

Lesson: Steel Erection

Lesson Objectives:

- List common steel erection activities and explain the importance of preplanning in steel erection.
- Describe OSHA requirements for these common steel erection activities: rigging and hoisting, structure steel assembly, column stability, and beams and columns.
- Describe OSHA requirements for open web steel joints.
- Describe OSHA requirements for systems-engineered metal buildings.
- Summarize the fall protection requirements in steel erection, including requirements for connectors and CDZ.

Topics

- Steel Erection and Preplanning
- OSHA Requirements
- Open Web Steel Joists
- System-Engineered Metal Buildings
- Fall Protection In Steel Erection

Topic: Steel Erection and Preplanning

This topic reviews where steel erection may occur, common steel erection activity, and the importance of preplanning in steel erection. Having completed this topic, you should be able to:

- List steel erection activities that OSHA covers
- Describe what needs to be considered when planning steel erection

Topic summary:

Please take a moment to review these major points before you continue with the next topic.

- OSHA covers the following steel erection activities:
 - Hoisting, laying out, placing, connecting, welding, burning, guying, bracing, bolting, plumbing, and rigging structural steel, steel joists, and metal buildings
 - Installing metal decking, curtain walls, window walls, siding systems, miscellaneous metals, ornamental iron and similar materials
 - Moving point-to-point while performing these activities
- Under current practices in the industry, erection decisions are often made in the field when the steel arrives. OSHA believes that preplanning and coordination should be carried out before any steel erection activities and has made the following requirements:
 - The controlling contractor must follow OSHA requirements in regard to the site layout prior to steel erection activities.
 - All hoisting operations that are to take place during steel erection operations must be planned in advance and be in compliance with the OSHA requirements for hoisting.

Topic: OSHA Requirements

This topic reviews OSHA requirements for some common steel erection activities. Having completed this topic, you should be able to:

- Describe OSHA requirements for rigging and hoisting steel members and materials
- Describe OSHA requirements for structural steel assembly
- Describe OSHA requirements for column stability
- Describe OSHA requirements for beams and columns

Topic summary:

Please take a moment to review these major points before you continue with the next topic.

- A competent person must visually inspect cranes that are being used in steel erection activities prior to each shift, and the inspection must include observation for deficiencies during operation.
- During steel erection activities, the routes for suspended loads must be preplanned to ensure that no employee is required to work directly below a suspended load, except for employees who are engaged in the initial connection of the steel or who are involved in hooking or unhooking the load.
- No crane may be used for a multiple lift if its use would go against the manufacturer's specifications and limitations.
- It is vital that structural stability be maintained at all times during the erection process. OSHA has set up requirements for the assembly of structural steel around three areas:
 - Walking/Working Surfaces
 - Plumbing-Up
 - Metal Decking
- Inadequate anchor rod (anchor bolt) installation has been identified as a contributing factor to structural collapses. It is important to ensure that columns are adequately stabilized during their erection to withstand construction loads:
 - All columns must be anchored by a minimum of four anchor rods (anchor bolts). In addition, the columns must be set on level finished floors, pregrouted leveling plates, leveling nuts, or shim packs that are adequate to transfer the construction loads.
 - All columns must be evaluated by a competent person to determine if guying or bracing is needed. Where it is determined by the competent person that guying or bracing is needed, it must be installed to ensure stability.
- Inappropriate or inadequate connections of beams and columns is hazardous and can lead to collapses and worker fatalities. Remember these two general requirements:
 - 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 that are the same size and strength as shown in the erection drawings. The bolts must be drawn up wrench-tight.
 - A competent person must determine if more than two bolts are necessary to ensure the stability of cantilevered members. If so, additional bolts must be installed prior to release from the hoisting line.

Topic: Open Web Steel Joists

Some of the most serious risks facing employees engaged in steel erection are encountered during the erection of open web steel joists, particularly landing loads on unbridged joists and improperly placing loads on joists. Based on an analysis of fatalities, OSHA determined that of the approximately 40 fatalities caused by collapse, more than half were related to the erection of steel joists.

OSHA has developed the combination of specification and performance requirements to provide more comprehensive protection to workers engaged in these activities. This topic presents these requirements. Having completed this topic, you should be able to:

- Describe OSHA requirements for working with/around open web steel joists

Topic summary:

Please take a moment to review these key points before you continue with the next topic:

- During construction operations 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 fieldbolted at the column to provide lateral stability to the column during erection.
 - A vertical stabilizer plate must be provided on each column for steel joists. The plate must be a minimum of 6 inches by 6 inches and must extend at least 3 inches below the bottom chord of the joist with a 13/16-inch hole to provide an attachment point for guying or plumbing cables.
 - The bottom chords of steel joists at columns must be stabilized to prevent rotation during erection.
 - Hoisting cables must not be released until the seat at each end of the steel joist is field-bolted and each end of the bottom chord restrained by the column stabilizer plate.
- During the erection of steel joists, both sides of the seat of one end of each steel joist that requires bridging must be attached to the support structure before hoisting cables are released.
- There are different safety requirements for bridging that apply to different ranges of spans.
- When placing a load on steel joists during construction, you must ensure that the load is distributed so that it will not exceed the carrying capacity of any steel joist.

Topic: System-Engineered Metal Buildings

If you look at steel erection activities, those associated with systems-engineered metal buildings are different from those associated with conventional steel erection. Now, over 50 percent of industrial buildings in steel erection are systems-engineered.

This topic reviews safety requirements to erect systems-engineered metal buildings safely.

Having completed this topic, you should be able to:

- Describe OSHA requirements for systems-engineered metal buildings

Topic Summary

Please take a moment to review these key points before you continue with the next topic.

- Each structural column must be anchored by a minimum of four anchor rods (anchor bolts).
- Both ends of all steel joists or cold-formed joists must be fully bolted and/or welded to the support structure before releasing the hoisting cables, allowing an employee on the joists, or allowing any construction loads on the joists.
- Construction loads may be placed only within a zone that is within eight feet of the centerline of the primary support member.

Topic: Fall Protection in Steel Erection

This topic reviews fall protection in steel erection. Having completed this topic, you should be able to:

- Describe general requirements for fall protection in steel erection
- Describe the fall protection requirements for connectors
- Define a controlled decking zone (CDZ)

Topic Summary

Please take a moment to review these key points before you continue with the next topic.

- Except for connectors, 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 must be protected from fall hazards by guardrail systems, safety net systems, personal fall arrest systems, positioning device systems, or fall restraint systems.
- A connector must be protected from fall hazards of more than 2 stories or 30 feet above a lower level, whichever is less, by guardrail systems, safety net systems, personal fall arrest systems, positioning device systems, or fall restraint systems.
- A controlled decking zone may be established in that area of the structure over 15 feet 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.
- Guardrail systems, safety net systems, personal fall arrest systems, positioning device systems, and their components must conform to the criteria established in the OSHA Fall Protection standard.