

SECTION 27
STEEL ERECTION

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1. **STEEL ERECTION:** On July 13, 2001 OSHA announced that its final steel erection rule will go into effect on January 18, 2002. The following rules apply to all employees and subcontractors. Additional specific information can be obtained from the above referenced OSHA standard.
 - A. **OSHA Reference:** 29 CFR 1926. Subpart R (750 through 761) Appendix A through H
 - B. **Definitions:**
 1. **Anchored** Bridging means that the steel joist bridging is connected to a bridging terminus point.
 2. **Bolted Diagonal Bridging** means diagonal bridging that is bolted to a steel joist or joists.
 3. **Bridging Clip** is a device that is attached to the steel joist to allow the bolting of the bridging to the steel joist.
 4. **Bridging Terminus Point** is a wall, beam, tandem joists (with all bridging installed and a horizontal truss in the plane of the top chord) or other element at an end or intermediate point(s) of a line of bridging that provides an anchor point for the steel joist bridging.
 5. **Choker** is a wire rope or synthetic fiber rigging assembly that is used to attach a load to a hoisting device.
 6. **Cold Forming** means the process of using press brakes, rolls, or other methods to shape steel into desired cross sections at room temperature.
 7. **Column** means a load-carrying vertical member that is part of the primary skeletal framing system. Columns do not include posts.
 8. **Competent Person** is 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.
 9. **Connector** is an employee who, working with hoisting equipment, is placing and connecting structural members and/or components.
 10. **Constructibility** is the ability to erect structural steel members in accordance with subpart R without having to alter the over-all structural design.
 11. **Construction Load** (for joist erection) means any load other than the weight of the employee(s), the joists and the bridging bundle.
 12. **Controlled Decking Zone (CDZ)** is an area in which certain work (for example, initial installation and placement of metal decking) may take place without the use of guardrail systems, personal fall arrest systems, fall restraint systems, or safety net systems and where access to the zone is controlled.
 13. **Controlled Load lowering** is defined as lowering a load by means of a mechanical hoist drum device that allows a hoisted load to be lowered with maximum control using the gear train or hydraulic components of the hoist mechanism. Controlled load lowering

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- requires the use of the hoist drive motor, rather than the load hoist brake, to lower the load.
14. **Controlling Contractor** means a prime contractor, general contractor, construction manager or any other legal entity which has the overall responsibility for the construction of the project planning, quality, completion.
 15. **Critical Lift** is a lift that either exceeds 75 percent of the rated capacity of the crane or derrick, or requires the use of more than one crane or derrick.
 16. **Decking Hole** is a gap or void more than 2 inches (5.1 cm) in its least dimension and less than 12 inches (30.5 cm) in its greatest dimension in a floor, roof or other walking/working surface. Pre-engineered holes in cellular decking (for wires, cables, etc.) are not included in this definition.
 17. **Derrick Floor** means an elevated floor of a building or structure that has been designated to receive hoisted pieces of steel prior to final placement.
 18. **Double Connection** means an attachment method where the connection point is intended for two pieces of steel which share common bolts on either side of a central piece.
 19. **Double Connection Seat** is a structural attachment that, during the installation of a double connection, supports the first member while the second member is connected.
 20. **Erection Bridging** is the bolted diagonal bridging that is required to be installed prior to releasing the hoisting cables from the steel joists.
 21. **Fall Restraint System** is a fall protection system that prevents the user from falling any distance. The system is comprised of either a body belt or body harness, along with an anchorage, connectors and other necessary equipment. The other components typically include lanyard, and may also include a lifeline and other devices.
 22. **Final Interior Perimeter** is the perimeter of a large permanent open space within a building such as an atrium or courtyard. This does not include openings for stairways, elevator shafts. etc.
 23. **Girt** (in systems engineered buildings) means a “Z” or “C” shaped member formed from sheet steel spanning between primary framing and supporting wall material.
 24. **Headache Ball** is a weighted hook that is used to attach loads to the hoist load line of the crane.
 25. **Hoisting Equipment** is commercially manufactured lifting equipment designed to lift and position a load of known weight to a location at some known elevation and horizontal distance from the equipment’s center of rotation. “Hoisting equipment” includes but is not limited to cranes, derricks, tower cranes, barge-mounted derricks or cranes, gin poles and gantry hoist systems. A “come-a-long” (a mechanical device, usually consisting of a chain or cable attached at each end, that is used to facilitate movement of materials through leverage) is not considered hoisting equipment.

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26. **Leading Edge** means the unprotected side and edge of a floor, roof, or formwork for a floor or other walking/working surface (such as deck) which changes location as additional floor, roof, decking or formwork sections are placed, formed or constructed.
27. **Metal Decking** is a commercially manufactured, structural grade, cold rolled metal panel formed into a series of parallel ribs. This includes metal floor and roof decks, standing seam metal roofs, other metal roof systems and other products such as bar gratings, checker plate, expanded metal panels, and similar products. After installation and proper fastening, these decking materials serve a combination of functions including, but not limited to: a structural element designed in combination with the structure and provide a diaphragm action; a walking/working surface; a form for concrete slabs; a support for roofing systems; and a finished floor roof.
28. **Multiple Lift Rigging** means a rigging assembly manufactured by wire rope rigging suppliers that facilitates the attachment of up to five independent loads to the hoist rigging of a crane.
29. **Opening** is a gap or void 12 inches or more in its least dimension in the floor, roof or other walking/working surface. For the purposes of this section, skylights and smoke domes that do not meet the strength requirements of 1926.754 (e)(3) will be regarded as openings.
30. **Permanent Floor** is defined as a structurally completed floor at any level or elevation (including slab on grade).
31. **Personal Fall Arrest System** is a system used to arrest an employee in a fall from a working level. A personal fall arrest system consists of an anchorage, connectors, body harness and may include a lanyard, deceleration device, lifeline, or suitable combination of these. The use of a body belt for fall arrest is prohibited.
32. **Positioning Device System** is a body belt or body harness rigged to allow an employee to be supported on an elevated, vertical surface, such as a wall or column and work with both hands free while leaning.
33. **Post** means a structural member with a longitudinal axis that is essentially vertical, that weighs 300 pounds or less and is axially loaded (a load presses down on the top end), or is not axially loaded, but is laterally restrained by the above member. Posts typically support stair landings, wall framing, mezzanines and other substructures.
34. **Project Structural Engineer** of record is the registered, licensed professional responsible for the design of structural steel framing and whose seal appears on the structural contract documents.
35. **Purlin** (in systems-engineered metal buildings) is a "Z" or "C" shaped member formed from sheet steel spanning between primary framing and supporting roof material.
36. **Qualified Person** is defined as one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully

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- demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project.
37. **Safety Deck Attachment** means an initial attachment that is used to secure an initially placed sheet of decking to keep proper alignment and bearing with structural support members.
38. **Shear Connector** is headed steel studs, steel bars, steel lugs, and similar devices which are attached to a structural member for the purpose of achieving composite action with concrete.
39. **Steel Erection** is the construction, alteration or repair of steel buildings, bridges and other structures, including the installation of metal decking and all planking used during the process of erection.
40. **Steel Joist** is defined as an open web, secondary load-carrying member of 144 feet or less, designed by the manufacturer, used for the support of floors and roofs. This does not include structural steel trusses or cold-formed joists.
41. **Steel Joist Girder** is an open web, primary load-carrying member, designed by the manufacturer, used for the support of floors and roofs. This does not include structural steel trusses.
42. **Steel Truss** means an open web member designed of structural steel components by the project structural engineer of record. For purposes of this section, a steel truss is considered equivalent to a solid web structural member.
43. **Structural Steel** is a steel member, or a member made of a substitute material (such as, but not limited to, fiberglass, aluminum, or composite members). These members include, but are not limited to, steel joists, joist girders, purlins, columns, beams, trusses, splices, seats, metal decking, girts, and all bridging, and cold formed metal framing which is integrated with the structural steel framing of a building.
44. **Systems-Engineered Metal Building** is defined as a metal, field-assembled building system consisting of framing, roof and wall coverings. Typically, many of these components are cold-formed shapes. These individual parts are fabricated in one or more manufacturing facilities and shipped to the job site for assembly into the final structure. The engineering design of the system is normally the responsibility of the systems-engineered metal building manufacturer.
45. **Tank** means a container for holding gases, liquids or solids.
46. **Unprotected Sides and Edges** are any side or edge (except at entrances to points of access) of a walking/working surface, for example a floor, roof, ramp or runway, where there is no wall or guardrail system at least 39 inches high.

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C. SITE LAYOUT: A steel erection contractor will not erect steel unless it has received written notification that the concrete in the footings, piers, and walls or the mortar in the masonry piers and walls has attained, on the basis of an appropriate ASTM standard test method of field-cured samples, either 75 percent of the intended minimum compressive design strength or sufficient strength to support the loads imposed during steel erection. The controlling contractor will ensure that the following is provided and maintained:

1. Adequate access roads into and through the site for the safe delivery and movement of derricks, cranes, trucks, other necessary equipment, and the material to be erected and means and methods for pedestrian and vehicular control. This requirement does not apply to roads outside the construction site.
2. A firm, properly graded, drained area, readily accessible to the work with adequate space for the safe storage of materials and the safe operation of the erector's equipment.
3. All hoisting operations in steel erection will be pre-planned.
4. A site specific steel erection plan will be developed by a qualified person and be available at the work site when alternate means and methods are developed due to conditions specific to the site.

D. HOISTING and RIGGING.

1. Cranes being used in steel erection activities must be visually inspected prior to each shift by a competent person.
1. The inspection will include observations for deficiencies during operation and at minimum the following:
 2. All control mechanisms for maladjustments.
 3. The control and drive mechanism for excessive wear of components and contamination by lubricants, water or other foreign matter.
 4. Safety devices, including but not limited to boom angle indicators, boom stops, boom kick out devices, anti-two block devices, and load movement indicators where required.
 5. Air, hydraulic, and other pressurized lines for deterioration or leakage, particularly those that flex in normal operation.
 6. Hooks and latches for deformation, chemical damage, cracks, or wear.

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7. Wire rope reeving for compliance with hoisting equipment manufacturer's specifications.
8. Electrical apparatus for malfunctioning, signs of excessive deterioration, dirt, or moisture accumulation.
9. Hydraulic system for proper fluid level.
10. Tires for proper inflation and condition.
11. Ground conditions for proper support, including ground settling under and around outriggers, ground water accumulation, or similar conditions.
12. The hoisting equipment must be level prior to, and after each move and setup.
13. If any deficiency is identified, an immediate determination will be made by the competent person as to whether the deficiency constitutes a hazard.
14. If the deficiency is determined to constitute a hazard, the hoisting equipment must be removed from service until the deficiency has been corrected.
15. The operator will be responsible for those operations under the operator's direct control. Whenever there is any doubt as to safety, the operator will have the authority to stop and refuse to handle loads until safety has been assured.
16. A qualified rigger (a rigger who is also a qualified person) must inspect the rigging prior to each shift in accordance with 29 CFR 1926.251.
17. The headache ball, hook or load must not be used to transport personnel unless all the provisions of Subpart N Cranes, Derricks, Elevators, and conveyors are met except when the erection, use, and dismantling of conventional means of reaching the work site would be more hazardous or is not possible because of structural design or worksite conditions.
18. Cranes or derricks may be used to hoist employees on a personnel platform during steel erection work provided that provisions of Subpart N Cranes, Derricks, Elevators, and Conveyors are met except when the erection, use, and dismantling of conventional means of reaching the work site would be more hazardous or is not possible because of structural design or worksite conditions.
19. Safety latches on hooks will not be deactivated or made inoperable except when a qualified rigger has determined that the hoisting and

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placing of purlins and single joists can be performed more safely by doing so, or when equivalent protection is provided in a site-specific erection plan.

E. WORKING UNDER LOADS.

1. Routes for suspended loads must be pre-planned to ensure that no employee is required to work directly below a suspended load except for employees engaged in the initial connection of the steel, or employees necessary for the hooking or unhooking of the load.
2. Materials being hoisted will be rigged to prevent unintentional displacement.
3. Hooks with self-closing safety latches or their equivalent must be used to prevent components from slipping out of the hook.
4. All loads are to be rigged by a qualified rigger.
5. Multiple lifts will only be performed if a multiple lift rigging assembly is used.
6. A maximum of five members will be allowed during multiple lifts.
7. Only beams and similar structural members will be lifted during multiple lifts.
8. All employees engaged in the multiple lift must be trained in multiple lift procedures in accordance with 29 CFR 1926.761 (c) (1).
9. No crane is permitted to be used for a multiple lift where such use is contrary to the manufacturer's specifications and limitations.
10. Components of the multiple lift rigging assembly must be specifically designed and assembled with a maximum capacity for total assembly and for each individual attachment point. This capacity, certified by the manufacturer or a qualified rigger, must be based on the manufacturer's specifications with a 5 to 1 safety factor for all components.
11. The total load may not exceed the rated capacity of the hoisting equipment specified in the hoisting equipment load charts or the rigging capacity specified in the rigging chart.
12. The multiple lift rigging assembly must be rigged with members attached at their center of gravity and maintained reasonably level.
13. Multiple lift rigging assemblies must be rigged from the top down and rigged at least 7 feet (2.1m) apart.

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14. The members on the multiple lift rigging assembly must be set from the bottom up.
15. Controlled load lowering must be used whenever the load is over the connectors.

2. STRUCTURAL STEEL ASSEMBLY

A. Structural stability must be maintained at all times during the erection process. The following additional requirements will apply for multi-story structures:

1. For multi-story structures the permanent floors must be installed as the erection of structural members progresses, and there can be not more than eight stories between the erection floor and the upper-most permanent floor, except where the structural integrity is maintained as a result of the design.
2. At no time can there be more than four floors or 48 feet (14.6 m), whichever is less, of unfinished bolting or welding above the foundation or uppermost permanently secured floor, except where the structural integrity is maintained as a result of the design.
3. A fully planked or decked floor or nets must be maintained within two stories or 30 feet (9.1m), whichever is less, directly under any erection work being performed.

B. WALKING/WORKING SURFACES.

1. Shear Connectors and Other Similar Devices.
 - a) Tripping Hazards. Shear connectors (such as headed steel studs, steel bars or steel lugs), reinforcing bars, deformed anchors or threaded studs must not be attached to the top flanges of beams, joists or beam attachments so that they project vertically from or
 - b) horizontally across the top flange of the member until after the metal decking, or other walking/working surface, has been installed.
 - c) Installation of Shear Connectors on Composite Floors. When shear connectors are used in construction of composite floors, roofs and bridge decks, employees must lay out and install the shear connectors after the metal decking has been installed, using the metal decking as a working platform. Shear connectors must not be installed from within a controlled decking zone (CDZ), as specified in 29 CFR 1926.760 (c) (8).

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- d) Slip Resistance of Skeletal Structural Steel. Workers will not be permitted to walk the top surface of any structural steel member installed after (5 years after effective date of final rule) that has been coated with paint or similar material unless documentation or certification that the coating has achieved a minimum average slip resistance of .50 when measured with an English XL tribometer or equivalent tester on a wetted surface at a testing laboratory is provided. Such documentation or certification must be based on the appropriate ASTM standard test method conducted by a laboratory capable of performing the test. The results must be available at the site and to the steel erector. (Appendix B to subpart R references appropriate ASTM standard test methods that may be used to comply with this paragraph).

C. PLUMBING – UP

1. When deemed necessary by a competent person, plumbing – up equipment must be installed in conjunction with the steel erection process to ensure the stability of the structure.
2. When used, plumbing – up equipment must be in place and properly installed before the structure is loaded with construction material such as loads of joists, bundles of decking or bundles of bridging.
3. Plumbing – up equipment will be removed only with the approval of a competent person.

D. METAL DECKING

1. Metal decking bundle packaging and strapping must not be used for hoisting unless specifically designed for that purpose.
2. Secure loose items such as dunnage, flashing, or other materials placed on the top of the metal decking bundles to be hoisted.
3. Bundles of metal decking must be landed in accordance with the Open Web Steel Joist portion of this section.
4. Metal decking bundles will be landed on framing members so that enough support is provided to allow the bundles to be unbanded without dislodging the bundles from the supports.
5. At the end of each shift or when environmental or jobsite conditions require, metal decking must be secured against displacement.

E. ROOF and FLOOR HOLES and OPENINGS.

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1. Framed metal deck openings must have structural members turned down to allow continuous deck installation except where not allowed by structural design constraints or constructibility.
2. Roof and floor holes and openings must be decked over. Where large size, configuration or other structural design does not allow openings to be decked over (such as elevator shafts, stair wells, etc.) each employee who is on a walking/working
3. Surface with an unprotected edge or side more than 15 feet (4.6m) above a lower level must be protected from fall hazards by guardrail systems, safety net systems, personal fall arrest systems, positioning device systems or fall restraint systems.
4. Metal decking holes and openings must not be cut until immediately prior to being permanently filled with the equipment or structure needed or intended to fulfill its specific use and which meets specified strength requirements of the following section, or must be covered immediately.

F. COVERING ROOF AND FLOOR OPENINGS

1. Covers for roof and floor openings must be capable of supporting, without failure, **twice the weight of the employees, equipment and materials** that may be imposed on the cover at any one time.
2. All covers must be secured when installed to prevent accidental displacement by the wind, equipment or employees.
3. All covers must be painted with high-visibility paint or must be marked with the word "HOLE" or "COVER" to provide warning of the hazard.
4. Smoke or skylight fixtures that have been installed, are not considered covers for the purposes of this section unless they are capable of supporting, without failure, **twice the weight of the employees, equipment and materials** that may be imposed on the cover at any one time.

G. DECKING GAPS AROUND COLUMNS

1. Wire mesh, exterior plywood, or equivalent, must be installed around columns where planks or metal decking do not fit tightly. The materials used must be of sufficient strength to provide fall protection for personnel and prevent objects from falling through.

H. INSTALLATION OF METAL DECKING

1. Metal decking must be laid tightly and immediately secured upon placement to prevent accidental movement or displacement. However, a Controlled Decking Zone (CDZ) 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.
2. During initial placement, metal decking panels must be placed to ensure full support by structural members.

I. DERRICK FLOORS

1. A derrick floor must be fully decked and/or planked and the steel member connections completed to support the intended floor loading.
2. Temporary loads placed on a derrick floor must be distributed over the underlying support members so as to prevent local overloading of the decking material.

3. COLUMN ANCHORAGE

A. GENERAL REQUIREMENTS FOR ERECTION STABILITY

1. All Columns must be anchored by a minimum of 4 anchor rods (anchor bolts).
2. Each column anchor rod (anchor bolt) assembly, including the column-to-base plate weld and the column foundation, must be designed to resist a minimum eccentric gravity load of 300 pounds (136.2kg) located 18 inches (.46m) from the extreme outer face of the column in each direction at the top of the column shaft.
3. Columns must be set on level finished floors, pre-grouted leveling plates, leveling nuts, or shim packs which are adequate to transfer the construction loads.
4. All columns must be evaluated by a competent person to determine whether guying or bracing is needed. Guying or bracing must be installed if it is needed.

B. REPAIR, REPLACEMENT, FIELD MODIFICATION of ANCHOR RODS (Anchor Bolts).

1. Anchor rods (anchor bolts) must not be repaired, replaced, or field-modified without the approval of the project structural engineer of record.

2. Prior to the erection of a column, Maul Electric, Inc. must provide written notification to the steel erector if there has been any repair, replacement or modification of the anchor rods (anchor bolts) of that column.

4. BEAMS and COLUMNS

A. GENERAL

1. During the final placing of solid web structural members, the load must not be released from the hoisting line until the members are secured with at least two bolts per connection, of the same size and strength as shown in the erection drawings, drawn up wrench-tight or the equivalent as specified by the project structural engineer of record. Solid web structural members used as diagonal bracing must be secured by at least one bolt per connection drawn up wrench-tight or the equivalent as specified by the project structural engineer of record.
2. A competent person must determine if more than two bolts are necessary to ensure the stability of cantilevered members. Install additional bolts as needed.

B. DIAGONAL BRACING

1. Solid web structural members used as diagonal bracing must be secured by at least one bolt per connection drawn up wrench-tight or the equivalent as specified by the project structural engineer of record.

C. DOUBLE CONNECTIONS AT COLUMNS/BEAM WEBS OVER A COLUMN

1. When two structural members on opposite sides of a column web, or a beam web over a column, are connected sharing common connection holes, at least one bolt with its wrench-tight nut must remain connected to the first member unless a shop-attached or field-attached seat or equivalent connection device is supplied with the member. (SEE Appendix H to subpart R for examples of equivalent connection devices).
2. If a seat or equivalent device is used, the seat (or device) must be designed to support the load during the double connection process. It shall be adequately bolted or welded to both a supporting member and the first member before the nuts on the shared bolts are removed to make the double connection.

D. COLUMN SPLICES

1. Each column splice must be designed to resist a minimum eccentric gravity load of 300 pounds (136.2 kg) located 18 inches (.46 m) from the extreme outer face of the column in each direction at the top of the column shaft.

E. PERIMETER COLUMNS

1. Perimeter columns must not be erected unless they extend a minimum of 48 inches (1.2 m) above the finished floor to permit installation of perimeter safety cables prior to erection of the next tier, (see Appendix F to Subpart R for exceptions).
2. Perimeter columns must not be erected if they have holes or other devices in or attached to perimeter columns at 42-45 inches (107-114 cm) above the finished floor and the midpoint between the finished floor and the top cable for installation of perimeter safety cables, (see Appendix F to Subpart R for exceptions).

5. OPEN WEB STEEL JOISTS

A. GENERAL

1. Where steel joists are used and columns are not framed in at least two directions with solid web structural steel members, a steel joist must be field-bolted at the column. Procedures for the installation of this joist can be found in 29 CFR 1926.757 (a) (1).
2. Where constructability does not allow a steel joist to be installed at the column an alternate means of stabilizing joists must be installed on both sides near the column and must:
 - (a) Provide stability equivalent to (A) (1) of this section.
 - (b) Be designed by a qualified person.
 - (c) Be shop installed.
 - (d) Be included in the erection drawings.
 - (e) Hoisting cables must not be released until the seat at each end of the steel joist is field-bolted and the joist is stabilized.
1. Where steel joists at or near columns span 60 feet (18.3 m) or less, the joist must be designed with sufficient strength to allow one employee to release the hoisting cable without the need for erection bridging.

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2. Where steel joists at or near columns span more than 60 feet (18.3 m), the joists must be set in tandem with all bridging installed unless an alternative method of erection, which provides equivalent stability to the steel joist, is designed by a qualified person and is included in the site-specific erection plan.
3. A steel joist or steel joist girder must not be placed on any support structure unless such structure is stabilized.
4. When steel joist(s) are landed on a structure, they must be secured to prevent unintentional displacement prior to installation.
5. No modification that affects the strength of a steel joist or steel joist girder will be made without the approval of the project structural engineer of record.
6. Field-Bolted Joists, except for steel joists that have been pre-assembled into panels, connections of individual steel joists to steel structures in bays of 40 feet (12.2 m) or more must be fabricated to allow for field bolting during erection. These connections must be field-bolted unless constructability does not allow.
7. Steel joists and steel joist girders must not be used as anchorage points for a fall arrest system unless written approval to do so is obtained from a qualified person.
8. A bridging terminus point must be established before bridging is installed.

B. ATTACHMENT of STEEL JOISTS/STEEL JOIST GIRDERS

1. Each end of "K" series steel joists must be attached to the support structure with a minimum of two-inch (3 mm) fillet welds 1 inch (25 mm) long or with two ½-inch (13 mm) bolts, or the equivalent.
2. Each end of "LH" and "DLH" series steel joists and steel joist girders must be attached to the support structure with a minimum of two ¼-inch (6 mm) long, or with two ¾-inch (19 mm) bolts, or the equivalent.
3. Except for panels that have been pre-assembled from steel joists with bridging, each steel joist must be attached to the support structure, at least one end on both sides of the seat,
4. Immediately upon placement in the final erection position and before additional joists are placed.

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5. Panels that have been pre-assembled from steel joists with bridging must be attached to the structure at each corner before the hoisting cables are released.

C. STEEL JOIST ERECTION

1. Both sides of the seat of one end of each steel joist that requires bridging under Tables A and B must be attached to the support structure before hoisting cables are released.
2. For joists over 60 feet, both ends of the joist must be attached as described in Paragraph B of this section and the provisions of paragraph D of this section before the hoisting cables are released.
3. On steel joists that do not require erection bridging under Tables A and B, only one employee must be allowed on the joist until all bridging is installed and anchored.
4. Maul Electric, Inc. or subcontractor employees must not be allowed on steel joists where the span of the steel joist is equal to or greater than the span shown in Tables A and B except in accordance with 1926.757 (d).
5. When permanent bridging terminus points cannot be used during erection, additional temporary bridging terminus points are required to provide stability.

D. ERECTION BRIDGING

1. Where the span of the steel joist is equal to or greater than the span shown in Tables A and B the following will apply:
 - a. A row of bolted diagonal erection bridging must be installed near the midspan of the steel joist.
 - b. Hoisting cables must not be released until bolted diagonal erection bridging is installed and anchored.
 - c. No more than one employee must be allowed on these spans until all other bridging is installed and anchored.
2. Where the span of the steel joist is over 60 feet (18.3 m) through 100 feet (30.5 m), the following will apply:
 - a. All rows of bridging must be bolted diagonal bridging.
 - b. Two rows of bolted diagonal erection bridging must be installed near the third points of the steel joists.

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- c. Hoisting cables must not be released until this bolted diagonal erection bridging is installed and anchored.
 - d. No more than two employees will be allowed on these spans until all other bridging is installed and anchored.
 3. Where the span of the steel joist is over 100 feet (30.5 m) through 144 feet (43.9 m): the following will apply:
 - a. All rows of bridging must be bolted diagonal bridging.
 - b. Hoisting cables must not be released until all bridging is installed and anchored.
 - c. No more than two employees will be allowed on these spans until all bridging is installed and anchored.
 4. For steel members spanning over 144 feet (43.9 m), the erection methods used must be in accordance with 1926.756.
 5. Where any steel joists specified in paragraphs (C) (2) and (D) (1), (D) (2), and (D) (3) of this section is a bottom chord bearing joist, a row of bolted diagonal bridging must be provided near the support(s). This bridging must be installed and anchored before the hoisting cable(s) is released.
 6. When bolted diagonal erection bridging is required, the following will apply:
 - a. The bridging must be indicated on the erection drawing.
 - b. The erection drawing must be the exclusive indicator of the proper placement of this bridging.
 7. Shop-installed bridging clips, or functional equivalents, shall be used where the bridging bolts to the steel joists.
 8. When two pieces of bridging are attached to the steel joist by a common bolt, the nut that secures the first piece of bridging must not be removed from the bolt for the attachment of the second.
 9. Bridging attachments must not protrude above the top chord of the steel joist.

6. LANDING/PLACING LOADS

1. During the construction period, the Maul Electric, Inc. or subcontractors placing a load on steel joists must ensure that the

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- load is distributed so as not to exceed the carrying capacity of any steel joist.
2. Except for paragraph (e)(4) of this section, no construction loads are allowed on the steel joists until all bridging is installed and anchored and all joist-bearing ends are attached.
 3. The weight of a bundle of joist bridging must not exceed a total of 1,000 pounds (454 kg). A bundle of joist bridging must be placed on a minimum of three steel joists that are secured at one end. The edge of the bridging bundle must be positioned within 1 foot (.30 m) of the secured end.
 4. No bundle of decking may be placed on steel joists until all bridging has been installed and anchored and all joist bearing ends attached, unless all of the following conditions are met:
 - a. Maul Electric, Inc. has first determined from a qualified person and documented in a site-specific erection plan that the structure or portion of the structure is capable of supporting the load.
 - b. The bundle of decking is placed on a minimum of three steel joists.
 - c. The joists supporting the bundle of decking are attached at both ends.
 - d. At least one row of bridging is installed and anchored.
 - e. The total weight of the bundle of decking does not exceed 4,000 pounds (1816 kg).
 - f. Placement of the bundle of decking must be in accordance with paragraph (E) (5) of this section.
 5. The edge of the construction load must be placed within 1 foot (.30m) of the bearing surface of the joist end.

7. SYSTEMS-ENGINEERED METAL BUILDINGS

1. All of the requirements of this section apply to the erection of systems-engineered metal buildings except for the requirements in the Column Anchorage (5), and Open Web Steel Joists (6).
2. Each structural column must be anchored by a minimum of four anchor rods (anchor bolts).

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3. Rigid frames must have 50 percent of their bolts or the number of bolts specified by the manufacturer (whichever is greater) installed and tightened on both sides of the web adjacent to each flange before the hoisting equipment is released.
4. Construction loads must not be placed on any structural steel framework unless such framework is safely bolted, welded or otherwise adequately secured.
5. In girt and eave strut-to-frame connections, when girts or eave struts share common connection holes, at least one bolt with its wrench-tight nut must remain connected to the first member unless a manufacturer-supplied, field-attached seat or similar connection device is present to secure the first member so that the girt or eave strut is always secured against displacement.
6. Both ends of all steel joists or cold-frame joists must be fully bolted and/or welded to the support structure before:
 - a) Releasing the hoisting cables.
 - b) Allowing an employee on the joists.
 - c) Allowing any construction loads on the joists.
7. Purlins and girts must not be used as an anchorage point for a fall arrest system unless written approval is obtained from a qualified person.
8. Purlins may only be used as a walking/working surface when installing safety systems, after all permanent bridging has been installed and fall protection is provided.
9. Construction loads may be placed only within a zone that is within 8 feet (2.5 m) of the center-line of the primary support member.

8. FALLING OBJECT PROTECTION

A. Securing Loose Items Aloft

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

B. Protection From Falling Objects

1. For falling objects other than materials being hoisted, Maul Electric, Inc. must bar other construction processes below steel erection unless overhead protection for the employees below is provided.

9. FALL PROTECTION

A. GENERAL REQUIREMENTS:

1. Except as provided by paragraph (A) (3) of this section, 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 (4.6 m) above a lower level must be protected from fall hazards by guardrail systems, safety net systems, personal fall arrest systems, positioning device systems or fall restraint systems.
2. On multi-story structures, perimeter safety cables must be installed at the final interior and exterior perimeters of the floors as soon as the metal decking has been installed.
3. Connectors and employees working in controlled decking zones must be protected from fall hazards as provided in paragraphs (B) and (C) of this section.

B. CONNECTORS

1. Each connector must be protected in accordance with paragraph (A) (1) of this section from fall hazards of more than two stories or 30 feet (9.1 m) above a lower level, whichever is less.
2. Connectors must have completed connector training in accordance with 1926.761.
3. Connectors must be provided 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 at heights over 15 and up to 30 feet above a lower level.

C. 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 will apply:

1. Each employee working at the leading edge in a CDZ must be protected from fall hazards of more than two stories or 30 feet (9.1 m), whichever is less.
2. Access to a CDZ must be limited to only those employees engaged in leading edge work.

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3. The boundaries of a CDZ must be designated and clearly marked. The CDZ must not be more than 90 feet (27.4 m) feet deep from any leading edge. The CDZ must be marked by the use of control lines or the equivalent. Examples of acceptable procedures for demarcating CDZ's can be found in Appendix D.
4. Each employee working in a CDZ must have completed CDZ training in accordance 1926.761.
5. Unsecured decking in a CDZ must not exceed 3000 square feet.
6. Safety Deck attachments must be performed in the CDZ from the leading edge back to the control line and must have at least two attachments for each metal decking panel.
7. Final deck attachments and installation of shear connectors must not be performed in the CDZ.

D. Criteria For Fall Protection Equipment

4. Guardrail systems, safety net systems, personal fall arrests systems, positioning device systems and their components must conform to the criteria in 1926.502. (see Appendix G to this subpart).
5. Fall arrest system components must be used in fall restraint systems and must conform to the criteria in 1926.502 (see Appendix G). Either body belts or body harnesses must be used in fall restraint systems.
6. Perimeter safety cables must meet the criteria for guardrail systems in 1926.502 (see Appendix G).

E. Custody of Fall Protection.

Fall protection provided by the steel erector must remain in the area where steel erection activity has been completed, to be used by other trades, only if Maul Electric, Inc. or its authorized representative:

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

10. TRAINING

- A. **Training Personnel.** Training required by this section must be provided by a qualified person(s).

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- B. Fall Hazard Training.** The Maul Electric, Inc. shall provide a training program for all employees exposed to fall hazards. The program will include training and instruction in the following areas:
1. The recognition and identification of fall hazards in the work area.
 2. 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.
 3. The correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection used.
 4. 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 of this steel erection standard.
- C. Special Training Programs.** In addition to the training required in paragraphs (A) and (B) of this section, Maul Electric, Inc. will provide special training to employees engaged in the following activities:
1. **Multiple lift rigging procedure.** The employer must ensure that each employee who performs multiple lift rigging has been provided training in the following areas:
 - a) The nature of the hazards associated with multiple lifts.
 - b) The proper procedures and equipment to perform multiple lifts required by 1926.753.
- D. Connector Procedures.** Maul Electric, Inc. must ensure that each connector has been provided training in the following areas:
- a) The nature of the hazards associated with connecting.
 - b) The establishment, access, proper connecting techniques and work practices required.
- E. Controlled Decking Zone Procedures.** Where CDZs are being used, Maul Electric, Inc. or its subcontractors will assure that each employee has been provided training in the following areas:
- a) The nature of the hazards associated with work within a controlled decking zone.
 - b) The establishment, access, proper installation techniques and work practices required by 1926.760 © and 1926.754(e).

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Appendix A to Subpart R – Guidelines for Establishing the Components of a Site-Specific Erection Plan: Non-Mandatory Guidelines for complying with 1926.752(e).

- A.** General. This appendix serves as a guideline to assist employers who elect to develop a site-specific erection plan in accordance with 1926.752(e) with alternate means and methods to provide employee protection in accordance with 1926.752(e), 1926.753©(5), 1926.757(a)(4) and 1926.757(e)(4).
- B.** Development of a Site-Specific Erection Plan. Pre-Construction conference(s) and site inspection(s) are held between the erector and the controlling contractor, and others such as the project engineer and fabricator before the start of steel erection. The purpose of such conference(s) is to develop and review the site-specific erection plan that will meet the requirements of this section.
- C.** Components of a Site-Specific Erection Plan. In developing a site-specific erection plan, a steel erector considers the following elements:
- D.** The sequence of erection activity, developed in coordination with the controlling contractor, that includes the following:

 - 1. Material deliveries.
 - 2. Material staging and storage.
 - 3. Coordination with other trades and construction activities.
- E.** A description of the crane and derrick selection and placement procedures, including the following.

 - 1. Site preparation.
 - 2. Path for overhead loads.
 - 3. Critical Lifts, including rigging supplies and equipment.
- F.** A description of steel erection activities and procedures, including the following:

 - 1. Stability considerations requiring temporary bracing and guying.
 - 2. Erection bridging terminus point.
 - 3. Anchor rod (anchor bolt) notifications regarding repair, replacement and modifications.
 - 4. Columns and beams (including joists and purlins).

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- a) Connections.
 - b) Decking.
 - c) Ornamental and miscellaneous iron.
5. A description of the fall protection procedures that will be used to comply with 1926.760.
 6. A description of the procedures that will be used to comply with 1926.759.
 7. A description of the procedures required for hazardous non-routine tasks.
 8. A certificate for each employee who has received training for performing steel erection operations as required by 1926.761.
 9. A list of qualified and competent persons.
 10. A description of the procedures that will be utilized in the event of rescue or emergency response.
- G.** Other Plan Information. The Plan:
1. Includes the identification of the site and the project.
 2. Is signed and dated by the qualified person(s) responsible for its preparation and modification.

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Appendix B to Subpart R – Acceptable Test Methods for Testing Slip-resistance of Walking/working Surfaces (1926.754 (c) (3). Non-mandatory Guidelines for Complying with 1926.754 (C) (3).

- A.** The following references provide acceptable test methods for complying with the requirements of 1926.754 (c) (3).
1. Standard Test Method for Using a Portable Inclineable Articulated Strut Slip Tester (PIAST) (ASTM) F1677-96)
 2. Standard Test Method for Using a Variable Incidence Tribometer (VIT)(ASTM F1679-96)

Appendix C to Subpart R – Illustrations of Bridging terminus Points: Non-mandatory Guidelines for Complying with 1926.757 (a) (10) and 1926.757 (c) (5).

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Appendix D to Subpart R – Illustration of the Use of Control Lines to Demarcate Controlled Decking Zones (CDZs): Non-mandatory Guidelines for Complying with 1926.760(c) (3).

- A.** 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.
1. A control line for a CDZ is erected not less than 6 feet nor more than 90 feet from the leading edge.
 2. Control lines extend along the entire length of the unprotected or leading edge and are approximately parallel to the unprotected or leading edge.
 3. Control lines consist of ropes, wires, tapes, or equivalent materials, and supporting stanchions as follows:
 - a) 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.
 - b) Each line has a minimum breaking strength of 200 pounds.

Appendix E to Subpart R – Training: Non-mandatory Guidelines for Complying with 1926.761.

The training requirements of 1926.761 will be deemed to have met if employees have completed a training course on steel erection, including instruction in the provisions of this standard, that has been approved by the U.S. Department of Labor Bureau of Apprenticeship.

Appendix F to Subpart R – Perimeter Columns: Non-mandatory Guidelines for complying with 1926.756(e) To protect the Unprotected Side or Edge of a walking/Working Surface.

In multi-story structures, when holes in the column web are used for perimeter safety cables, the column splice must be placed sufficiently high so as not to interfere with any attachments to the column necessary for the column splice. Column splices are recommended to be placed at every other or fourth levels as design allows. Column splices at third levels are detrimental to the erection process and should be avoided if possible.

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Appendix G to Subpart R – 1926.502 (b) – (e) Fall Protection Systems Criteria and Practices

- A. Guardrail systems and their use must comply with the following provisions:
1. Top edge height of rails, or equivalent guardrail system members, must 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 of this paragraph 1926.502 (b).

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.

2. Midrails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members must 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.
3. Midrails, when used, must be installed at a height midway between the top edge of the guardrail system and the walking/working level.
4. Screens and mesh, when used, must extend from the top rail to the walking/working level and along the entire opening between top rail supports.
5. Intermediate members (such as balusters), when used between posts, must be not more than 19 inches apart.
6. Other structural members (such as additional midrails and architectural panels) must be installed such that there are no openings in the guardrail system that are more than 19 inches wide.
7. Guardrail systems must 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.
8. When the 200 pound test load specified in paragraph (b)(3) of this section (1926.502) is applied in a downward direction, the top edge of the guardrail must not deflect to a height less than 39 inches 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.
9. Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members must be capable of withstanding, without failure, a force of at least 150 pounds applied

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in any downward or outward direction at any point along the midrail or other member.

10. Guardrail systems must be so surfaced as to prevent injury to an employee from punctures or lacerations, and to prevent snagging of clothing.
11. The ends of all top rails and midrails must not overhang the terminal posts, except where such overhang does not constitute a projection hazard.
12. Steel banding and plastic banding must not be used as top rails or midrails.
13. Top rails and midrails must be at least $\frac{1}{4}$ inch nominal diameter or thickness to prevent cuts and lacerations. If wire rope is used for top rails, it must be flagged at not more than 6-foot intervals with high visibility material.
14. When guardrail systems are used at hoisting areas, a chain, gate or removable guardrail section must be placed across the access opening between guardrail sections when hoisting operations are not taking place.
15. When guardrail systems are used at holes, they must be erected on all unprotected sides or edges of the hole.
16. When guardrail systems are used around holes used for the passage of materials, the hole must 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 must be closed over with cover, or a guardrail system must be provided along all unprotected sides and edges.
17. When guardrail systems are used around holes which are used as points of access (such as ladderways), they must be provided with a gate, or be so offset that a person cannot walk directly into the hole.
18. Guardrail systems used on ramps and runways must be erected along each unprotected side or edge.
19. Manila, plastic or synthetic rope being used for top rails or midrails must 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.

B. Safety net systems and their use must comply with the following provisions:

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1. Safety nets must 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 must be unobstructed.
2. Safety nets must 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

3. Safety nets must 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 (4) of this section 1926.502.
4. Safety nets and their installations must 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.
 - a. Except as provided in paragraph (c) (4) (ii) of this section [1926.502], safety net and safety net installation must 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 must consist of a 400 pound bag of sand 30 + or – 2 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.
 - b. When the employer can demonstrate that it is unreasonable to perform the drop-test required by paragraph (c) (4) (i) of this section [1926.502], the employer (or designated competent person) must certify that the net and net installation is in compliance with the provisions of paragraphs (c) (3) and (c) (4) (i) of this section [1926.502] by preparing a certification record prior to the net being used as a fall protection system. The certification record must

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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 [1926.502] and the signature of the person making the determination and certification. The most recent certification for each net and net installation must be available at the jobsite for inspection.

5. Defective nets must not be used. Safety nets must be inspected at least once a week for wear, damage, and other deterioration. Defective components must be removed from service. Safety nets must also be inspected after any occurrence which could affect the integrity of the safety net system
 6. Materials, scrap pieces, equipment, and tools which have fallen into the safety net must be removed as soon as possible from the net and at least before the next work shift.
 7. The maximum size of each safety net mesh opening must 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, must not be longer than 6 inches. All mesh crossings must be secured to prevent enlargement of the net opening.
 8. Each safety net (or section of it) must have a border rope for webbing with a minimum breaking strength of 5,000 pounds.
 9. Connections between safety net panels must be as strong as integral net components and must be spaced not more than 6 inches apart.
- C. Personal Fall Arrest Systems. Personal fall arrest systems and their use must 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].
1. Connectors must be dropped forged, pressed or formed steel, or made of equivalent materials.
 2. Connectors must have a corrosion-resistant finish, and all surfaces and edges must be smooth to prevent damage to interfacing parts of the system.
 3. Dee-rings and snaphooks must have a minimum tensile strength of 5,000 pounds.

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4. Dee-rings and snaphooks must be proof-tested to a minimum tensile load of 3,600 pounds without cracking, breaking, or taking permanent deformation.
5. Snaphooks must 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.
6. Unless the snaphook is a locking type and designed for the following connections, snaphooks must not be engaged:
 - a. Directly to webbing, rope or wire rope.
 - b. To each other.
 - c. To a dee-ring to which another snaphook or other connector is attached.
 - d. To a horizontal lifeline.
 - e. 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.
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 must be capable of locking in both directions on the lifeline.
8. Horizontal lifelines must 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.
9. Lanyards and vertical lifelines must have a minimum breaking strength of 5,000 pounds

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10. Except as provided in paragraph (d) (10) (ii) of this section [1926.502], when vertical lifelines are used, each employee must be attached to a separate lifeline.
 - a. 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]; and all other criteria specified in this paragraph for lifelines have been met.
11. Lifelines must be protected against being cut or abraded.
12. Self – retracting lifelines and lanyards which automatically limit free fall distance to 2 feet or less must be capable of sustaining a minimum tensile load of 3,000 pounds applied to the device with the lifeline or lanyard in the fully extended position.
13. Self-retracting lifelines and lanyards which do not limit free fall distance to 2 feet or less, ripstitch lanyards, and tearing and deforming lanyards must 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.
14. Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses must be made from synthetic fibers.
15. Anchorages used for attachment of personal fall arrest equipment must 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:
 - a. As part of a complete personal fall arrest system which maintains a safety factor of at least two.
 - b. Under the supervision of a qualified person.
16. Personal fall arrest systems, when stopping a fall, must:
 - a. Limit maximum arresting force on an employee to 900 pounds when used with a body belt.
 - b. Limit maximum arresting force on an employee to 1,800 pounds when used with a body harness.

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- c. Be rigged such that an employee can neither free fall more than 6 feet, nor contact any lower level.
- d. Bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet.
- e. 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 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, the system will be considered to be in compliance with the provisions of paragraph (d) (16) of this section [1926.502]. 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 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].

- 17. The attachment point of the body belt must be located in the center of the wearer's back. The attachment point of the body harness must be located in the center of the wearer's back near shoulder level, or above the wearer's head.
- 18. Body belts, harnesses, and components must be used only for employee protection (as part of a personal fall arrest system or positioning device system) and not to hoist materials.
- 19. Personal fall arrest systems and components subjected to impact loading must be immediately removed from service and must not be used again for employee protection until inspected and determined by a competent person to be undamaged and suitable for reuse.
- 20. The employer must provide for prompt rescue of employees in the event of a fall or shall assure that employees are able to rescue themselves.
- 21. Personal fall arrest systems must be inspected prior to each use for wear, damage and other deterioration, and defective components must be removed from service.
- 22. Body belts must be at least one and five-eighths (1 5/8) inches wide.
- 23. Personal fall arrest systems must not be attached to guardrail systems, nor must they be attached to hoists except as specified in other subparts of this Part.

24. When a personal fall arrest system is used at hoist areas, it must be rigged to allow the movement of the employee only as far as the edge of the walking/working surface.

D. Positioning Device Systems

1. Positioning devices must be rigged such that an employee cannot free fall more than 2 feet.
2. Positioning devices must 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.
3. Connectors must be drop forged, pressed or formed steel, or made of equivalent materials.
4. Connectors must have a corrosion-resistant finish, and all surfaces and edges must be smooth to prevent damage to interfacing parts of this system.
5. Connecting assemblies must have a minimum tensile strength of 5,000 pounds.
6. Dee-rings and snaphooks must be proof-tested to a minimum tensile load of 3,600 pounds without cracking, breaking, or taking permanent deformation.
7. Snaphooks must 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 must 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 must be used.
8. Unless the snaphook is a locking type and designed for the following connections, snaphooks must not be engaged:
 - a. Directly to webbing, rope or wire rope.
 - b. To each other.
 - c. To a dee-ring to which another snaphook or other connector is attached.
 - d. To a horizontal lifeline, or to depress the snaphook keeper and release itself.

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- e. To any object which is incompatibly shaped or dimensioned in relation to the snap hook such that unintentional disengagement could occur by the connected object being able to depress the snaphook keeper and release itself.
9. Positioning device systems must be inspected prior to each use for wear, damage, and other deterioration, and defective components must be removed from service.
10. Body belts, harnesses, and components must be used only for employee protection (as part of a personal fall arrest system or positioning device system) and not to hoist materials.

Appendix H to Subpart R --- Double Connections: Illustrations of a Clipped End Connection and a Staggered Connection: Non-Mandatory Guidelines for Complying with 1926.756 (c) (1).

Clipped end connections are connection material on the end of a structural member which has a notch at the bottom and/or top to allow the bolt(s) of the first member placed on the opposite side of the central member to remain in place. The notch(es) fits around the nut or bolt head of the opposing member to allow the second member to be bolted up without removing the bolt(s) holding the first member.

Staggered connections are connection material on a structural member in which all of the bolt holes in the common member web are not shared by the two incoming members in the final connection. The extra hole in the column web allows the erector to maintain at least a one bolt connection at all times while making the double connection.