees.

#### **1926.502(i)(4)**

All covers shall be color coded or they shall be marked with the word "HOLE" or "COVER" to provide warning of the hazard.

Note: This provision does not apply to cast iron manhole covers or steel grates used on streets or roadways.

### **1926.502(j)**

"Protection from falling objects." Falling object protection shall comply with the following provisions:

#### **1926.502(j)(1)**

Toeboards, when used as falling object protection, shall be erected along the edge of the overhead walking/working surface for a distance sufficient to protect employees below.

#### **1926.502(j)(2)**

Toeboards shall be capable of withstanding, without failure, a force of at least 50 pounds (222 N) applied in any downward or outward direction at any point along the toeboard.

#### **1926.502(j)(3)**

Toeboards shall be a minimum of 3 1/2 inches (9 cm) in vertical height from their top edge to the level of the walking/working surface. They shall have not more than 1/4 inch (0.6 cm) clearance above the walking/working surface. They shall be solid or have openings not over 1 inch (2.5 cm) in greatest dimension.

#### **1926.502(j)(4)**

Where tools, equipment, or materials are piled higher than the top edge of a toeboard, paneling or screening shall be erected from the walking/working surface or toeboard to the top of a guardrail system's top rail or midrail, for a distance sufficient to protect employees below.

#### **1926.502(j)(5)**

Guardrail systems, when used as falling object protection, shall have all openings small enough to prevent passage of potential falling objects.

#### **1926.502(j)(6)**

During the performance of overhand bricklaying and related work:

##### **1926.502(j)(6)(i)**

No materials or equipment except masonry and mortar shall be stored within 4 feet (1.2 m) of the working edge.

##### **1926.502(j)(6)(ii)**

Excess mortar, broken or scattered masonry units, and all other materials and debris shall be kept clear from the work area by removal at regular intervals.

#### **1926.502(j)(7)**

During the performance of roofing work:

##### **1926.502(j)(7)(i)**

Materials and equipment shall not be stored within 6 feet (1.8 m) of a roof edge unless guardrails are erected at the edge.

##### **1926.502(j)(7)(ii)**

Materials which are piled, grouped, or stacked near a roof edge shall be stable and self-supporting.

#### **1926.502(j)(8)**

Canopies, when used as falling object protection, shall be strong enough to prevent collapse and to prevent penetration by any objects which may fall onto the canopy.

#### **1926.502(k)**

"Fall protection plan." This option is available only to employees engaged in leading edge work, precast concrete erection work, or residential construction work (See 1926.501(b)(2), (b)(12), and (b)(13)) who can demonstrate that it is infeasible or it creates a greater hazard to use conventional fall protection equipment. The fall protection plan must conform to the following provisions.



**1926.502(k)(1)**

The fall protection plan shall be prepared by a qualified person and developed specifically for the site where the leading edge work, precast concrete work, or residential construction work is being performed and the plan must be maintained up to date.

**1926.502(k)(2)**

Any changes to the fall protection plan shall be approved by a qualified person.

**1926.502(k)(3)**

A copy of the fall protection plan with all approved changes shall be maintained at the job site.

**1926.502(k)(4)**

The implementation of the fall protection plan shall be under the supervision of a competent person.

**1926.502(k)(5)**

The fall protection plan shall document the reasons why the use of conventional fall protection systems (guardrail systems, personal fall arrest systems, or safety nets systems) are infeasible or why their use would create a greater hazard.

**1926.502(k)(6)**

The fall protection plan shall include a written discussion of other measures that will be taken to reduce or eliminate the fall hazard for workers who cannot be provided with protection from the conventional fall protection systems. For example, the employer shall discuss the extent to which scaffolds, ladders, or vehicle mounted work platforms can be used to provide a safer working surface and thereby reduce the hazard of falling.

**1926.502(k)(7)**

The fall protection plan shall identify each location where conventional fall protection methods cannot be used. These locations shall then be classified as controlled access zones and the employer must comply with the criteria in paragraph (g) of this section.

**1926.502(k)(8)**

Where no other alternative measure has been implemented, the employer shall implement a safety monitoring system in conformance with 1926.502(h).

**1926.502(k)(9)**

The fall protection plan must include a statement which provides the name or other method of identification for each employee who is designated to work in controlled access zones. No other employees may enter controlled access zones.

**1926.502(k)(10)**

In the event an employee falls, or some other related, serious incident occurs, (e.g., a near miss) the employer shall investigate the circumstances of the fall or other incident to determine if the fall protection plan needs to be changed (e.g. new practices, procedures, or training) and shall implement those changes to prevent similar types of falls or incidents.

[44 FR 8577, Feb. 9, 1979; 44 FR 20940, Apr. 6, 1979, as amended at 45 FR 75626, Nov. 14, 1980; 55 FR 47687, Nov. 14, 1990; 59 FR 40733, Aug. 9, 1994; 60 FR 5131, Jan. 26, 1995]

<b>Part Number:</b>	<b>1926</b>
• <b>Part Title:</b>	<b>Safety and Health Regulations for Construction</b>
• <b>Subpart:</b>	<b>M</b>
• <b>Subpart Title:</b>	<b>Fall Protection</b>
• <b>Standard Number:</b>	<b><u>1926.503</u></b>
• <b>Title:</b>	<b>Training requirements.</b>

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The following training provisions supplement and clarify the requirements of 1926.21 regarding the hazards addressed in subpart M of this part.

**1926.503(a)**

"Training Program."

**1926.503(a)(1)**

The employer shall provide a training program for each employee who might be exposed to fall hazards. The program shall enable each employee to recognize the hazards of falling and shall train each employee in the procedures to be followed in order to minimize these hazards.

**1926.503(a)(2)**

The employer shall assure that each employee has been trained, as necessary, by a competent person qualified in the following areas:

**1926.503(a)(2)(i)**

The nature of fall hazards in the work area;

**1926.503(a)(2)(ii)**

The correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection systems to be used;

**1926.503(a)(2)(iii)**

The use and operation of guardrail systems, personal fall arrest systems, safety net systems, warning line systems, safety monitoring systems, controlled access zones, and other protection to be used;

**1926.503(a)(2)(iv)**

The role of each employee in the safety monitoring system when this system is used;

**1926.503(a)(2)(v)**

The limitations on the use of mechanical equipment during the performance of roofing work on low-sloped roofs;

**1926.503(a)(2)(vi)**

The correct procedures for the handling and storage of equipment and materials and the erection of overhead protection; and

**1926.503(a)(2)(vii)**

The role of employees in fall protection plans;

**1926.503(a)(2)(viii)**

The standards contained in this subpart.

**1926.503(b)**

"Certification of training."

**1926.503(b)(1)**

The employer shall verify compliance with paragraph (a) of this section by preparing a written certification record. The written certification record shall contain the name or other identity of the employee trained, the date(s) of the training, and the signature of the person who conducted the training or the signature of the employer. If the employer relies on training conducted by another employer or completed prior to the effective date of this section, the certification record shall indicate the date the employer determined the prior training was adequate rather than the date of actual training.

**1926.503(b)(2)**

The latest training certification shall be maintained.

**1926.503(c)**

"Retraining." When the employer has reason to believe that any affected employee who has already been trained does not have the understanding and skill required by paragraph (a) of this section, the employer shall retrain each such employee. Circumstances where retraining is required include, but are not limited to, situations where:

**1926.503(c)(1)**

Changes in the workplace render previous training obsolete; or

**1926.503(c)(2)**

Changes in the types of fall protection systems or equipment to be used render previous training obsolete; or

**1926.503(c)(3)**

Inadequacies in an affected employee's knowledge or use of fall protection systems or equipment indicate that the employee has not retained the requisite understanding or skill.

Note: The following appendices to subpart M of this part serve as non-mandatory guidelines to assist employers in complying with the appropriate requirements of subpart M of this part.

[59 FR 40738, Aug. 9, 1994; 60 FR 5131, Jan. 26, 1995]

<b>Part Number:</b>	<b>1926</b>
<b>• Part Title:</b>	<b>Safety and Health Regulations for Construction</b>
<b>• Subpart:</b>	<b>M</b>
<b>• Subpart Title:</b>	<b>Fall Protection</b>
<b>• Standard Number:</b>	<b>1926 Subpart M App A</b>
<b>• Title:</b>	<b>Determining Roof Widths - Non-mandatory Guidelines for Complying with 1926.501(b)(10)</b>

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(1) This Appendix serves as a guideline to assist employers complying with the requirements of 1926.501(b)(10). Section 1910.501(b)(10) allows the use of a safety monitoring system alone as a means of providing fall protection during the performance of roofing operations on low-sloped roofs 50 feet (15.25 m) or less in width. Each example in the appendix shows a roof plan or plans and indicates where each roof or roof area is to be measured to determine its width. Section views or elevation views are shown where appropriate. Some examples show "correct" and "incorrect" subdivisions of irregularly shaped roofs divided into smaller, regularly shaped areas. In all examples, the dimension selected to be the width of an area is the lesser of the two primary dimensions of the area, as viewed from above. Example A shows that on a simple rectangular roof, width is the lesser of the two primary overall dimensions. This is also the case with roofs which are sloped toward or away from the roof center, as shown in Example B.

(2) Many roofs are not simple rectangles. Such roofs may be broken down into subareas as shown in Example C. The process of dividing a roof area can produce many different configurations. Example C gives the general rule of using dividing lines of minimum length to minimize the size and number of the areas which are potentially less than 50 feet (15.25 m) wide. The intent is to minimize the number of roof areas where safety monitoring systems alone are sufficient protection.

(3) Roofs which are comprised of several separate, non-contiguous roof areas, as in Example D, may be considered as a series of individual roofs. Some roofs have penthouses, additional floors, courtyard openings, or similar architectural features; Example E shows how the rule for dividing roofs into subareas is applied to such configurations. Irregular, non-rectangular roofs must be considered on an individual basis, as shown in Example F.

Example A

Rectangular Shaped Roofs

(For Example A, [Click Here](#))

Example B

Sloped Rectangular Shaped Roofs

(For Example B, [Click Here](#))

Example C

Irregularly Shaped Roofs With Rectangular Shaped Sections

Such roofs are to be divided into sub-areas by using dividing lines of minimum length to minimize the size and

number of the areas which are potentially less than or equal to 50 feet (15.25 meters) in width, in order to limit the size of roof areas where the safety monitoring system alone can be used [1926.502(b)(10)]. Dotted lines are used in the examples to show the location of dividing lines. W denotes incorrect measurements of width.

(For Example C, [Click Here](#))

Example D

Separate, Non-Contiguous Roof Areas

(For Example D, [Click Here](#))

Example E

Roofs With Penthouses, Open Courtyards, Additional Floors, etc.

Such roofs are to be divided into sub-areas by using dividing lines of minimum length to minimize the size and number of the areas which are potentially less than or equal to 50 feet (15.25 meters) in width, in order to limit the size of roof areas where the safety monitoring system alone can be used [1926.502(b)(10)]. Dotted lines are used in the examples to show the location of dividing lines. W denotes incorrect measurements of width.

(For Example E, [Click Here](#))

Example F

Irregular, Non-Rectangular Shaped Roofs

(For Example F, [Click Here](#))

[59 FR 40738, Aug. 9, 1994; 60 FR 5131, Jan. 26, 1995]

- Part Number:** 1926  
• **Part Title:** Safety and Health Regulations for Construction  
• **Subpart:** M  
• **Subpart Title:** Fall Protection  
• **Standard Number:** 1926 Subpart M App B  
• **Title:** Guardrail Systems - Non-Mandatory Guidelines for Complying with 1926.502(b)
- 

The standard requires guardrail systems and components to be designed and built to meet the requirements of 1926.502(b)(3), (4), and (5). This Appendix serves as a non-mandatory guideline to assist employers in complying with these requirements. An employer may use these guidelines as a starting point for designing guardrail systems. However, the guidelines do not provide all the information necessary to build a complete system, and the employer is still responsible for designing and assembling these components in such a way that the completed system will meet the requirements of 1926.502(b)(3), (4), and (5). Components for which no specific guidelines are given in this Appendix (e.g., joints, base connections, components made with other materials, and components with other dimensions) must also be designed and constructed in such a way that the completed system meets the requirements of 1926.502.

- (1) For wood railings: Wood components shall be minimum 1500 lb-ft/in<sup>2</sup> fiber (stress grade) construction grade lumber; the posts shall be at least 2-inch by 4-inch (5 cm x 10 cm) lumber spaced not more than 8 feet (2.4 m) apart on centers; the top rail shall be at least 2-inch by 4-inch (5 cm x 10 cm) lumber, the intermediate rail shall be at least 1-inch by 6-inch (2.5 cm x 15 cm) lumber. All lumber dimensions are nominal sizes as provided by the American Softwood Lumber Standards, dated January 1970.
- (2) For pipe railings: posts, top rails, and intermediate railings shall be at least one and one-half inches nominal diameter (schedule 40 pipe) with posts spaced not more than 8 feet (2.4 m) apart on centers.
- (3) For structural steel railings: posts, top rails, and intermediate rails shall be at least 2-inch by 2-inch (5 cm x 10 cm) by 3/8-inch (1.1 cm) angles, with posts spaced not more than 8 feet (2.4 m) apart on centers.

[59 FR 40743, Aug. 9, 1994; 60 FR 5131, Jan. 26, 1995]

**Part Number:** 1926  
• **Part Title:** Safety and Health Regulations for Construction  
• **Subpart:** M  
• **Subpart Title:** Fall Protection  
• **Standard Number:** 1926 Subpart M App C  
• **Title:** Personal Fall Arrest Systems - Non-Mandatory Guidelines for Complying with 1926.502(d)

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I. Test methods for personal fall arrest systems and positioning device systems -

(a) "General." This appendix serves as a non-mandatory guideline to assist employers comply with the requirements in 1926.502(d). Paragraphs (b), (c), (d) and (e) of this Appendix describe test procedures which may be used to determine compliance with the requirements in 1926.502 (d)(16). As noted in Appendix D of this subpart, the test methods listed here in Appendix C can also be used to assist employers comply with the requirements in 1926.502(e) (3) and (4) for positioning device systems.

(b) "General conditions for all tests in the Appendix to 1926.502(d)."

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

(2) The 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 500 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 to 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 5 pounds (135 kg plus or minus 2.5 kg) should be used. (See paragraph (b)(4) of this section.)



- (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 m plus or minus 5 cm) as measured from the fixed anchorage to the attachment on the body belt or 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 belt or 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 m) 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 which 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 which detaches from the belt or harness has failed the strength test.
- (d) "Force test" - (1) "General." The test consists of dropping the respective test weight once as specified in paragraph (d)(2)(i) or (d)(3)(i) of this section. A new, unused system should be used for each test.
- (2) "For lanyard systems." (i) A test weight of 220 pounds plus or minus 3 pounds (100 kg plus or minus 1.6 kg) should be used. (See paragraph (b)(4) of this appendix).
- (ii) Lanyard length should be 6 feet plus or minus two inches (1.83 m plus or minus 5 cm) as measured from the fixed anchorage to the attachment on the body belt or 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 3 pounds (100 kg plus or minus 1.6 kg) should be used. (See paragraph (b)(4) of this appendix)
- (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 which have 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 belt or harness).
- (B) For deceleration device systems with integral lifelines or lanyards which 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) A system fails the force test if the recorded maximum arresting force exceeds 1,260 pounds (5.6 kN) when using a body belt, and/or exceeds 2,520 pounds (11.2 kN) when using a body harness.

(5) 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, type of lifeline, etc.), 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(s) of lifeline which 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.

II. Additional non-mandatory guidelines for personal fall arrest systems. The following information constitutes additional guidelines for use in complying with requirements for a personal fall arrest system.

(a) "Selection and use considerations." (1) The kind of personal fall arrest system selected should match the particular work situation, and any possible free fall distance should be kept to a minimum. Consideration should be given to the particular work environment. For example, the presence of acids, dirt, moisture, oil, grease, etc., and their effect on the system, should be evaluated. Hot or cold environments may also have an adverse effect on the system. Wire rope should not be used where an electrical hazard is anticipated. As required by the standard, the employer must plan to have means available to promptly rescue an employee should a fall occur, since the suspended employee may not be able to reach a work level independently.

(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. 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. In some cases, a program for cleaning and maintenance of the system may be necessary.

(b) "Testing considerations." Before purchasing or putting into use a personal fall arrest system, an employer should obtain from the supplier information about the system based on its performance during testing so that the employer can know if the system meets this standard. Testing should be done using recognized test methods. This Appendix contains test methods recognized for evaluating the performance of fall arrest systems. Not all systems may need to be individually tested; the performance of some systems may be based on data and calculations derived from testing of similar systems, provided that enough information is available to demonstrate similarity of function and design.

(c) "Component compatibility considerations." Ideally, a personal fall arrest 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. The employer and employee should realize that not all components are interchangeable. For instance, a lanyard should not be connected between a body belt (or harness) and a deceleration device of the self-retracting type since this can result in additional free fall for which the system was not designed. Any substitution or change to a personal fall arrest system should be fully evaluated or tested by a competent person to determine that it meets the standard, before the modified system is put in use.

(d) "Employee training considerations." Thorough employee training in the selection and use of personal fall arrest systems is imperative. Employees must be trained in the safe use of the system. This should include the following: application limits; proper anchoring and tie-off techniques; estimation of free fall distance, including determination of deceleration distance, and total fall distance to prevent striking a lower level; methods of use; and inspection and storage of the system. Careless or improper use of the equipment can result in serious injury or death. Employers and employees should become familiar with the material in this Appendix, as well as manufacturer's recommendations, before a system is used. Of uppermost importance is the reduction in strength caused by certain tie-offs (such as using knots, tying around sharp edges, etc.) and maximum permitted free fall distance. Also, to be stressed are the importance of inspections prior to use, the limitations of the equipment, and unique conditions at the worksite which may be important in determining the type of system to use.

(e) "Instruction considerations." Employers should obtain comprehensive instructions from the supplier 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) Application limits;

(6) Proper hook-up, anchoring and tie-off techniques, including the proper dee-ring or other attachment point to use on the body belt and harness for fall arrest;

(7) Proper climbing techniques;

(8) Methods of inspection, use, cleaning, and storage; and

(9) Specific lifelines which may be used.

This information should be provided to employees during training.

(f) "Rescue considerations." As required by 1926.502(d)(20), when personal fall arrest systems are used, the employer must assure that employees can be promptly rescued or can rescue themselves should a fall occur. The availability of rescue personnel, ladders or other rescue equipment should be evaluated. In some situations, equipment which allows employees to rescue themselves after the fall has been arrested may be desirable, such as devices which have descent capability.

(g) "Inspection considerations." As required by 1926.502(d)(21), personal fall arrest systems must be regularly inspected. Any component with any significant defect, such as cuts, tears, abrasions, mold, or undue stretching; alterations or additions which might affect its efficiency; damage due to deterioration; contact with fire, acids, or other corrosives; distorted hooks or faulty hook springs; tongues unfitted to the shoulder of buckles; loose or damaged mountings; non-functioning parts; or wearing or internal deterioration in the ropes must be withdrawn from service immediately, and should be tagged or marked as unusable, or destroyed.

(h) "Tie-off considerations." (1) One of the most important aspects of personal fall protection systems is fully planning the system before it is put into use. Probably the most overlooked component is planning for suitable anchorage points. Such planning should ideally be done before the structure or building is constructed so that

anchorage points can be incorporated during construction for use later for window cleaning or other building maintenance. If properly planned, these anchorage points may be used during construction, as well as afterwards.

(i) Properly planned anchorages should be used if they are available. In some cases, anchorages must be installed immediately prior to use. In such cases, a registered professional engineer with experience in designing fall protection systems, or another qualified person with appropriate education and experience should design an anchor point to be installed.

(ii) In other cases, the Agency recognizes that there will be a need to devise an anchor point from existing structures. Examples of what might be appropriate anchor points are steel members or I-beams if an acceptable strap is available for the connection (do not use a lanyard with a snaphook clipped onto itself); large eye-bolts made of an appropriate grade steel; guardrails or railings if they have been designed for use as an anchor point; or masonry or wood members only if the attachment point is substantial and precautions have been taken to assure that bolts or other connectors will not pull through. A qualified person should be used to evaluate the suitability of these "make shift" anchorages with a focus on proper strength.

(2) 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 which does not reduce the strength of the system (such as a properly dimensioned eye-bolt/snap-hook 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, but one that will also maintain the appropriate maximum arrest force characteristics.

(3) Tie-off using a knot in a rope lanyard or lifeline (at any location) can reduce the lifeline or lanyard strength by 50 percent or more. Therefore, a stronger lanyard or lifeline should be used to compensate for the weakening effect of 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.

(4) Tie-off of a rope lanyard or lifeline around an "H" or "I" beam or similar support can reduce its strength as much as 70 percent due to the cutting action of the beam edges. Therefore, use should be made of a webbing lanyard or wire core lifeline around the beam; or the lanyard or lifeline should be protected from the edge; or free fall distance should be greatly minimized.

(5) Tie-off where the line passes over or around rough or sharp surfaces reduces strength drastically. Such a tie-off should be avoided or an alternative tie-off rigging should be used. Such alternatives may include use of a snap-hook/dee ring connection, wire rope tie-off, an effective padding of the surfaces, or an abrasion-resistance strap around or over the problem surface.

(6) Horizontal lifelines may, depending on their geometry and angle of sag, 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. The reason for this is that in multiple tie-offs to a horizontal lifeline, if one employee falls, the movement of the falling employee and the horizontal lifeline during arrest of the fall may cause other employees to fall also. Horizontal lifeline and anchorage strength should be increased for each additional employee to be tied off. For these and other reasons, the design of systems using horizontal lifelines must only be done by qualified persons. Testing of installed lifelines and anchors prior to use is recommended.

(7) The strength of an eye-bolt is rated along the axis of the bolt and its strength is greatly reduced if the force is applied at an angle to this axis (in the direction of shear). Also, care should be exercised in selecting the proper diameter of the eye to avoid accidental disengagement of snap-hooks not designed to be compatible for the connection.

(8) Due to the significant reduction in the strength of the lifeline/lanyard (in some cases, as much as a 70 percent reduction), the sliding hitch knot (prusik) should not be used for lifeline/lanyard connections except in emergency situations where no other available system is practical. 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" knot (preferable) may be used in emergency situations; however, care should be taken to limit free fall distance to a minimum because of reduced lifeline/lanyard strength.

(i) "Vertical lifeline considerations." As required by the standard, each employee must have a separate lifeline [except employees engaged in constructing elevator shafts who are permitted to have two employees on one lifeline] when the lifeline is vertical. The reason for this is that in multiple tie-offs to a single lifeline, if 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.

(j) "Snap-hook considerations." (1) Although not required by this standard for all connections until January 1, 1998, locking snaphooks designed for connection to suitable objects (of sufficient strength) are highly recommended in lieu of the nonlocking type. Locking snaphooks incorporate a positive locking mechanism in addition to the spring loaded keeper, which will not allow the keeper to open under moderate pressure without someone first releasing the mechanism. Such a feature, properly designed, effectively prevents roll-out from occurring.

(2) As required by 1926.502(d)(6), the following connections must be avoided (unless properly designed locking snaphooks are used) because they are conditions which can result in roll-out when a nonlocking snaphook is used:

(i) Direct connection of a snaphook to a horizontal lifeline.

(ii) Two (or more) snaphooks connected to one dee-ring.

(iii) Two snaphooks connected to each other.

(iv) A snaphook connected back on its integral lanyard.

(v) A snaphook connected to a webbing loop or webbing lanyard.

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

(k) "Free fall considerations." The employer and employee should at all times be aware that a system's maximum arresting force is evaluated under normal use conditions established by the manufacturer, and in no case using a free fall distance in excess of 6 feet (1.8 m). A few extra feet of free fall can significantly increase the arresting force on the employee, possibly to the point of causing injury. Because of this, the free fall distance should be kept at a minimum, and, as required by the standard, in no case greater than 6 feet (1.8 m). To help 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 belt or harness. (Since otherwise additional free fall distance is added to the length of the connecting means (i.e. lanyard)). Attaching to the 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 working level to the body belt (or harness) attachment point plus the 6 feet (1.8 m)

of lanyard length. Another important consideration is that the arresting force which the fall system must withstand also goes up with greater distances of free fall, possibly exceeding the strength of the system.

(l) "Elongation and deceleration distance considerations." Other factors involved in a proper tie-off are elongation and deceleration distance. During the arresting of a fall, a lanyard will experience a length of stretching or elongation, 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 very 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 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 worker from inadvertently moving past the end of the lifeline and having the rope grab become disengaged from the lifeline.

(m) "Obstruction considerations." The location of the tie-off should also consider the hazard of obstructions in the potential fall path of the employee. Tie-offs which minimize the possibilities of exaggerated swinging should be considered. In addition, when a body belt is used, the employee's body will go through a horizontal position to a jack-knifed position during the arrest of all falls. Thus, obstructions which might interfere with this motion should be avoided or a severe injury could occur.

(n) "Other considerations." Because of the design of some personal fall arrest systems, additional considerations may be required for proper tie-off. For example, heavy deceleration devices of the self-retracting type should be secured overhead in order to avoid the weight of the device having to be supported by the employee. Also, if self-retracting equipment is connected to a horizontal lifeline, the sag in the lifeline should be minimized to prevent the device from sliding down the lifeline to a position which creates a swing hazard during fall arrest. In all cases, manufacturer's instructions should be followed.

[59 FR 40743, Aug. 9, 1994; 60 FR 5131, Jan. 26, 1995]

**Part Number:** 1926  
**• Part Title:** Safety and Health Regulations for Construction  
**• Subpart:** M  
**• Subpart Title:** Fall Protection  
**• Standard Number:** 1926 Subpart M App D  
**• Title:** Positioning Device Systems - Non-Mandatory Guidelines for Complying with 1926.502(e)

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#### I. Testing Methods For Positioning Device Systems.

This appendix serves as a non-mandatory guideline to assist employers comply with the requirements for positioning device systems in 1926.502(e). Paragraphs (b), (c), (d) and (e) of Appendix C of subpart M relating to 1926.502(d) - Personal Fall Arrest Systems - set forth test procedures which may be used, along with the procedures listed below, to determine compliance with the requirements for positioning device systems in 1926.502(e)(3) and (4) of Subpart M.

- (a) "General." (1) Single strap positioning devices shall have one end attached to a fixed anchorage and the other end connected to a body belt or harness in the same manner as they would be used to protect employees. Double strap positioning devices, similar to window cleaner's belts, shall have one end of the strap attached to a fixed anchorage and the other end shall hang free. The body belt or harness shall be attached to the strap in the same manner as it would be used to protect employees. The two strap ends shall be adjusted to their maximum span.
- (2) The fixed anchorage shall be rigid, and shall not have a deflection greater than .04 inches (1 mm) when a force of 2,250 pounds (10 kN) is applied.
- (3) During the testing of all systems, a test weight of 250 pounds plus or minus 3 pounds (113 kg plus or minus 1.6 kg) shall be used. 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).
- (4) Each test shall consist of dropping the specified weight one time without failure of the system being tested. A new system shall be used for each test.
- (5) The test weight for each test shall be hoisted exactly 4 feet (1.2 m above its "at rest" position), and shall be dropped so as to permit a vertical free fall of 4 feet (1.2 m).
- (6) The test is failed whenever any breakage or slippage occurs which permits the weight to fall free of the system.
- (7) Following the test, the system need not be capable of further operation; however, all such incapacities shall be readily apparent.

## II. Inspection Considerations.

As required in 1926.502 (e)(5), positioning device systems must be regularly inspected. Any component with any significant defect, such as cuts, tears, abrasions, mold, or undue stretching; alterations or additions which might affect its efficiency; damage due to deterioration; contact with fire, acids, or other corrosives; distorted hooks or faulty hook springs; tongues unfitted to the shoulder of buckles; loose or damaged mountings; non-functioning parts; or wearing or internal deterioration in the ropes must be withdrawn from service immediately, and should be tagged or marked as unusable, or destroyed.

[59 FR 40746, Aug. 9, 1994; 60 FR 5131, Jan. 26, 1995]

<b>Part Number:</b>	<b>1926</b>
<b>• Part Title:</b>	<b>Safety and Health Regulations for Construction</b>
<b>• Subpart:</b>	<b>M</b>
<b>• Subpart Title:</b>	<b>Fall Protection</b>
<b>• Standard Number:</b>	<b><a href="#">1926 Subpart M App E</a></b>
<b>• Title:</b>	<b>Sample Fall Protection Plan - Non-Mandatory Guidelines for Complying with 1926.502(k)</b>

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Employers engaged in leading edge work, precast concrete construction work and residential construction work who can demonstrate that it is infeasible or creates a greater hazard to use conventional fall protection systems must develop and follow a fall protection plan. Below are sample fall protection plans developed for precast concrete construction and residential work that could be tailored to be site specific for other precast concrete or residential jobsite. This sample plan can be modified to be used for other work involving leading edge work. The sample plan outlines the elements that must be addressed in any fall protection plan. The reasons outlined in this sample fall protection plan are for illustrative purposes only and are not necessarily a valid, acceptable rationale (unless the conditions at the job site are the same as those covered by these sample plans) for not using conventional fall protection systems for a particular precast concrete or residential construction worksite. However, the sample plans provide guidance to employers on the type of information that is required to be discussed in fall protection plans.

### Sample Fall Protection Plans

Fall Protection Plan For Precast/Prestress Concrete Structures  
This Fall Protection Plan is specific for the following project:

Location of Job  
Erecting Company  
Date Plan Prepared or Modified  
Plan Prepared By  
Plan Approved By  
Plan Supervised By

The following Fall Protection Plan is a sample program prepared for the prevention of injuries associated with falls. A Fall Protection Plan must be developed and evaluated on a site by site basis. It is recommended that erectors discuss the written Fall Protection Plan with their OSHA Area Office prior to going on a jobsite.

### I. Statement of Company Policy

(Company Name) is dedicated to the protection of its employees from on-the-job injuries. All employees of



(Company Name) have the responsibility to work safely on the job. The purpose of this plan is: (a) To supplement our standard safety policy by providing safety standards specifically designed to cover fall protection on this job and; (b) to ensure that each employee is trained and made aware of the safety provisions which are to be implemented by this plan prior to the start of erection.

This Fall Protection Plan addresses the use of other than conventional fall protection at a number of areas on the project, as well as identifying specific activities that require non-conventional means of fall protection. These areas include:

- a. Connecting activity (point of erection).
- b. Leading edge work.
- c. Unprotected sides or edge.
- d. Grouting.

This plan is designed to enable employers and employees to recognize the fall hazards on this job and to establish the procedures that are to be followed in order to prevent falls to lower levels or through holes and openings in walking/working surfaces. Each employee will be trained in these procedures and strictly adhere to them except when doing so would expose the employee to a greater hazard. If, in the employee's opinion, this is the case, the employee is to notify the foreman of the concern and the concern addressed before proceeding.

Safety policy and procedure on any one project cannot be administered, implemented, monitored and enforced by any one individual. The total objective of a safe, accident free work environment can only be accomplished by a dedicated, concerted effort by every individual involved with the project from management down to the last employee. Each employee must understand their value to the company; the costs of accidents, both monetary, physical, and emotional; the objective of the safety policy and procedures; the safety rules that apply to the safety policy and procedures; and what their individual role is in administering, implementing, monitoring, and compliance of their safety policy and procedures. This allows for a more personal approach to compliance through planning, training, understanding and cooperative effort, rather than by strict enforcement. If for any reason an unsafe act persists, strict enforcement will be implemented.

It is the responsibility of (name of competent person) to implement this Fall Protection Plan. (Name of Competent Person) is responsible for continual observational safety checks of their work operations and to enforce the safety policy and procedures. The foreman also is responsible to correct any unsafe acts or conditions immediately. It is the responsibility of the employee to understand and adhere to the procedures of this plan and to follow the instructions of the foreman. It is also the responsibility of the employee to bring to management's attention any unsafe or hazardous conditions or acts that may cause injury to either themselves or any other employees. Any changes to this Fall Protection Plan must be approved by (name of Qualified Person).

## II. Fall Protection Systems to Be Used on This Project

Where conventional fall protection is infeasible or creates a greater hazard at the leading edge and during initial connecting activity, we plan to do this work using a safety monitoring system and expose only a minimum number of employees for the time necessary to actually accomplish the job. The maximum number of workers to be monitored by one safety monitor is six (6). We are designating the following trained employees as designated erectors and they are permitted to enter the controlled access zones and work without the use of conventional fall protection.

Safety monitor:  
Designated erector:  
Designated erector:  
Designated erector:  
Designated erector:  
Designated erector:  
Designated erector:

The safety monitor shall be identified by wearing an orange hard hat. The designated erectors will be identified by one of the following methods:

1. They will wear a blue colored arm band, or
2. They will wear a blue colored hard hat, or
3. They will wear a blue colored vest.

Only individuals with the appropriate experience, skills, and training will be authorized as designated erectors. All employees that will be working as designated erectors under the safety monitoring system shall have been trained and instructed in the following areas:

1. Recognition of the fall hazards in the work area (at the leading edge and when making initial connections-point of erection).
2. Avoidance of fall hazards using established work practices which have been made known to the employees.
3. Recognition of unsafe practices or working conditions that could lead to a fall, such as windy conditions.
4. The function, use, and operation of safety monitoring systems, guardrail systems, body belt/harness systems, control zones and other protection to be used.
5. The correct procedure for erecting, maintaining, disassembling and inspecting the system(s) to be used.
6. Knowledge of construction sequence or the erection plan.

A conference will take place prior to starting work involving all members of the erection crew, crane crew and supervisors of any other concerned contractors. This conference will be conducted by the precast concrete erection supervisor in charge of the project. During the pre-work conference, erection procedures and sequences pertinent to this job will be thoroughly discussed and safety practices to be used throughout the project will be specified. Further, all personnel will be informed that the controlled access zones are off limits to all personnel other than those designated erectors specifically trained to work in that area.

### Safety Monitoring System

A safety monitoring system means a fall protection system in which a competent person is responsible for recognizing and warning employees of fall hazards. The duties of the safety monitor are to:

1. Warn by voice when approaching the open edge in an unsafe manner.
2. Warn by voice if there is a dangerous situation developing which cannot be seen by another person involved with product placement, such as a member getting out of control.
3. Make the designated erectors aware they are in a dangerous area.
4. Be competent in recognizing fall hazards.
5. Warn employees when they appear to be unaware of a fall hazard or are acting in an unsafe manner.
6. Be on the same walking/working surface as the monitored employees and within visual sighting distance of the monitored employees.
7. Be close enough to communicate orally with the employees.
8. Not allow other responsibilities to encumber monitoring. If the safety monitor becomes too encumbered with other responsibilities, the monitor shall (1) stop the erection process; and (2) turn over other responsibilities to a designated erector; or (3) turn over the safety monitoring function to another designated, competent person. The safety monitoring system shall not be used when the wind is strong enough to cause loads with large surface areas to swing out of

radius, or result in loss of control of the load, or when weather conditions cause the walking-working surfaces to become icy or slippery.

## Control Zone System

A controlled access zone means an area designated and clearly marked, in which leading edge work may take place without the use of guardrail, safety net or personal fall arrest systems to protect the employees in the area. Control zone systems shall comply with the following provisions:

1. When used to control access to areas where leading edge and other operations are taking place the controlled access zone shall be defined by a control line or by any other means that restricts access.

When control lines are used, they shall be erected not less than 6 feet (1.8 m) nor more than 60 feet (18 m) or half the length of the member being erected, whichever is less, from the leading edge.

2. The control line shall extend along the entire length of the unprotected or leading edge and shall be approximately parallel to the unprotected or leading edge.

3. The control line shall be connected on each side to a guardrail system or wall.

4. Control lines shall consist of ropes, wires, tapes, or equivalent materials, and supporting stanchions as follows:

5. Each line shall be flagged or otherwise clearly marked at not more than 6-foot (1.8 m) intervals with high-visibility material.

6. Each line shall be rigged and supported in such a way that its lowest point (including sag) is not less than 39 inches (1 m) from the walking/working surface and its highest point is not more than 45 inches (1.3 m) from the walking/working surface.

7. Each line shall have a minimum breaking strength of 200 pounds (.88 kN).

## Holes

All openings greater than 12 in. x 12 in. will have perimeter guarding or covering. All predetermined holes will have the plywood covers made in the precasters' yard and shipped with the member to the jobsite. Prior to cutting holes on the job, proper protection for the hole must be provided to protect the workers. Perimeter guarding or covers will not be removed without the approval of the erection foreman.

Precast concrete column erection through the existing deck requires that many holes be provided through this deck. These are to be covered and protected. Except for the opening being currently used to erect a column, all opening protection is to be left undisturbed. The opening being uncovered to erect a column will become part of the point of erection and will be addressed as part of this Fall Protection Plan. This uncovering is to be done at the erection foreman's direction and will only occur immediately prior to "feeding" the column through the opening. Once the end of the column is through the slab opening, there will no longer exist a fall hazard at this location.

### III. Implementation of Fall Protection Plan

The structure being erected is a multistory total precast concrete building consisting of columns, beams, wall panels and hollow core slabs and double tee floor and roof members.

The following is a list of the products and erection situations on this job:

#### Columns

For columns 10 ft to 36 ft long, employees disconnecting crane hooks from columns will work from a ladder and wear a body belt/harness with lanyard and be tied off when both hands are needed to disconnect. For tying off, a vertical lifeline will be connected to the lifting eye at the top of the column, prior to lifting, to be used with a manually operated or mobile rope grab. For columns too high for the use of a ladder, 36 ft and higher, an added cable will be used to reduce the height of the disconnecting point so that a ladder can be used. This cable will be left in place until a point in erection that it can be removed safely. In some cases, columns will be unhooked from the crane by using an erection tube or shackle with a pull pin which is released from the ground after the column is stabilized.

The column will be adequately connected and/or braced to safely support the weight of a ladder with an employee on it.

#### Inverted Tee Beams

Employees erecting inverted tee beams, at a height of 6 to 40 ft, will erect the beam, make initial connections, and final alignment from a ladder. If the employee needs to reach over the side of the beam to bar or make an adjustment to the alignment of the beam, they will mount the beam and be tied off to the lifting device in the beam after ensuring the load has been stabilized on its bearing. To disconnect the crane from the beam an employee will stand a ladder against the beam. Because the use of ladders is not practical at heights above 40 ft, beams will be initially placed with the use of tag lines and their final alignment made by a person on a manlift or similar employee positioning systems.

#### Spandrel Beams

Spandrel beams at the exterior of the building will be aligned as closely as possible with the use of tag lines with the final placement of the spandrel beam made from a ladder at the open end of the structure. A ladder will be used to make the initial connections and a ladder will be used to disconnect the crane. The other end of the beam will be placed by the designated erector from the double tee deck under the observation of the safety monitor.

The beams will be adequately connected and/or braced to safely support the weight of a ladder with an employee on it.

#### Floor and Roof Members

During installation of the precast concrete floor and/or roof members, the work deck continuously increases in area as more and more units are being erected and positioned. Thus, the unprotected floor/roof perimeter is constantly modified with the leading edge changing location as each member is installed. The fall protection for

workers at the leading edge shall be assured by properly constructed and maintained control zone lines not more than 60 ft away from the leading edge supplemented by a safety monitoring system to ensure the safety of all designated erectors working within the area defined by the control zone lines.

The hollow core slabs erected on the masonry portion of the building will be erected and grouted using the safety monitoring system. Grout will be placed in the space between the end of the slab and face shell of the concrete masonry by dumping from a wheelbarrow. The grout in the keyways between the slabs will be dumped from a wheelbarrow and then spread with long handled tools, allowing the worker to stand erect facing toward the unprotected edge and back from any work deck edge.

Whenever possible, the designated erectors will approach the incoming member at the leading edge only after it is below waist height so that the member itself provides protection against falls.

Except for the situations described below, when the arriving floor or roof member is within 2 to 3 inches of its final position, the designated erectors can then proceed to their position of erection at each end of the member under the control of the safety monitor. Crane hooks will be unhooked from double tee members by designated erectors under the direction and supervision of the safety monitor.

Designated erectors, while waiting for the next floor or roof member, will be constantly under the control of the safety monitor for fall protection and are directed to stay a minimum of six (6) ft from the edge. In the event a designated erector must move from one end of a member, which has just been placed at the leading edge, they must first move away from the leading edge a minimum of six (6) ft and then progress to the other end while maintaining the minimum distance of six (6) ft at all times.

Erection of double tees, where conditions require bearing of one end into a closed pocket and the other end on a beam ledge, restricting the tee legs from going directly into the pockets, require special considerations. The tee legs that are to bear in the closed pocket must hang lower than those at the beam bearing. The double tee will be "two-lined" in order to elevate one end higher than the other to allow for the low end to be ducked into the closed pocket using the following procedure.

The double tee will be rigged with a standard four-way spreader off of the main load line. An additional choker will be attached to the married point of the two-legged spreader at the end of the tee that is to be elevated. The double tee will be hoisted with the main load line and swung into a position as close as possible to the tee's final bearing elevation. When the tee is in this position and stabilized, the whip line load block will be lowered to just above the tee deck. At this time, two erectors will walk out on the suspended tee deck at midspan of the tee member and pull the load block to the end of the tee to be elevated and attach the additional choker to the load block. The possibility of entanglement with the crane lines and other obstacles during this two lining process while raising and lowering the crane block on that second line could be hazardous to an encumbered employee. Therefore, the designated erectors will not tie off during any part of this process. While the designated erectors are on the double tee, the safety monitoring system will be used. After attaching the choker, the two erectors then step back on the previously erected tee deck and signal the crane operator to hoist the load with the whip line to the elevation that will allow for enough clearance to let the low end tee legs slide into the pockets when the main load line is lowered. The erector, who is handling the lowered end of the tee at the closed pocket bearing, will step out on the suspended tee. An erection bar will then be placed between the end of the tee leg and the inside face of the pocketed spandrel member. The tee is barred away from the pocketed member to reduce the friction and lateral force against the pocketed member. As the tee is being lowered, the other erector remains on the tee which was previously erected to handle the other end. At this point the tee is slowly lowered by the crane to a point where the tee legs can freely slide into the pockets. The erector working the lowered end of the tee must keep pressure on the bar between the tee and the face of the pocketed spandrel member to very gradually let the tee legs slide into the pocket to its proper bearing dimension.

The tee is then slowly lowered into its final erected position.

The designated erector should be allowed onto the suspended double tee, otherwise there is no control over the horizontal movement of the double tee and this movement could knock the spandrel off of its bearing or the column out of plumb. The control necessary to prevent hitting the spandrel can only be done safely from the top of the double tee being erected.

**Loadbearing Wall Panels:** The erection of the loadbearing wall panels on the elevated decks requires the use of a safety monitor and a controlled access zone that is a minimum of 25 ft and a maximum of 1/2 the length of the wall panels away from the unprotected edge, so that designated erectors can move freely and unencumbered when receiving the panels. Bracing, if required for stability, will be installed by ladder. After the braces are secured, the crane will be disconnected from the wall by using a ladder. The wall to wall connections will also be performed from a ladder.

**Non-Loadbearing Panels (Cladding):** The locating of survey lines, panel layout and other installation prerequisites (prewelding, etc.) for non-loadbearing panels (cladding) will not commence until floor perimeter and floor openings have been protected. In some areas, it is necessary because of panel configuration to remove the perimeter protection as the cladding is being installed. Removal of perimeter protection will be performed on a bay to bay basis, just ahead of cladding erection to minimize temporarily unprotected floor edges. Those workers within 6 ft of the edge, receiving and positioning the cladding when the perimeter protection is removed shall be tied off.

## Detailing

Employees exposed to falls of six (6) feet or more to lower levels, who are not actively engaged in leading edge work or connecting activity, such as welding, bolting, cutting, bracing, guying, patching, painting or other operations, and who are working less than six (6) ft from an unprotected edge will be tied off at all times or guardrails will be installed. Employees engaged in these activities but who are more than six (6) ft from an unprotected edge as defined by the control zone lines, do not require fall protection but a warning line or control lines must be erected to remind employees they are approaching an area where fall protection is required.

## IV. Conventional Fall Protection Considered for the Point of Erection or Leading Edge Erection Operations

### A. Personal Fall Arrest Systems

In this particular erection sequence and procedure, personal fall arrest systems requiring body belt/harness systems, lifelines and lanyards will not reduce possible hazards to workers and will create offsetting hazards during their usage at the leading edge of precast/prestressed concrete construction.

Leading edge erection and initial connections are conducted by employees who are specifically trained to do this type of work and are trained to recognize the fall hazards. The nature of such work normally exposes the employee to the fall hazard for a short period of time and installation of fall protection systems for a short duration is not feasible because it exposes the installers of the system to the same fall hazard, but for a longer period of time.

1. It is necessary that the employee be able to move freely without encumbrance in order to guide the sections of precast concrete into their final position without having lifelines attached which will restrict the employee's ability to move about at the point of erection.

2. A typical procedure requires 2 or more workers to maneuver around each other as a concrete member is positioned to fit into the structure. If they are each attached to a lifeline, part of their attention must be diverted from their main task of positioning a member weighing several tons to the task of avoiding entanglements of

their lifelines or avoiding tripping over lanyards. Therefore, if these workers are attached to lanyards, more fall potential would result than from not using such a device.

In this specific erection sequence and procedure, retractable lifelines do not solve the problem of two workers becoming tangled. In fact, such a tangle could prevent the lifeline from retracting as the worker moved, thus potentially exposing the worker to a fall greater than 6 ft. Also, a worker crossing over the lifeline of another worker can create a hazard because the movement of one person can unbalance the other. In the event of a fall by one person there is a likelihood that the other person will be caused to fall as well. In addition, if contamination such as grout (during hollow core grouting) enters the retractable housing it can cause excessive wear and damage to the device and could clog the retracting mechanism as the lanyard is dragged across the deck. Obstructing the cable orifice can defeat the device's shock absorbing function, produce cable slack and damage, and adversely affect cable extraction and retraction.

3. Employees tied to a lifeline can be trapped and crushed by moving structural members if the employee becomes restrained by the lanyard or retractable lifeline and cannot get out of the path of the moving load. The sudden movement of a precast concrete member being raised by a crane can be caused by a number of factors. When this happens, a connector may immediately have to move a considerable distance to avoid injury. If a tied off body belt/harness is being used, the connector could be trapped. Therefore, there is a greater risk of injury if the connector is tied to the structure for this specific erection sequence and procedure.

When necessary to move away from a retractable device, the worker cannot move at a rate greater than the device locking speed typically 3.5 to 4.5 ft/sec. When moving toward the device it is necessary to move at a rate which does not permit cable slack to build up. This slack may cause cable retraction acceleration and cause a worker to lose their balance by applying a higher than normal jerking force on the body when the cable suddenly becomes taut after building up momentum. This slack can also cause damage to the internal spring-loaded drum, uneven coiling of cable on the drum, and possible cable damage.

The factors causing sudden movements for this location include:

- (a) Cranes
  - (1) Operator error.
  - (2) Site conditions (soft or unstable ground).
  - (3) Mechanical failure.
  - (4) Structural failure.
  - (5) Rigging failure.
  - (6) Crane signal/radio communication failure.
  
- (b) Weather Conditions
  - (1) Wind (strong wind/sudden gusting) - particularly a problem with the large surface areas of precast concrete members.
  - (2) Snow/rain (visibility).
  - (3) Fog (visibility).
  - (4) Cold - causing slowed reactions or mechanical problems.
  
- (c) Structure/Product Conditions.
  - (1) Lifting Eye failure.
  - (2) Bearing failure or slippage.
  - (3) Structure shifting.
  - (4) Bracing failure.
  - (5) Product failure.
  
- (d) Human Error.
  - (1) Incorrect tag line procedure.
  - (2) Tag line hang-up.

- (3) Incorrect or misunderstood crane signals.
- (4) Misjudged elevation of member.
- (5) Misjudged speed of member.
- (6) Misjudged angle of member.

4. Anchorages or special attachment points could be cast into the precast concrete members if sufficient preplanning and consideration of erectors' position is done before the members are cast. Any hole or other attachment must be approved by the engineer who designed the member. It is possible that some design restrictions will not allow a member to be weakened by an additional hole; however, it is anticipated that such situations would be the exception, not the rule. Attachment points, other than on the deck surface, will require removal and/or patching. In order to remove and/or patch these points, requires the employee to be exposed to an additional fall hazard at an unprotected perimeter. The fact that attachment points could be available anywhere on the structure does not eliminate the hazards of using these points for tying off as discussed above. A logical point for tying off on double tees would be using the lifting loops, except that they must be cut off to eliminate a tripping hazard at an appropriate time.

5. Providing attachment at a point above the walking/working surface would also create fall exposures for employees installing their devices. Final positioning of a precast concrete member requires it to be moved in such a way that it must pass through the area that would be occupied by the lifeline and the lanyards attached to the point above. Resulting entanglements of lifelines and lanyards on a moving member could pull employees from the work surface. Also, the structure is being created and, in most cases, there is no structure above the members being placed.

(a) Temporary structural supports, installed to provide attaching points for lifelines limit the space which is essential for orderly positioning, alignment and placement of the precast concrete members. To keep the lanyards a reasonable and manageable length, lifeline supports would necessarily need to be in proximity to the positioning process. A sudden shift of the precast concrete member being positioned because of wind pressure or crane movement could make it strike the temporary supporting structure, moving it suddenly and causing tied off employees to fall.

(b) The time in manhours which would be expended in placing and maintaining temporary structural supports for lifeline attaching points could exceed the expended manhours involved in placing the precast concrete members. No protection could be provided for the employees erecting the temporary structural supports and these supports would have to be moved for each successive step in the construction process, thus greatly increasing the employee's exposure to the fall hazard.

(c) The use of a cable strung horizontally between two columns to provide tie off lines for erecting or walking a beam for connecting work is not feasible and creates a greater hazard on this multi-story building for the following reasons:

(1) If a connector is to use such a line, it must be installed between the two columns. To perform this installation requires an erector to have more fall exposure time attaching the cable to the columns than would be spent to make the beam to column connection itself.

(2) If such a line is to be installed so that an erector can walk along a beam, it must be overhead or below him. For example, if a connector must walk along a 24 in. wide beam, the presence of a line next to the connector at waist level, attached directly to the columns, would prevent the connector from centering their weight over the beam and balancing themselves. Installing the line above the connector might be possible on the first level of a two-story column; however, the column may extend only a few feet above the floor level at the second level or be flush with the floor level. Attaching the line to the side of the beam could be a solution; however, it would require the connector to attach the lanyard below foot level which would most likely extend a fall farther than 6 ft.



(3) When lines are strung over every beam, it becomes more and more difficult for the crane operator to lower a precast concrete member into position without the member becoming fouled. Should the member become entangled, it could easily dislodge the line from a column. If a worker is tied to it at the time, a fall could be caused.

6. The ANSI A10.14-1991 American National Standard for Construction and Demolition Operations - Requirements for Safety Belts, Harnesses, Lanyards and Lifelines for Construction and Demolition Use, states that the anchor point of a lanyard or deceleration device should, if possible, be located above the wearer's belt or harness attachment. ANSI A10.14 also states that a suitable anchorage point is one which is located as high as possible to prevent contact with an obstruction below should the worker fall. Most manufacturers also warn in the user's handbook that the safety block/retractable lifeline must be positioned above the D-ring (above the work space of the intended user) and OSHA recommends that fall arrest and restraint equipment be used in accordance with the manufacturer's instructions.

Attachment of a retractable device to a horizontal cable near floor level or using the inserts in the floor or roof members may result in increased free fall due to the dorsal D-ring of the full-body harness riding higher than the attachment point of the snaphook to the cable or insert (e.g., 6 foot tall worker with a dorsal D-ring at 5 feet above the floor or surface, reduces the working length to only one foot, by placing the anchorage five feet away from the fall hazard). In addition, impact loads may exceed maximum fall arrest forces (MAF) because the fall arrest D-ring would be 4 to 5 feet higher than the safety block/retractable lifeline anchored to the walking-working surface; and the potential for swing hazards is increased. Manufacturers also require that workers not work at a level where the point of snaphook attachment to the body harness is above the device because this will increase the free fall distance and the deceleration distance and will cause higher forces on the body in the event of an accidental fall.

Manufacturers recommend an anchorage for the retractable lifeline which is immovably fixed in space and is independent of the user's support systems. A moveable anchorage is one which can be moved around (such as equipment or wheeled vehicles) or which can deflect substantially under shock loading (such as a horizontal cable or very flexible beam). In the case of a very flexible anchorage, a shock load applied to the anchorage during fall arrest can cause oscillation of the flexible anchorage such that the retractable brake mechanism may undergo one or more cycles of locking/unlocking/locking (ratchet effect) until the anchorage deflection is dampened. Therefore, use of a moveable anchorage involves critical engineering and safety factors and should only be considered after fixed anchorage has been determined to be not feasible.

Horizontal cables used as an anchorage present an additional hazard due to amplification of the horizontal component of maximum arrest force (of a fall) transmitted to the points where the horizontal cable is attached to the structure. This amplification is due to the angle of sag of a horizontal cable and is most severe for small angles of sag. For a cable sag angle of 2 degrees the horizontal force on the points of cable attachment can be amplified by a factor of 15.

It is also necessary to install the retractable device vertically overhead to minimize swing falls. If an object is in the worker's swing path (or that of the cable) hazardous situations exist: (1) due to the swing, horizontal speed of the user may be high enough to cause injury when an obstacle in the swing fall path is struck by either the user or the cable; (2) the total vertical fall distance of the user may be much greater than if the user had fallen only vertically without a swing fall path.

With retractable lines, overconfidence may cause the worker to engage in inappropriate behavior, such as approaching the perimeter of a floor or roof at a distance appreciably greater than the shortest distance between the anchorage point and the leading edge. Though the retractable lifeline may arrest a worker's fall before he or she has fallen a few feet, the lifeline may drag along the edge of the floor or beam and swing the worker like a pendulum until the line has moved to a position where the distance between the anchorage point and floor edge is the shortest distance between those two points. Accompanying this pendulum swing is a lowering of the

worker, with the attendant danger that he or she may violently impact the floor or some obstruction below.

The risk of a cable breaking is increased if a lifeline is dragged sideways across the rough surface or edge of a concrete member at the same moment that the lifeline is being subjected to a maximum impact loading during a fall. The typical 3/16 in. cable in a retractable lifeline has a breaking strength of from 3000 to 3700 lbs.

7. The competent person, who can take into account the specialized operations being performed on this project, should determine when and where a designated erector cannot use a personal fall arrest system.

## B. Safety Net Systems

The nature of this particular precast concrete erection worksite precludes the safe use of safety nets where point of erection or leading edge work must take place.

1. To install safety nets in the interior high bay of the single story portion of the building poses rigging attachment problems. Structural members do not exist to which supporting devices for nets can be attached in the area where protection is required. As the erection operation advances, the location of point of erection or leading edge work changes constantly as each member is attached to the structure. Due to this constant change it is not feasible to set net sections and build separate structures to support the nets.
2. The nature of the erection process for the precast concrete members is such that an installed net would protect workers as they position and secure only one structural member. After each member is stabilized the net would have to be moved to a new location (this could mean a move of 8 to 10 ft or the possibility of a move to a different level or area of the structure) to protect workers placing the next piece in the construction sequence. The result would be the installation and dismantling of safety nets repeatedly throughout the normal work day. As the time necessary to install a net, test, and remove it is significantly greater than the time necessary to position and secure a precast concrete member, the exposure time for the worker installing the safety net would be far longer than for the workers whom the net is intended to protect. The time exposure repeats itself each time the nets and supporting hardware must be moved laterally or upward to provide protection at the point of erection or leading edge.
3. Strict interpretation of 1926.502(c) requires that operations shall not be undertaken until the net is in place and has been tested. With the point of erection constantly changing, the time necessary to install and test a safety net significantly exceeds the time necessary to position and secure the concrete member.
4. Use of safety nets on exposed perimeter wall openings and opensided floors, causes attachment points to be left in architectural concrete which must be patched and filled with matching material after the net supporting hardware is removed. In order to patch these openings, additional numbers of employees must be suspended by swing stages, boatswain chairs or other devices, thereby increasing the amount of fall exposure time to employees.
5. Installed safety nets pose an additional hazard at the perimeter of the erected structure where limited space is available in which members can be turned after being lifted from the ground by the crane. There would be a high probability that the member being lifted could become entangled in net hardware, cables, etc.
6. The use of safety nets where structural wall panels are being erected would prevent movement of panels to point of installation. To be effective, nets would necessarily have to provide protection across the area where structural supporting wall panels would be set and plumbed before roof units could be placed.
7. Use of a tower crane for the erection of the high rise portion of the structure poses a particular hazard in that the crane operator cannot see or judge the proximity of the load in relation to the structure or nets. If the signaler is looking through nets and supporting structural devices while giving instructions to the crane operator, it is not

possible to judge precise relationships between the load and the structure itself or to nets and supporting structural devices. This could cause the load to become entangled in the net or hit the structure causing potential damage.

### C. Guardrail Systems

On this particular worksite, guardrails, barricades, ropes, cables or other perimeter guarding devices or methods on the erection floor will pose problems to safe erection procedures. Typically, a floor or roof is erected by placing 4 to 10 ft wide structural members next to one another and welding or grouting them together. The perimeter of a floor and roof changes each time a new member is placed into position. It is unreasonable and virtually impossible to erect guardrails and toe boards at the ever changing leading edge of a floor or roof.

1. To position a member safely it is necessary to remove all obstructions extending above the floor level near the point of erection. Such a procedure allows workers to swing a new member across the erected surface as necessary to position it properly without worrying about knocking material off of this surface.

Hollow core slab erection on the masonry wall requires installation of the perimeter protection where the masonry wall has to be constructed. This means the guardrail is installed then subsequently removed to continue the masonry construction. The erector will be exposed to a fall hazard for a longer period of time while installing and removing perimeter protection than while erecting the slabs.

In hollow core work, as in other precast concrete erection, others are not typically on the work deck until the precast concrete erection is complete. The deck is not complete until the leveling, aligning, and grouting of the joints is done. It is normal practice to keep others off the deck until at least the next day after the installation is complete to allow the grout to harden.

2. There is no permanent boundary until all structural members have been placed in the floor or roof. At the leading edge, workers are operating at the temporary edge of the structure as they work to position the next member in the sequence. Compliance with the standard would require a guardrail and toe board be installed along this edge. However, the presence of such a device would prevent a new member from being swung over the erected surface low enough to allow workers to control it safely during the positioning process. Further, these employees would have to work through the guardrail to align the new member and connect it to the structure. The guardrail would not protect an employee who must lean through it to do the necessary work, rather it would hinder the employee to such a degree that a greater hazard is created than if the guardrail were absent.

3. Guardrail requirements pose a hazard at the leading edge of installed floor or roof sections by creating the possibility of employees being caught between guardrails and suspended loads. The lack of a clear work area in which to guide the suspended load into position for placement and welding of members into the existing structure creates still further hazards.

4. Where erection processes require precast concrete stairways or openings to be installed as an integral part of the overall erection process, it must also be recognized that guardrails or handrails must not project above the surface of the erection floor. Such guardrails should be terminated at the level of the erection floor to avoid placing hazardous obstacles in the path of a member being positioned.

### V. Other Fall Protection Measures Considered for This Job

The following is a list and explanation of other fall protection measures available and an explanation of limitations for use on this particular jobsite. If during the course of erecting the building the employee sees an

area that could be erected more safely by the use of these fall protection measures, the foreman should be notified.

A. Scaffolds are not used because:

1. The leading edge of the building is constantly changing and the scaffolding would have to be moved at very frequent intervals. Employees erecting and dismantling the scaffolding would be exposed to fall hazards for a greater length of time than they would by merely erecting the precast concrete member.
2. A scaffold tower could interfere with the safe swinging of a load by the crane.
3. Power lines, terrain and site do not allow for the safe use of scaffolding.

B. Vehicle mounted platforms are not used because:

1. A vehicle mounted platform will not reach areas on the deck that are erected over other levels.
2. The leading edge of the building is usually over a lower level of the building and this lower level will not support the weight of a vehicle mounted platform.
3. A vehicle mounted platform could interfere with the safe swinging of a load by the crane, either by the crane swinging the load over or into the equipment.
4. Power lines and surrounding site work do not allow for the safe use of a vehicle mounted platform.

C. Crane suspended personnel platforms are not used because:

1. A second crane close enough to suspend any employee in the working and erecting area could interfere with the safe swinging of a load by the crane hoisting the product to be erected.
2. Power lines and surrounding site work do not allow for the safe use of a second crane on the job.

## VI. Enforcement

Constant awareness of and respect for fall hazards, and compliance with all safety rules are considered conditions of employment. The jobsite Superintendent, as well as individuals in the Safety and Personnel Department, reserve the right to issue disciplinary warnings to employees, up to and including termination, for failure to follow the guidelines of this program.

## VII. Accident Investigations

All accidents that result in injury to workers, regardless of their nature, shall be investigated and reported. It is an integral part of any safety program that documentation take place as soon as possible so that the cause and means of prevention can be identified to prevent a reoccurrence.

In the event that an employee falls or there is some other related, serious incident occurring, this plan shall be reviewed to determine if additional practices, procedures, or training need to be implemented to prevent similar types of falls or incidents from occurring.

## VIII. Changes to Plan

Any changes to the plan will be approved by (name of the qualified person). This plan shall be reviewed by a qualified person as the job progresses to determine if additional practices, procedures or training needs to be implemented by the competent person to improve or provide additional fall protection. Workers shall be notified and trained, if necessary, in the new procedures. A copy of this plan and all approved changes shall be maintained at the jobsite.

## Sample Fall Protection Plan for Residential Construction (Insert Company Name)

### This Fall Protection Plan Is Specific For The Following Project:

Location of Job  
Date Plan Prepared or Modified  
Plan Prepared By  
Plan Approved By  
Plan Supervised By

The following Fall Protection Plan is a sample program prepared for the prevention of injuries associated with falls. A Fall Protection Plan must be developed and evaluated on a site by site basis. It is recommended that builders discuss the written Fall Protection Plan with their OSHA Area Office prior to going on a jobsite.

### I. Statement of Company Policy

(Your company name here) is dedicated to the protection of its employees from on-the-job injuries. All employees of (Your company name here) have the responsibility to work safely on the job. The purpose of the plan is to supplement our existing safety and health program and to ensure that every employee who works for (Your company name here) recognizes workplace fall hazards and takes the appropriate measures to address those hazards.

This Fall Protection Plan addresses the use of conventional fall protection at a number of areas on the project, as well as identifies specific activities that require non-conventional means of fall protection. During the construction of residential buildings under 48 feet in height, it is sometimes infeasible or it creates a greater hazard to use conventional fall protection systems at specific areas or for specific tasks. The areas or tasks may include, but are not limited to:

- a. Setting and bracing of roof trusses and rafters;
- b. Installation of floor sheathing and joists;
- c. Roof sheathing operations; and
- d. Erecting exterior walls.

In these cases, conventional fall protection systems may not be the safest choice for builders. This plan is designed to enable employers and employees to recognize the fall hazards associated with this job and to establish the safest procedures that are to be followed in order to prevent falls to lower levels or through holes and openings in walking/working surfaces.

Each employee will be trained in these procedures and will strictly adhere to them except when doing so would expose the employee to a greater hazard. If, in the employee's opinion, this is the case, the employee is to notify the competent person of their concern and have the concern addressed before proceeding.

It is the responsibility of (name of competent person) to implement this Fall Protection Plan. Continual observational safety checks of work operations and the enforcement of the safety policy and procedures shall be regularly enforced. The crew supervisor or foreman (insert name) is responsible for correcting any unsafe

practices or conditions immediately.

It is the responsibility of the employer to ensure that all employees understand and adhere to the procedures of this plan and to follow the instructions of the crew supervisor. It is also the responsibility of the employee to bring to management's attention any unsafe or hazardous conditions or practices that may cause injury to either themselves or any other employees. Any changes to the Fall Protection Plan must be approved by (name of qualified person).

## II. Fall Protection Systems To Be Used on This Job

Installation of roof trusses/rafters, exterior wall erection, roof sheathing, floor sheathing and joist/truss activities will be conducted by employees who are specifically trained to do this type of work and are trained to recognize the fall hazards. The nature of such work normally exposes the employee to the fall hazard for a short period of time. This Plan details how (Your company name here) will minimize these hazards.

### Controlled Access Zones

When using the Plan to implement the fall protection options available, workers must be protected through limited access to high hazard locations. Before any non-conventional fall protection systems are used as part of the work plan, a controlled access zone (CAZ) shall be clearly defined by the competent person as an area where a recognized hazard exists. The demarcation of the CAZ shall be communicated by the competent person in a recognized manner, either through signs, wires, tapes, ropes or chains.

(Your company name here) shall take the following steps to ensure that the CAZ is clearly marked or controlled by the competent person:

All access to the CAZ must be restricted to authorized entrants;

All workers who are permitted in the CAZ shall be listed in the appropriate sections of the Plan (or be visibly identifiable by the competent person) prior to implementation;

The competent person shall ensure that all protective elements of the CAZ be implemented prior to the beginning of work.

### Installation Procedures for Roof Truss and Rafter Erection

During the erection and bracing of roof trusses/rafters, conventional fall protection may present a greater hazard to workers. On this job, safety nets, guardrails and personal fall arrest systems will not provide adequate fall protection because the nets will cause the walls to collapse, while there are no suitable attachment or anchorage points for guardrails or personal fall arrest systems.

On this job, requiring workers to use a ladder for the entire installation process will cause a greater hazard because the worker must stand on the ladder with his back or side to the front of the ladder. While erecting the truss or rafter the worker will need both hands to maneuver the truss and therefore cannot hold onto the ladder. In addition, ladders cannot be adequately protected from movement while trusses are being maneuvered into place. Many workers may experience additional fatigue because of the increase in overhead work with heavy materials, which can also lead to a greater hazard.

Exterior scaffolds cannot be utilized on this job because the ground, after recent backfilling, cannot support the scaffolding. In most cases, the erection and dismantling of the scaffold would expose workers to a greater fall

hazard than erection of the trusses/rafters.

On all walls eight feet or less, workers will install interior scaffolds along the interior wall below the location where the trusses/rafters will be erected. "Sawhorse" scaffolds constructed of 46 inch sawhorses and 2x10 planks will often allow workers to be elevated high enough to allow for the erection of trusses and rafters without working on the top plate of the wall.

In structures that have walls higher than eight feet and where the use of scaffolds and ladders would create a greater hazard, safe working procedures will be utilized when working on the top plate and will be monitored by the crew supervisor. During all stages of truss/rafter erection the stability of the trusses/rafters will be ensured at all times.

(Your company name here) shall take the following steps to protect workers who are exposed to fall hazards while working from the top plate installing trusses/rafters:

Only the following trained workers will be allowed to work on the top plate during roof truss or rafter installation:

Workers shall have no other duties to perform during truss/rafter erection procedures;

All trusses/rafters will be adequately braced before any worker can use the truss/rafter as a support;

Workers will remain on the top plate using the previously stabilized truss/rafter as a support while other trusses/rafters are being erected;

Workers will leave the area of the secured trusses only when it is necessary to secure another truss/rafter;

The first two trusses/rafters will be set from ladders leaning on side walls at points where the walls can support the weight of the ladder; and

A worker will climb onto the interior top plate via a ladder to secure the peaks of the first two trusses/rafters being set.

The workers responsible for detaching trusses from cranes and/or securing trusses at the peaks traditionally are positioned at the peak of the trusses/rafters. There are also situations where workers securing rafters to ridge beams will be positioned on top of the ridge beam.

(Your company name here) shall take the following steps to protect workers who are exposed to fall hazards while securing trusses/rafters at the peak of the trusses/ridge beam:

Only the following trained workers will be allowed to work at the peak during roof truss or rafter installation:

Once truss or rafter installation begins, workers not involved in that activity shall not stand or walk below or adjacent to the roof opening or exterior walls in any area where they could be struck by falling objects;

Workers shall have no other duties than securing/bracing the trusses/ridge beam;

Workers positioned at the peaks or in the webs of trusses or on top of the ridge beam shall work from a stable position, either by sitting on a "ridge seat" or other equivalent surface that provides additional stability or by

positioning themselves in previously stabilized trusses/rafters and leaning into and reaching through the trusses/rafters;

Workers shall not remain on or in the peak/ridge any longer than necessary to safely complete the task.

### Roof Sheathing Operations

Workers typically install roof sheathing after all trusses/rafters and any permanent truss bracing is in place. Roof structures are unstable until some sheathing is installed, so workers installing roof sheathing cannot be protected from fall hazards by conventional fall protection systems until it is determined that the roofing system can be used as an anchorage point. At that point, employees shall be protected by a personal fall arrest system.

Trusses/rafters are subject to collapse if a worker falls while attached to a single truss with a belt/harness. Nets could also cause collapse, and there is no place to attach guardrails.

All workers will ensure that they have secure footing before they attempt to walk on the sheathing, including cleaning shoes/boots of mud or other slip hazards.

To minimize the time workers must be exposed to a fall hazard, materials will be staged to allow for the quickest installation of sheathing.

(Your company name here) shall take the following steps to protect workers who are exposed to fall hazards while installing roof sheathing:

Once roof sheathing installation begins, workers not involved in that activity shall not stand or walk below or adjacent to the roof opening or exterior walls in any area where they could be struck by falling objects;

The competent person shall determine the limits of this area, which shall be clearly communicated to workers prior to placement of the first piece of roof sheathing;

The competent person may order work on the roof to be suspended for brief periods as necessary to allow other workers to pass through such areas when this would not create a greater hazard;

Only qualified workers shall install roof sheathing;

The bottom row of roof sheathing may be installed by workers standing in truss webs;

After the bottom row of roof sheathing is installed, a slide guard extending the width of the roof shall be securely attached to the roof. Slide guards are to be constructed of no less than nominal 4" height capable of limiting the uncontrolled slide of workers. Workers should install the slide guard while standing in truss webs and leaning over the sheathing;

Additional rows of roof sheathing may be installed by workers positioned on previously installed rows of sheathing. A slide guard can be used to assist workers in retaining their footing during successive sheathing operations; and

Additional slide guards shall be securely attached to the roof at intervals not to exceed 13 feet as successive rows of sheathing are installed. For roofs with pitches in excess of 9-in-12, slide guards will be installed at four-foot intervals.

When wet weather (rain, snow, or sleet) are present, roof sheathing operations shall be suspended unless safe



footing can be assured for those workers installing sheathing.

When strong winds (above 40 miles per hour) are present, roof sheathing operations are to be suspended unless wind breakers are erected. Installation of Floor Joists and Sheathing During the installation of floor sheathing/joists (leading edge construction), the following steps shall be taken to protect workers:

Only the following trained workers will be allowed to install floor joists or sheathing:

Materials for the operations shall be conveniently staged to allow for easy access to workers;

The first floor joists or trusses will be rolled into position and secured either from the ground, ladders or sawhorse scaffolds;

Each successive floor joist or truss will be rolled into place and secured from a platform created from a sheet of plywood laid over the previously secured floor joists or trusses;

Except for the first row of sheathing which will be installed from ladders or the ground, workers shall work from the established deck; and

Any workers not assisting in the leading edge construction while leading edges still exist (e.g. cutting the decking for the installers) shall not be permitted within six feet of the leading edge under construction.

#### Erection of Exterior Walls

During the construction and erection of exterior walls, employers shall take the following steps to protect workers:

Only the following trained workers will be allowed to erect exterior walls:

A painted line six feet from the perimeter will be clearly marked prior to any wall erection activities to warn of the approaching unprotected edge;

Materials for operations shall be conveniently staged to minimize fall hazards; and

Workers constructing exterior walls shall complete as much cutting of materials and other preparation as possible away from the edge of the deck.

#### III. Enforcement

Constant awareness of and respect for fall hazards, and compliance with all safety rules are considered conditions of employment. The crew supervisor or foreman, as well as individuals in the Safety and Personnel Department, reserve the right to issue disciplinary warnings to employees, up to and including termination, for failure to follow the guidelines of this program.

#### IV. Accident Investigations

All accidents that result in injury to workers, regardless of their nature, shall be investigated and reported. It is an integral part of any safety program that documentation take place as soon as possible so that the cause and

means of prevention can be identified to prevent a reoccurrence.

In the event that an employee falls or there is some other related, serious incident occurring, this plan shall be reviewed to determine if additional practices, procedures, or training need to be implemented to prevent similar types of falls or incidents from occurring.

#### V. Changes to Plan

Any changes to the plan will be approved by (name of the qualified person). This plan shall be reviewed by a qualified person as the job progresses to determine if additional practices, procedures or training needs to be implemented by the competent person to improve or provide additional fall protection. Workers shall be notified and trained, if necessary, in the new procedures. A copy of this plan and all approved changes shall be maintained at the jobsite.

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