

ABOUT FALL PROTECTION AND STRUCTURAL STEEL ERECTION

Fall protection is a broad concept. It describes human behavior, mechanical systems, operational procedures, equipment, and regulations — all intended to protect workers from fall hazards. This guide will help you understand the fall protection concept and apply it to structural steel erection work.

Structural steel erection involves moving and erecting skeletal steel members in or on buildings and other structures. Two key structural steel erection activities involve *connecting* and *nonconnecting* tasks, and those who do these tasks need to be especially aware of fall hazards. The worker who receives and lands rigged suspended steel from a crane is doing connecting tasks. A worker does nonconnecting tasks when the steel members no longer need to be suspended by crane and rigging. Examples of nonconnecting tasks include:

- **Bolting crew work** such as plumbing guys and turnbuckles; installing, adjusting, and tightening process points; performing pneumatic operations at process points; and moving point to point.
- **Bridging crew work** such as staging, placing, and welding.
- **Laying out floor and roof decks**, including welding, cutting, and positioning.

Workers frequently do connecting and nonconnecting tasks on the same job. Because connecting and nonconnecting tasks have different fall protection requirements under OSHA rules, it is important that workers know the requirements for both types of tasks before they begin a project.

FALL PROTECTION REQUIREMENTS FOR STEEL ERECTION

The General Requirement

All workers must be protected from fall hazards when they are on unguarded surfaces more than 10 feet above a lower level or at any height above dangerous equipment.

Requirements for Workers who do Connecting Tasks

Workers who do connecting tasks more than 25 feet above a lower level must be protected by personal fall-arrest systems connected to securely anchored lifelines or lanyards. They must be protected at their work stations and while they are moving point to point. A personal fall arrest system consists of a full-body harness, connectors, and an anchorage that can support at least 5,000 pounds per attached worker. The system must be connected to a lanyard, vertical lifeline, or horizontal lifeline. Vertical lifelines or lanyards anchored to I-beams must be attached with tie-off adaptors or beam trolleys.

Personal fall arrest systems may not be practical for some connecting tasks; when that is the case, workers must be protected with safety nets that can be no more than 25 feet below the working surface and must meet the safety net requirements.

When it is feasible, workers connecting steel beams must straddle-walk the bottom flange of beams.

Workers do not need fall protection to do connecting tasks up to 25 feet above a lower level. However, as soon as they finish connecting tasks, they must be protected from falling if they are more than 10 feet above a lower level.

Requirements for Workers who do Nonconnecting Tasks

Workers who do nonconnecting tasks must be protected from falling when they are more than 10 feet above a lower level. Examples of appropriate fall protection include:

- **Personal fall arrest systems** for open-sided and leading-edge work
- **Retractable lanyards** secured to structural members for leading-edge work involving positioning, layout, cutting, or spot welding
- **Preinstalled horizontal lifelines** for positioning, layout, and spot welding
- **Double lanyards** for moving point to point
- Putting the requirements in perspective

Suppose you are a worker 20 feet above a lower level receiving a bar joist suspended by a crane (a connecting task). After receiving and landing the bar joist, you begin welding (a nonconnecting task) at the same level. You do not need fall protection to do the connecting task, but you do need fall protection when you begin welding, because you are more than 10 feet above a lower level.

FALL PROTECTION

- All employees shall be protected from fall hazards when working on unguarded surfaces more than 10 feet above a lower level or at any height above dangerous equipment, except when connecting steel beams as (below).
- Employees connecting steel beams of a skeleton steel building or structure, where the fall distance is greater than 25 feet, shall be tied off by a safety belt and lifeline to the columns, by a pendant line secured at the top of the columns, by a catenary line, or other secure anchoring method.
- When feasible, employees connecting steel beams shall “straddle walk” the bottom flange of steel beams when it is necessary to release choker lines, land intermediate members, or perform other work on the beams.
- If the procedures are impractical, then safety nets shall be used. Nets shall be installed no more than 25 feet below the working surface.

NOTE: When the work is of limited duration and limited exposure, and the hazards involved in rigging and installing the safety devices equal or exceed the hazards involved in the actual construction, these provisions may be temporarily suspended, provided adequate risk control is exercised under immediate competent supervision.

Lifelines

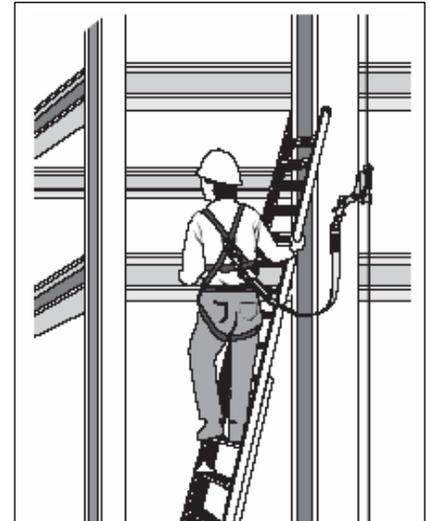
A **lifeline** is a flexible cable or rope attached to an anchor and to a personal fall-arrest system, lanyard, or deceleration device. A **vertical lifeline** hangs vertically from an anchor; it must have a minimum breaking strength of 5,000 pounds and must be connected directly to a full-body harness, lanyard, or deceleration device. Only one worker can be attached to a vertical lifeline.

A **horizontal lifeline** stretches horizontally between two anchors and must be capable of supporting at least 5,000 pounds per attached worker. A horizontal lifeline used by more than one worker at a time should be designed and installed with extreme care. Protect all lifelines from cuts and abrasions. Do not use lifelines made from natural-fiber rope.

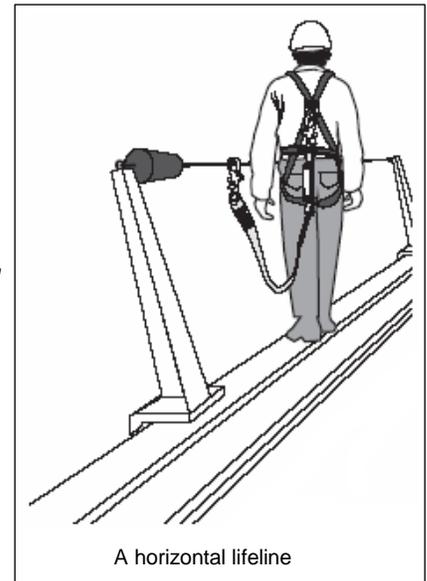
Anchoring Vertical Lifelines on Columns and Beams

There are two ways to anchor a vertical lifeline to a column: You can attach the lifeline to the top of a column while the column is still on the ground or, if the column is in place and the configuration of the structure permits, use a ladder or a powered elevated work platform to reach the anchor point at the top of the column.

There are many ways to anchor vertical lifelines to beams. If you do not need to move from your work area, you can attach a shock-absorbing lanyard to an overhead beam with a tie-off adaptor. If you need to move about, you can use a beam trolley (“beamer”) or — if the risk of a “swing fall” is not severe — a *self-retracting lifeline*. You increase the risk of a swing fall by moving away from the anchorage point, increasing the length of the lifeline. If you fall, you will swing back under the anchorage and could strike an object or a lower level during the pendulum motion. Avoid swing falls by keeping the lifeline short.



This worker is attached to a vertical lifeline with a lanyard and rope grab. The lifeline was anchored to the top of the column while it was on the ground.



Installing and Using Horizontal Lifelines

Horizontal lifelines should be designed and installed on beams before they are placed. Some horizontal lifeline systems use I-beam flange clamps and a pair of columns to support a horizontal line. After the beam has been placed, you can connect to the lifeline with a shock-absorbing lanyard or a self-retracting lifeline.

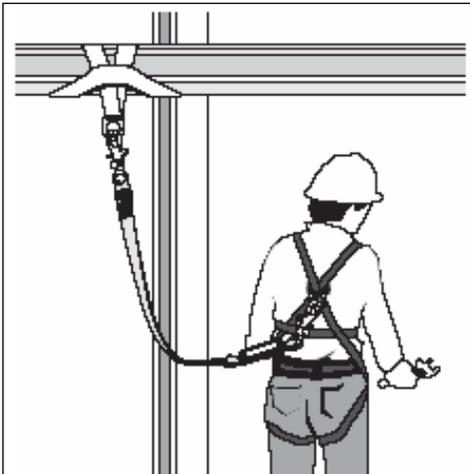
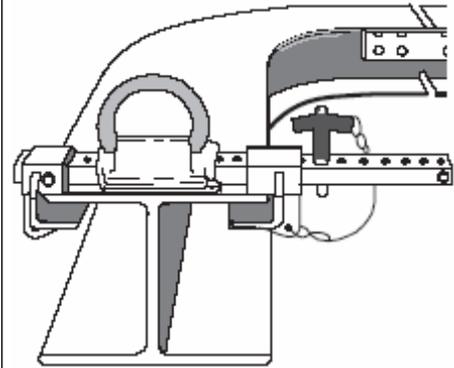
You can install horizontal lifelines after beams are in place; however, there should be attachment points on the structural members, such as welded lugs or punched holes, which will provide a secure anchor. Workers who install and connect lifelines also need to be protected from falls. They may be able to do the work from a powered elevating work platform or while they are protected by preinstalled vertical lifelines anchored to the top of a column and extended to a safe access area. Each worker can connect to a vertical lifeline with a *rope grab* and a personal fall-arrest system. A rope grab is a deceleration device that moves with a worker along a vertical lifeline and that automatically locks on the line during a fall.

Horizontal lifelines, depending on their geometry and *sag angle*, can be subjected to greater loads than the impact load imposed by an attached component. When the horizontal lifeline sag angle is less than 30 degrees, the impact force generated by an attached lanyard is greatly amplified. For example, with a sag angle of 15 degrees, the force is about 2:1. However, the force is 6:1 when the sag is five degrees. The strength of a horizontal lifeline and the anchorages to which it is attached should be several times that of its connecting components. To minimize potential loads on a horizontal lifeline, increase the sag angle or use a shock-absorbing lanyard or self-retracting lifeline with a personal fall-arrest system.

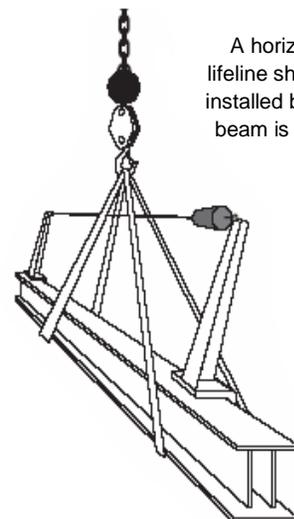
Horizontal lifeline anchorages must be capable of supporting at least 5,000 pounds per attached worker or they must be designed and installed with a safety factor of at least two (two times the impact force of a potential fall) under the supervision of a *qualified person*.

OSHA defines a qualified person as “one who by extensive knowledge, training, and experience, has successfully demonstrated the ability to resolve problems relating to a specific subject, operation, or project.” A qualified person must also be available at the work site to make sure horizontal lifelines are properly inspected.

Workers who need to move about can attach a shock-absorbing lanyard to a beam trolley (“beamer”).



If a worker does not need to move from the work area, he or she can attach a shock-absorbing lanyard to an overhead beam with a tie-off adaptor.



A horizontal lifeline should be installed before a beam is placed

TEMPORARY FLOORS, FRAME EXPOSURE, AND PERIPHERY SAFETY RAILINGS

Temporary Floors

As the frame of a structure is going up, make sure tightly planked floors are installed every two stories or 30 feet, whichever is less, directly below the tier of beams on which work is being done. This requirement does not apply while workers are gathering temporary floor planks to transfer them to the upper level. The workers must be protected from falling while they are gathering and stacking the planks.

Frame Exposure

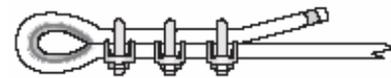
There cannot be more than four floors or 48 feet of unfinished bolting or welding above the foundation or the uppermost permanently secured floor.

Periphery Safety Railings

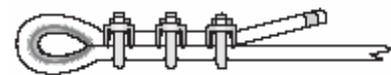
You must install a safety railing 42 inches high (± 3 inches) around the periphery of all temporary planked or temporary metal-decked floors during structural steel erection. The railing must be made of $\frac{1}{2}$ -inch-thick wire rope or a barrier of equal strength and flagged every six feet with high-visibility material.

You can construct an effective safety railing by welding $\frac{1}{2}$ -inch-thick washers to each vertical perimeter structural steel member. Thread $\frac{1}{2}$ -inch-thick wire rope through each of the washer eyes to form a single cable railing. Secure the ends of the wire rope to the columns with three U-bolt wire-rope clips on each dead end of the rope. Be aware that wire-rope clips and other end connections, if not properly installed and tightened, can fail at the connection points. Wire-rope clips must never have the saddle on the “dead” side of the line. (Remember the saying, “Never saddle a dead horse.”) The clips must be drop-forged, installed with three-inch spacing between them (six times the rope diameter), and be torqued to proper tightness. Once secured, the periphery railing must not sag below 39 inches when a 200-pound load is applied in a downward direction.

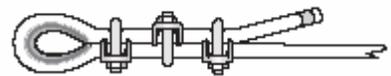
How to use wire-rope U-bolt clips



Correct Method: U-bolts on short end of rope. (No distortion on the live end of rope.)



Wrong Method: U-bolts on live end of rope. (This will cause mashed spots on live end of rope.)



Wrong Method: Staggered clips. (This will cause a mashed spot in live end of rope due to wrong position of center clip.)

FALL PROTECTION TRAINING

Structural steel erection workers must be thoroughly familiar with on-the-job hazards and the protective equipment they use to control the hazards. Make sure that those who work more than 10 feet above a lower level have been trained to do the following before they begin work:

- Recognize fall hazards in their work area
- Use appropriate procedures to minimize their exposure to fall hazards
- Attach fall protection equipment to lifelines and use it correctly
- Understand appropriate anchoring and tie-off techniques
- Estimate free-fall distances
- Inspect fall protection equipment and store it properly
- Demonstrate appropriate self-rescue procedures and techniques of fall protection equipment

Workers who do not recognize fall hazards or use fall protection equipment appropriately put themselves and their co-workers at risk. Retrain them.

PREPARING FOR EMERGENCIES

Fall protection systems are designed to minimize workers' exposure to fall hazards and to reduce their risk of injury if they do fall. Nevertheless, employers must establish procedures to ensure that workers who fall receive prompt emergency and medical attention.

Emergency procedures should identify key rescue and medical personnel, equipment available for rescue, emergency communications procedures, retrieval methods, and primary first-aid requirements.

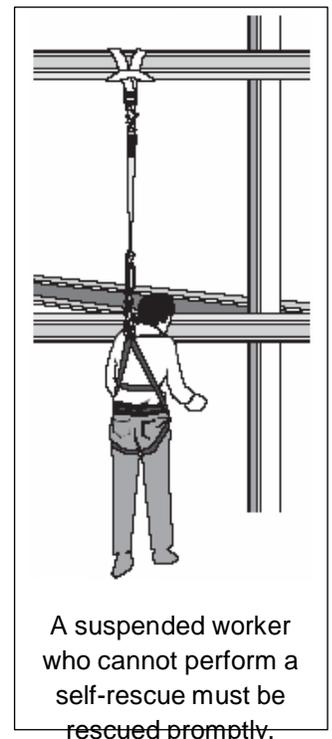
Workers in 911 service areas can use this number for ambulance service; however, most 911 responders are not trained to rescue an injured worker suspended in a personal fall-arrest system. Emergency procedures must ensure the prompt rescue of a suspended worker. The 911 number does not ensure a prompt rescue.

Use the following guidelines to develop your emergency response procedures:

Before On-Site Begins

Make fire department or other emergency responders aware of any conditions at the site that may hinder a rescue effort.

- Document rescue procedures and make sure they are posted at the worksite.
- Post emergency-responder phone numbers and addresses at the worksite.
- Mark the worksite with signs noting the easiest routes in and out of the site.
- Make sure responders have quick access to rescue and retrieval equipment such as lifts and ladders.



As On-Site Work Progresses

- Identify on-site equipment that can be used for rescue and retrieval. Examples: aerial lifts, ladders, and forklifts.
- Maintain a current equipment inventory at the site. Equipment may change frequently as the job progresses.
- Re-evaluate and update the emergency response plan if onsite work tasks change.

If an Emergency Occurs

- Call 911 or other emergency numbers in the emergency-response plan. First responders should clear a path to the victim. Others should direct emergency personnel to the scene.
- Make sure only qualified personnel attempt a technical rescue.
- Prohibit all nonessential personnel from the fall-rescue site.
- Talk to the fall victim; determine the victim's condition, if possible.
- If the victim is accessible, make the victim comfortable and check vital signs. If necessary, administer CPR and attempt to stop bleeding.

Investigating accidents

- Report fatalities and catastrophes OSHA within eight hours. Report injuries requiring overnight hospitalization and medical treatment other than first aid within 24 hours.
- Identify all equipment associated with the accident and put it out of service until the investigation is finished.
- Document what went wrong, step by step.
- Review the fall-protection procedures; determine how the procedures could be changed to prevent similar accidents; revise the procedures accordingly.
- Have a competent person examine equipment associated with the accident. If the equipment is damaged, repair or replace it. If the equipment caused the accident, determine how and why.

DEFINITIONS OF SELECTED TERMS

Anchorage — A secure point of attachment for workers' lifelines, lanyards or deceleration devices. Anchorages must be capable of supporting a minimum load of 5,000 pounds per worker or be designed, installed, and used under the supervision of a qualified person as part of a complete personal fall-arrest system that maintains a safety factor of at least two.

Body harness — Straps that distribute fall-arresting forces over the wearer's thighs, waist, chest, shoulders, and pelvis and that attach to other components of a personal fall-arrest system. The maximum arresting force permitted for a body harness is 1,800 pounds.

Competent person — One who can identify workplace hazards and who has management authorization to promptly eliminate the hazards.

Connector — (1) A device used to attach components of a personal fall protection system or positioning device. A connector may be an independent component (such as a carabineer) or an integral component (such as a buckle or D-ring sewn into a harness) of the system. Connectors must be made of drop-forged steel or similar materials, and must have a corrosion-resistant finish and smooth surfaces. Non-locking connectors are prohibited. (2) A trained ironworker who receives rigged steel members from a crane.

Deceleration device — Any mechanism that dissipates the energy imposed on a person during fall arrest. Deceleration devices include rope grabs, rip-stitch lanyards, special woven lanyards, and automatic self-retracting lifelines.

Lanyard — Flexible rope, strap, or webbing that connects a body harness to a deceleration device, lifeline, or anchor. A lanyard must have a minimum breaking strength of 5,000 pounds. Lanyards that automatically limit free-fall distance to two feet or less must have components capable of sustaining a minimum static tensile load of 3,000 pounds with the lanyard in the fully-extended position.

Lifeline — A flexible line that attaches directly to a person's body harness, lanyard, or deceleration device at one end and to an anchor at the other end. A vertical lifeline hangs from a single secure anchor. A horizontal lifeline stretches between two anchors. Lifelines must be protected against cuts or abrasions and cannot be made from natural-fiber rope.

Nonbuilding structure — Structures such as bridges, viaducts, overpasses, towers, tanks, billboards, and antennas.

Personal fall-arrest system — Protective equipment designed to stop a single worker from free falling to a lower level. Components include an anchorage, connectors, and a body harness, and may include a lanyard, deceleration device, or lifeline.

Rope grab — A deceleration device that travels on a lifeline and automatically engages the lifeline and locks to arrest a fall.

Safety net system — A fall arrest system of mesh nets including panels, connectors, and other impact-absorbing components.

Steel erection — Work involving moving and erecting skeleton steel members in or on buildings and nonbuilding structures.

Tiered — A skeleton steel framework that is erected in vertically stacked columns.

OSHA'S FALL PROTECTION REGULATIONS FOR STEEL ERECTION

General Requirements

- Each employee engaged in a steel erection activity who is on a walking/working surface with an unprotected side or edge more than 15 feet above a lower level shall be protected from fall hazards by guardrail systems, safety net systems, personal fall arrest systems, positioning device systems, or fall restraint systems.
- Perimeter safety cables. On multi-story structures, perimeter safety cables shall be installed at the final interior and exterior perimeters of the floors as soon as the metal decking has been installed.
- Connectors and employees working in controlled decking zones shall be protected from fall hazards.

Connectors

Each connector shall:

- Be protected from fall hazards of more than two stories or 30 feet above a lower level, whichever is less.
- Have completed connector training.
- Be provided, at heights over 15 and up to 30 feet above a lower level, with a personal fall arrest system, positioning device system or fall restraint system and wear the equipment necessary to be able to be tied off; or be provided with other means of protection from fall hazards.

Controlled Decking Zone (CDZ)

A controlled decking zone may be established in that area of the structure over 15 and up to 30 feet above a lower level where metal decking is initially being installed and forms the leading edge of a work area. In each CDZ, the following shall apply:

- Each employee working at the leading edge in a CDZ shall be protected from fall hazards of more than two stories or 30 feet, whichever is less.
- Access to a CDZ shall be limited to only those employees engaged in leading edge work.
- The boundaries of a CDZ shall be designated and clearly marked. The CDZ shall not be more than 90 feet wide and 90 feet deep from any leading edge. The CDZ shall be marked by the use of control lines or the equivalent.
- Each employee working in a CDZ shall have completed CDZ training.
- Unsecured decking in a CDZ shall not exceed 3,000 square feet.
- Safety deck attachments shall be performed in the CDZ from the leading edge back to the control line and shall have at least two attachments for each metal decking panel.
- Final deck attachments and installation of shear connectors shall not be performed in the CDZ.

Use of Control Lines to Demarcate Controlled Decking Zones (CDZs)

- When used to control access to areas where leading edge and initial securement of metal deck and other operations connected with leading edge work are taking place, the controlled decking zone (CDZ) is defined by a control line or by any other means that restricts access.
 - A control line for a CDZ is erected not less than 6 feet nor more than 90 feet from the leading edge.
 - Control lines extend along the entire length of the unprotected or leading edge and are approximately parallel to the unprotected or leading edge.
 - Control lines are connected on each side to a guardrail system, wall, stanchion or other suitable anchorage.
- Control lines consist of ropes, wires, tapes, or equivalent materials, and supporting stanchions as follows:
 - Each line is rigged and supported in such a way that its lowest point (including sag) is not less than 39 inches from the walking/working surface and its highest point is not more than 45 inches from the walking/working surface.
 - Each line has a minimum breaking strength of 200 pounds.

Criteria for Fall Protection Equipment

- Guardrail systems, safety net systems, personal fall arrest systems, positioning device systems and their components shall conform OSHA standards.
- Fall arrest system components shall be used in fall restraint systems and shall conform to OSHA standards. Either body belts or body harnesses shall be used in fall restraint systems.
- Perimeter safety cables shall meet the criteria for guardrail systems.

Custody of Fall Protection

Fall protection provided by the steel erector shall remain in the area where steel erection activity has been completed, to be used by other trades, only if the controlling contractor or its authorized representative:

- Has directed the steel erector to leave the fall protection in place.
- Has inspected and accepted control and responsibility of the fall protection prior to authorizing persons other than steel erectors to work in the area.

TRAINING

Training Personnel

Training required by this section shall be provided by a qualified person(s).

Fall Hazard Training

The employer shall provide a training program for all employees exposed to fall hazards. The program shall include training and instruction in the following areas:

- The recognition and identification of fall hazards in the work area.
- The use and operation of guardrail systems (including perimeter safety cable systems), personal fall arrest systems, positioning device systems, fall restraint systems, safety net systems, and other protection to be used.
- The correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection systems to be used.
- The procedures to be followed to prevent falls to lower levels and through or into holes and openings in walking/working surfaces and walls.
- The fall protection requirements for Steel Erection.

Special Training Programs

In addition to the training required, the employer shall provide special training to employees engaged in the following activities.

- **Multiple lift rigging procedure.** The employer shall ensure that each employee who performs multiple lift rigging has been provided training in the following areas:
 - The nature of the hazards associated with multiple lifts.
 - The proper procedures and equipment to perform multiple lifts.
- **Connector procedures.** The employer shall ensure that each connector has been provided training in the following areas:
 - The nature of the hazards associated with connecting.
 - The establishment, access, proper connecting techniques and work practices.
- **Controlled Decking Zone Procedures.** Where CDZs are being used, the employer shall assure that each employee has been provided training in the following areas:
 - The nature of the hazards associated with work within a CDZ.
 - The establishment, access, proper installation techniques and work practices.

FALL PROTECTION SYSTEMS CRITERIA AND PRACTICES

Guardrail Systems

Guardrail systems and their use shall comply with the following provisions:

- Top edge height of top rails, or equivalent guardrail system members, shall be 42 inches plus or minus 3 inches 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.

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.

- 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 high.
 - Midrails, when used, shall be installed at a height midway between the top edge of the guardrail system and the walking/working level.
 - 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.
 - Intermediate members (such as balusters), when used between posts, shall be not more than 19 inches apart.
 - 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 wide.
- Guardrail systems shall be capable of withstanding, without failure, a force of at least 200 pounds applied within 2 inches of the top edge, in any outward or downward direction, at any point along the top edge.
- When the 200 pound test load specified is applied in a downward direction, the top edge of the guardrail shall not deflect to a height less than 39 inches above the walking/working level.
- 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 applied in any downward or outward direction at any point along the midrail or other member.
- Guardrail systems shall be so surfaced as to prevent injury to an employee from punctures or lacerations, and to prevent snagging of clothing.
- The ends of all top rails and midrails shall not overhang the terminal posts, except where such overhang does not constitute a projection hazard.
- Steel banding and plastic banding shall not be used as top rails or midrails.
- Top rails and midrails shall be at least one-quarter inch 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.

FALL PROTECTION: STEEL ERECTION

- 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.
- When guardrail systems are used at holes, they shall be erected on all unprotected sides or edges of the hole.
- 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.
- 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.
- Guardrail systems used on ramps and runways shall be erected along each unprotected side or edge.
- 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.

Safety Net Systems

Safety net systems and their use shall comply with the following provisions:

- 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 below such level. When nets are used on bridges, the potential fall area from the walking/working surface to the net shall be unobstructed.
- Safety nets shall extend outward from the outermost projection of the work surface as follows:

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:
Up to 5 feet	8 feet
More than 5 feet up to 10 feet	10 feet
More than 10 feet	13 feet

- 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.
- Safety nets and their installations shall be capable of absorbing an impact force equal to that produced by the drop test specified.
 - Except as provided, 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 bag of sand 30 inches (± 3 inches) 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 above that level.

- When the employer can demonstrate that it is unreasonable to perform the drop-test required, the employer (or a designated competent person) shall certify that the net and net installation is in compliance 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, 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.
- 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.
- 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.
- The maximum size of each safety net mesh opening shall not exceed 36 square inches nor be longer than 6 inches on any side, and the opening, measured center-to-center of mesh ropes or webbing, shall not be longer than 6 inches. All mesh crossings shall be secured to prevent enlargement of the mesh opening.
- Each safety net (or section of it) shall have a border rope for webbing with a minimum breaking strength of 5,000 pounds.
- Connections between safety net panels shall be as strong as integral net components and shall be spaced not more than 6 inches apart.

Personal Fall Arrest Systems

Personal fall arrest systems and their use shall comply with the provisions set forth below. 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.

- Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials.
- Connectors shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of the system.
- Dee-rings and snaphooks shall have a minimum tensile strength of 5,000 pounds.
- Dee-rings and snaphooks shall be proof-tested to a minimum tensile load of 3,600 pounds without cracking, breaking, or taking permanent deformation.
- 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.

- Unless the snaphook is a locking type and designed for the following connections, snaphooks shall not be engaged:
 - Directly to webbing, rope, or wire rope.
 - To each other.
 - To a dee-ring to which another snaphook or other connector is attached.
 - To a horizontal lifeline.
 - 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.
- 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.
- 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.
- Lanyards and vertical lifelines shall have a minimum breaking strength of 5,000 pounds.
- Except as provided, when vertical lifelines are used, each employee shall be attached to a separate lifeline.
 - 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 and the strength of the lifeline is 10,000 pounds [5,000 pounds per employee attached].
- Lifelines shall be protected against being cut or abraded.
- Self-retracting lifelines and lanyards which automatically limit free fall distance to 2 feet or less shall be capable of sustaining a minimum tensile load of 3,000 pounds applied to the device with the lifeline in the fully extended position.
- Self-retracting lifelines and lanyards which do not limit free fall distance to 2 feet or less, ripstitch lanyards, and tearing and deforming lanyards shall be capable of sustaining a minimum tensile load of 5,000 pounds applied to the device with the lifeline or lanyard in the fully extended position.
- Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses shall be made from synthetic fibers.
- Anchorages 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 per employee attached, or shall be designed, installed, and used as follows:
 - As part of a complete personal fall arrest system which maintains a safety factor of at least two.
 - Under the supervision of a qualified person.
- Personal fall arrest systems, when stopping a fall, shall:
 - Limit maximum arresting force on an employee to 900 pounds when used with a body belt.

- Limit maximum arresting force on an employee to 1,800 pounds when used with a body harness.
- Be rigged such that an employee can neither free fall more than 6 feet, nor contact any lower level.
- Bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet.
- Have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet, or the free fall distance permitted by the system, whichever is less.

Note: If the personal fall arrest system meets the criteria and protocols, and if the system is being used by an employee having a combined person and tool weight of less than 310 pounds, the system will be considered to be in compliance. If the system is used by an employee having a combined tool and body weight of 310 pounds or more, then the employer must appropriately modify the criteria and protocols to provide proper protection for such heavier weights, or the system will not be in compliance.

- 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.
- 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.
- 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.
- 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.
- 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.
- Body belts shall be at least one and five-eighths (1-⁵/₈) inches wide.
- Personal fall arrest systems shall not be attached to guardrail systems, nor shall they be attached to hoists except as specified.
- 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.

Positioning Device Systems

Positioning device systems and their use shall conform to the following provisions:

- Positioning devices shall be rigged such that an employee cannot free fall more than 2 feet.
- 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, whichever is greater.

- Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials.
- Connectors shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of this system.
- Connecting assemblies shall have a minimum tensile strength of 5,000 pounds.
- Dee-rings and snaphooks shall be proof-tested to a minimum tensile load of 3,600 pounds without cracking, breaking, or taking permanent deformation.
- 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.
- Unless the snaphook is a locking type and designed for the following connections, snaphooks shall not be engaged:
 - Directly to webbing, rope, or wire rope.
 - To each other.
 - To a dee-ring to which another snaphook or other connector is attached.
 - To a horizontal lifeline; or to depress the snaphook keeper and release itself.
 - 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 inadvertently release the snaphook keeper.
- Positioning device systems shall be inspected prior to each use for wear, damage, and other deterioration, and defective components shall be removed from service.
- 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.

Falling Object Protection

Securing Loose Items Aloft

All materials, equipment, and tools, which are not in use while aloft, shall be secured against accidental displacement.

Protection from Falling Objects other than Materials being Hoisted

The controlling contractor shall bar other construction processes below steel erection unless overhead protection for the employees below is provided.

