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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, shall be based on the manufacturer's specifications with a 5 to 1 safety factor for all components.

(3) The total load shall not exceed:

(i) The rated capacity of the hoisting equipment specified in the hoisting equipment load charts;

(ii) The rigging capacity specified in the rigging rating chart.

(4) The multiple lift rigging assembly shall be rigged with members:

(i) Attached at their center of gravity and maintained reasonably level;

(ii) Rigged from top down; and

(iii) Rigged at least 7 feet (2.1 m) apart.

(5) The members on the multiple lift rigging assembly shall be set from the bottom up.

(6) Controlled load lowering shall be used whenever the load is over the connectors.

[66 FR 5265, Jan. 18, 2001, as amended at 75 FR 48134, Aug. 9, 2010]

§ 1926.754 Structural steel assembly.

(a) Structural stability shall be maintained at all times during the erection process.

NOTE TO PARAGRAPH (a): Federal Highway Administration (FHWA) regulations incorporate by reference a number of standards, policies, and standard specifications published by the American Association of State Highway and Transportation Officials (AASHTO) and other organizations. (See 23 CFR 625.4). Many of these incorporated provisions may be relevant to maintaining structural stability during the erection process. For instance, as of May 17, 2010, in many cases FHWA requires a Registered Engineer to prepare and seal working drawings for falsework used in highway bridge construction. (See AASHTO Specifications for Highway Bridges, Div. II, § 3.2.1, 15th edition, 1992, which FHWA incorporates by reference in 23 CFR 625.4). FHWA also encourages compliance with AASHTO Specifications that the FHWA regulations do not currently incorporate by reference. (See <http://www.fhwa.dot.gov/bridge/lrfd/index.htm>.)

(b) The following additional requirements shall apply for multi-story structures:

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(1) The permanent floors shall be installed as the erection of structural members progresses, and there shall 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 shall 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 shall be maintained within two stories or 30 feet (9.1 m), whichever is less, directly under any erection work being performed.

(c) *Walking/working surfaces—shear connectors and other similar devices—*(1) *Tripping hazards.* Shear connectors (such as headed steel studs, steel bars or steel lugs), reinforcing bars, deformed anchors or threaded studs shall not be attached to the top flanges of beams, joists or beam attachments so that they project vertically from or horizontally across the top flange of the member until after the metal decking, or other walking/working surface, has been installed.

(2) *Installation of shear connectors on composite floors, roofs and bridge decks.* When shear connectors are used in construction of composite floors, roofs and bridge decks, employees shall lay out and install the shear connectors after the metal decking has been installed, using the metal decking as a working platform. Shear connectors shall not be installed from within a controlled decking zone (CDZ), as specified in § 1926.760(c)(7).

(d) *Plumbing-up.* (1) When deemed necessary by a competent person, plumbing-up equipment shall be installed in conjunction with the steel erection process to ensure the stability of the structure.

(2) When used, plumbing-up equipment shall 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 shall be removed only with the approval of a competent person.

(e) *Metal decking*—(1) *Hoisting, landing and placing of metal decking bundles.* (i) Bundle packaging and strapping shall not be used for hoisting unless specifically designed for that purpose.

(ii) If loose items such as dunnage, flashing, or other materials are placed on the top of metal decking bundles to be hoisted, such items shall be secured to the bundles.

(iii) Bundles of metal decking on joists shall be landed in accordance with §1926.757(e)(4).

(iv) Metal decking bundles shall 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.

(v) At the end of the shift or when environmental or jobsite conditions require, metal decking shall be secured against displacement.

(2) *Roof and floor holes and openings.* Metal decking at roof and floor holes and openings shall be installed as follows:

(i) Framed metal deck openings shall have structural members turned down to allow continuous deck installation except where not allowed by structural design constraints or constructibility.

(ii) Roof and floor holes and openings shall 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.) employees shall be protected in accordance with §1926.760(a)(1).

(iii) Metal decking holes and openings shall 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 the strength requirements of paragraph (e)(3) of this section, or shall be immediately covered.

(3) *Covering roof and floor openings.* (i) Covers for roof and floor openings shall 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.

(ii) All covers shall be secured when installed to prevent accidental dis-

placement by the wind, equipment or employees.

(iii) All covers shall be painted with high-visibility paint or shall be marked with the word "HOLE" or "COVER" to provide warning of the hazard.

(iv) Smoke dome or skylight fixtures that have been installed, are not considered covers for the purpose of this section unless they meet the strength requirements of paragraph (e)(3)(i) of this section.

(4) *Decking gaps around columns.* Wire mesh, exterior plywood, or equivalent, shall 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.

(5) *Installation of metal decking.* (i) Except as provided in §1926.760(c), metal decking shall be laid tightly and immediately secured upon placement to prevent accidental movement or displacement.

(ii) During initial placement, metal decking panels shall be placed to ensure full support by structural members.

(6) *Derrick floors.* (i) A derrick floor shall be fully decked and/or planked and the steel member connections completed to support the intended floor loading.

(ii) Temporary loads placed on a derrick floor shall be distributed over the underlying support members so as to prevent local overloading of the deck material.

[66 FR 5265, Jan. 18, 2001, as amended at 71 FR 2885, Jan. 18, 2006; 71 FR 16674, Apr. 3, 2006; 75 FR 27429, May 17, 2010; 85 FR 8745, Feb. 18, 2020]

§ 1926.755 Column anchorage.

(a) *General requirements for erection stability.* (1) All columns shall 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, shall be designed to resist a minimum eccentric gravity load of 300 pounds (136.2 kg) located 18 inches (.46m) from the extreme outer face of the column in each direction at the top of the column shaft.

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(3) Columns shall 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 shall be evaluated by a competent person to determine whether guying or bracing is needed; if guying or bracing is needed, it shall be installed.

(b) *Repair, replacement or field modification of anchor rods (anchor bolts).* (1) Anchor rods (anchor bolts) shall 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, the controlling contractor shall 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.

§ 1926.756 Beams and columns.

(a) *General.* (1) During the final placing of solid web structural members, the load shall 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, except as specified in paragraph (b) of this section.

(2) A competent person shall determine if more than two bolts are necessary to ensure the stability of cantilevered members; if additional bolts are needed, they shall be installed.

(b) *Diagonal bracing.* Solid web structural members used as diagonal bracing shall 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)(1) *Double connections at columns and/or at beam webs over a column.* 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 shall remain connected to the first member unless a shop-attached or field-attached seat or equivalent connection device is supplied with the member to

secure the first member and prevent the column from being displaced (See appendix H to this subpart for examples of equivalent connection devices).

(2) If a seat or equivalent device is used, the seat (or device) shall 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.* Each column splice shall 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.* Perimeter columns shall not be erected unless:

(1) The perimeter columns 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, except where constructibility does not allow (see appendix F to this subpart);

(2) The perimeter columns 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 to permit installation of perimeter safety cables required by § 1926.760(a)(2), except where constructibility does not allow. (See appendix F to this subpart).

§ 1926.757 Open web steel joists.

(a) *General.* (1) Except as provided in paragraph (a)(2) of this section, where steel joists are used and columns are not framed in at least two directions with solid web structural steel members, a steel joist shall be field-bolted at the column to provide lateral stability to the column during erection. For the installation of this joist:

(i) A vertical stabilizer plate shall be provided on each column for steel joists. The plate shall be a minimum of 6 inch by 6 inch (152 mm by 152 mm) and shall extend at least 3 inches (76 mm) below the bottom chord of the joist with a $\frac{13}{16}$ inch (21 mm) hole to provide an attachment point for guying or plumbing cables.

(ii) The bottom chords of steel joists at columns shall be stabilized to prevent rotation during erection.

(iii) Hoisting cables shall not be released until the seat at each end of the steel joist is field-bolted, and each end of the bottom chord is restrained by the column stabilizer plate.

(2) Where constructibility does not allow a steel joist to be installed at the column:

(i) an alternate means of stabilizing joists shall be installed on both sides near the column and shall:

(A) provide stability equivalent to paragraph (a)(1) of this section;

(B) be designed by a qualified person;

(C) be shop installed; and

(D) be included in the erection drawings.

(ii) hoisting cables shall not be released until the seat at each end of the steel joist is field-bolted and the joist is stabilized.

(3) Where steel joists at or near columns span 60 feet (18.3 m) or less, the joist shall be designed with sufficient strength to allow one employee to release the hoisting cable without the need for erection bridging.

(4) Where steel joists at or near columns span more than 60 feet (18.3 m), the joists shall 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.

(5) A steel joist or steel joist girder shall not be placed on any support structure unless such structure is stabilized.

(6) When steel joist(s) are landed on a structure, they shall be secured to prevent unintentional displacement prior to installation.

(7) No modification that affects the strength of a steel joist or steel joist girder shall be made without the approval of the project structural engineer of record.

(8) *Field-bolted joists.* (i) 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 shall be fabricated to allow for field bolting during erection.

(ii) These connections shall be field-bolted unless constructibility does not allow.

(9) Steel joists and steel joist girders shall not be used as anchorage points for a fall arrest system unless written approval to do so is obtained from a qualified person.

(10) A bridging terminus point shall be established before bridging is installed. (See appendix C to this subpart.)

(b) *Attachment of steel joists and steel joist girders.* (1) Each end of "K" series steel joists shall be attached to the support structure with a minimum of two ¼-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 shall be attached to the support structure with a minimum of two ¼-inch (6 mm) fillet welds 2 inches (51 mm) long, or with two ¾-inch (19 mm) bolts, or the equivalent.

(3) Except as provided in paragraph (b)(4) of this section, each steel joist shall be attached to the support structure, at least at one end on both sides of the seat, immediately upon placement in the final erection position and before additional joists are placed.

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

(c) *Erection of steel joists.* (1) Both sides of the seat of one end of each steel joist that requires bridging under Tables A and B shall be attached to the support structure before hoisting cables are released.

(2) For joists over 60 feet, both ends of the joist shall be attached as specified in paragraph (b) of this section and the provisions of paragraph (d) of this section met before the hoisting cables are released.

(3) On steel joists that do not require erection bridging under Tables A and B, only one employee shall be allowed on the joist until all bridging is installed and anchored.

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TABLE A—ERECTION BRIDGING FOR SHORT SPAN JOISTS

Joist	Span
8L1	NM
10K1	NM
12K1	23–0
12K3	NM
12K5	NM
14K1	27–0
14K3	NM
14K4	NM
14K6	NM
16K2	29–0
16K3	30–0
16K4	32–0
16K5	32–0
16K6	NM
16K7	NM
16K9	NM
18K3	31–0
18K4	32–0
18K5	33–0
18K6	35–0
18K7	NM
18K9	NM
18K10	NM
20K3	32–0
20K4	34–0
20K5	34–0
20K6	36–0
20K7	39–0
20K9	39–0
20K10	NM
22K4	34–0
22K5	35–0
22K6	36–0
22K7	40–0
22K9	40–0
22K10	40–0
22K11	40–0
24K4	36–0
24K5	38–0
24K6	39–0
24K7	43–0
24K8	43–0
24K9	44–0
24K10	NM
24K12	NM
26K5	38–0
26K6	39–0
26K7	43–0
26K8	44–0
26K9	45–0
26K10	49–0
26K12	NM
28K6	40–0
28K7	43–0
28K8	44–0
28K9	45–0
28K10	49–0
28K12	53–0
30K7	44–0
30K8	45–0
30K9	45–0
30K10	50–0
30K11	52–0
30K12	54–0
10KCS1	NM
10KCS2	NM
10KCS3	NM
12KCS1	NM
12KCS2	NM
12KCS3	NM
14KCS1	NM

TABLE A—ERECTION BRIDGING FOR SHORT SPAN JOISTS—Continued

Joist	Span
14KCS2	NM
14KCS3	NM
16KCS2	NM
16KCS3	NM
16KCS4	NM
16KCS5	NM
18KCS2	35–0
18KCS3	NM
18KCS4	NM
18KCS5	NM
20KCS2	36–0
20KCS3	39–0
20KCS4	NM
20KCS5	NM
22KCS2	36–0
22KCS3	40–0
22KCS4	NM
22KCS5	NM
24KCS2	39–0
24KCS3	44–0
24KCS4	NM
24KCS5	NM
26KCS2	39–0
26KCS3	44–0
26KCS4	NM
26KCS5	NM
28KCS2	40–0
28KCS3	45–0
28KCS4	53–0
28KCS5	53–0
30KCS3	45–0
30KCS4	54–0
30KCS5	54–0

NM = diagonal bolted bridging not mandatory.

TABLE B—ERECTION BRIDGING FOR LONG SPAN JOISTS

Joist	Span
18LH02	33–0.
18LH03	NM.
18LH04	NM.
18LH05	NM.
18LH06	NM.
18LH07	NM.
18LH08	NM.
18LH09	NM.
20LH02	33–0.
20LH03	38–0.
20LH04	NM.
20LH05	NM.
20LH06	NM.
20LH07	NM.
20LH08	NM.
20LH09	NM.
20LH10	NM.
24LH03	35–0.
24LH04	39–0.
24LH05	40–0.
24LH06	45–0.
24LH07	NM.
24LH08	NM.
24LH09	NM.
24LH10	NM.
24LH11	NM.
28LH05	42–0.
28LH06	42–0.
28LH07	NM.
28LH08	NM.