Module 16: Scaffolds Pages 374 - 403

Virgin Islands—have plans that cover the public sector only, and use federal OSHA regulations for private industry. There are 28 states/territories that use only federal OSHA regulations.

- Consultation assistance is available upon request to employers who want help in establishing and maintaining a safe and healthful workplace. Funded equally by OSHA and each state, consultation services are provided at no cost to the employer.
- Voluntary Protection Programs (VPPs) recognize employers and workers in the private industry who have implemented effective safety and health management systems and maintain injury and illness rates below national Bureau of Labor Statistics averages for their respective industries. To participate, employers must submit an application to OSHA and undergo a rigorous onsite evaluation by a team of safety and health professionals.
- OSHA's Strategic Partnership Program, the newest of OSHA's cooperative programs, helps encourage, assist, and recognize the efforts of partners to eliminate serious workplace hazards and achieve a high level of worker safety and health.
- OSHA's area offices offer a variety of information services, such as compliance assistance, technical advice, publications, audiovisual aids, and speakers for special engagements. OSHA's Training Institute in Arlington Heights, IL, provides basic and advanced courses in safety and health for federal and state compliance officers, state consultants, federal agency personnel, and private sector employers, employees, and their representatives.

Module 16: Scaffolds

Module Description

This module provides a general overview of the safety measures that are required when working on a scaffold. The module begins with an introduction into the various types of scaffolds and goes on to outline the OSHA safety requirements and safety measures that can be taken to ensure that employees working on scaffolds are safe.

Module Learning Objectives

At the conclusion of this module, students will be able to:

- Describe the various classifications of scaffolds
- Discuss the basic OSHA safety requirements
- Describe the measures that can be taken to ensure safe working conditions on a scaffold

Lesson 1: Introduction to Scaffolds

Lesson Focus

At the end of this lesson, students will be able to:

- Explain what a scaffold is and how it works
- Describe the types of scaffolds

An estimated 2.3 million construction workers, or 65 percent of the construction industry, work on scaffolds. Protecting these workers from scaffold-related accidents may prevent some of the 4,500 injuries and over 60 deaths every year, at a savings for American employers of $90 million in workdays not lost.

What is a Scaffold?

A scaffold is a term that describes any sort of temporary elevated platform that is used to support workers, materials, or both. They are commonly used in the construction field (usually in the construction of buildings); however, they are also used in other fields such as ship construction and by cleaning services (to clean the outer windows of high rises).

Workers who use scaffolds can be divided into three groups:

Erectors and dismantlers: Whose principal activity involves assembling and disassembling scaffolding before other work can begin, and after that work, or a portion of it, has been completed.

Scaffold users: Workers whose work requires them to be supported by scaffolding to access the area of a structure where that work is performed.

Scaffold designers: workers who are qualified to design scaffolds.

Types of Scaffolds

There are two basic types of scaffolds:

- Supported scaffolds, which consist of one or more platforms supported by rigid, load-bearing members, such as poles, legs, frames, outriggers, etc.
- Suspended scaffolds, which are one or more platforms suspended by ropes or other non-rigid, overhead support

Other types of equipment, principally scissor lifts and aerial lifts, can also be regarded as supported scaffolds.



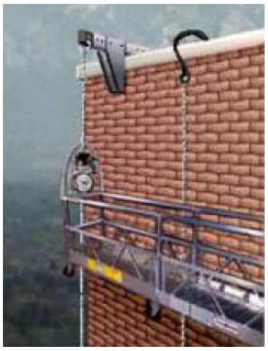


Suspended Scaffolds

These are types of scaffolds that are suspended from a fixed overhead position (often placed at the top of a building, but it can be any fixed elevated structure). They are suspended by ropes or other non-rigid means. The various types of suspended scaffolds are discussed next.

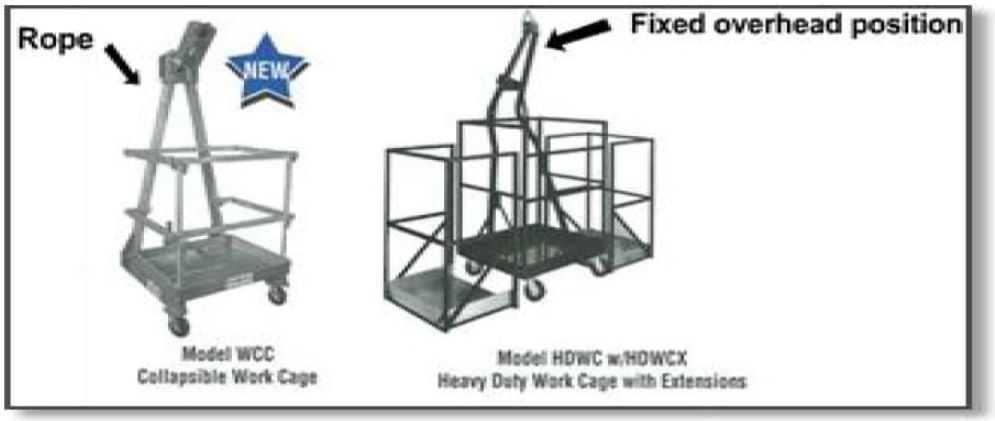
Two-Point (Swing Stage)

These are one of the most common types of suspended scaffolds. You see them frequently on construction sites as well as on skyscrapers and other high-rises where they are used by window washers and exterior building workers. The scaffold is hung from the top of a building by two ropes that are secured at either end of the platform, usually with stirrups to provide for vertical movement. The safe use of a suspended scaffold begins with secure anchorage. The weight of the scaffold and its occupants must be supported by both the structure to which it is attached and by each of the scaffold components that make up the anchorage system.



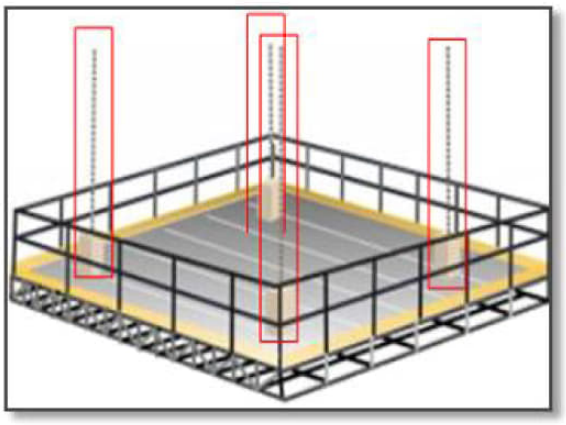
Single-Point Adjustable (Spider Scaffolds)

This scaffold is smaller than the two-point, as it usually accommodates only one person at a time. It is secured to the top of the building using one rope from a fixed overhead support. As with the two-point, it has a mechanism to allow for vertical movement (up and down). It is often used by window washers to clean the outside of a skyscraper and is also known a boatswain's chair.



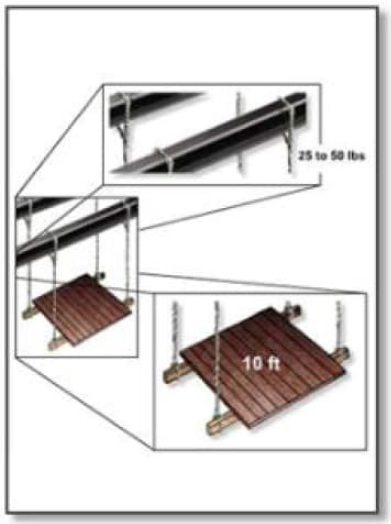
Suspended Scaffold Platform

These consist of at least one platform (they may be more, but they rarely exceed a single platform) that is supported by more than two ropes (usually four ropes are used, one secured at each corner of the platform) from an overhead structure and fitted with a mechanism to allow for vertical movement. They are commonly used as chimney hoists in the cleaning and repair of chimney and/or other ventilation shafts.



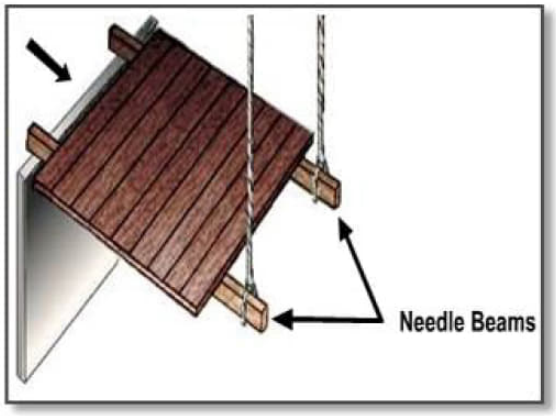
Interior Hung

This scaffold consists of two parallel, horizontal beams upon which a board or plank is placed. It is then suspended by ropes (sometimes up to four, one at each corner of the platform) from a roof or ceiling structures. Roof structures must be inspected before scaffolds are erected to ensure they can support the load. Suspension ropes or cables must be connected to overhead supports by shackles, clips, thimbles, or equivalent means. This type of scaffold is primarily used indoors because it must be hung from roof structures.



Needle Beam

In this case, the platform (usually a simple wooden board) is supported by two needle beams hung from ropes. Usually, one end of the platform is supported on the edge of a permanent structure, to which the scaffold support beams must be installed.



Multi-Level

A multi-level scaffold is a series of platforms that are arranged vertically, one on top of the other. Visually, it looks like two or more two-point scaffolds (or multi-point scaffolds) on top of one another. The platforms are placed within the same framework, secured by a single stirrup from the same fixed overhead.



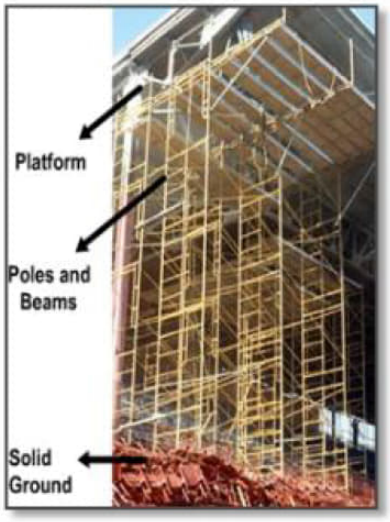
Float (Ship)

The float (or ship) scaffold consists of a platform supported by two bearers and is hung from a fixed overhead support with ropes.



Supported Scaffolds

These are scaffolds that consist of one or more platforms elevated on poles and beams, which are placed upon a solid ground. The various types of supported scaffolds are discussed next.



Frame or Fabricated

This is one of the most common types of scaffolds used. They are easy to build, economical, and practical. They range in size from small set-ups used for one- or two-story residential houses to large set-ups used on commercial projects; however, it is possible to make them stand several stories high if the need arises. They consist of a single or multiple platforms elevated on tubes.



Mobile

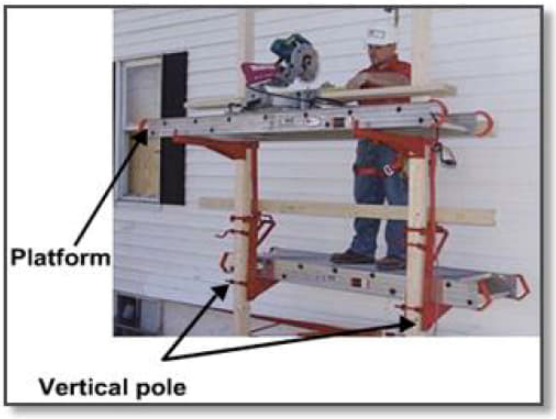
Mobile scaffolds are visually similar to frame scaffolds, but with one main difference: they are mounted on wheels or casters. They are commonly used by painters,

plasterers, electricians, plumbers, and others who need to change position frequently, hence the wheels.



Pump Jack Scaffold

This scaffold consists of a platform that is elevated on a pair of vertical poles and fitted with moveable brackets. The brackets allow the platform to be moved up and down using a jack (similar to those used to change a car tire). They are attractive because of their ability to be raised and lowered somewhat quickly and easily and because they are relatively inexpensive.



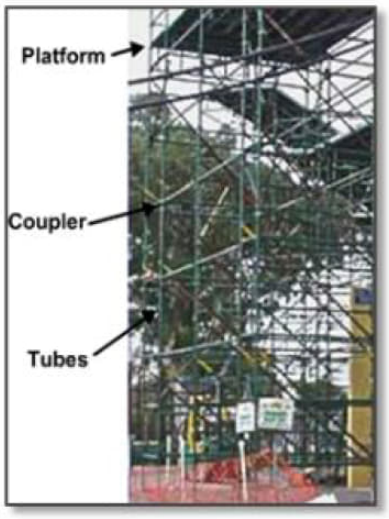
Ladder Jack

This is a very simple scaffold. In this case, the platform is placed in brackets that are attached to a pair of ladders. They are mostly used for light applications. They are popular mostly due to their practicality, ease, and economy.



Tube and Coupler

In this case, tubes (which look like pipes) are placed together in a lattice-like framework using couplers (joints) to hold them together. The lattice-like pattern into which they are arranged adds balance and strength to the framework. Platforms can be placed at the top of the framework and at multiple levels. Tube and coupler scaffolds are often used to carry heavy weights, and they can be built to a height of multiple stories while being able to be erected to conform to the shape of a building. A prime advantage lies in that they can be built in several directions and combinations that cater to any structure.



Poles

This type of scaffold is also known as Wood Pole, because every part of the scaffold, from the platform on down, is built using wooden poles and boards. There are two types: single pole, which are supported on one side (the interior side) by a fixed structure, such as a building; and two-pole, which are supported by two sets of wooden poles on either side of the platform. They are not commonly used due to the fact that they must be built from scratch, cannot be reused, and are difficult to erect and use in a safe and compliant manner.



Specialty

There are a large number of scaffolds that are not widely used but rather are employed only in specific jobs. Some of the more common ones include the following:

- Plasterers', Decorators', and Large-Area Scaffolds
- Bricklayers' Square Scaffolds
- Horse Scaffolds
- Form Scaffolds and Carpenters' Bracket Scaffolds
- Roof Bracket Scaffolds
- Outrigger Scaffolds
- Window Jack Scaffolds
- Crawling Boards (Chicken Ladders)
- Step, Platform, and Trestle Ladder Scaffolds



Lesson Summary

A scaffold refers to a temporary, elevated platform that is used to support workers and/or materials. There are several types of scaffolds:

1. **Suspended scaffolds:** the type that are suspended by a wire rope from a fixed overhead position (usually placed at the top of a building). They can be broken down further into the subcategories that include: Two-point (or swing stage) scaffolds; single-point adjustable (spider) scaffolds; catenary (using horizontal and parallel wire ropes); multi-point adjustable; interior-hung; float (ship); and more.
5. **Supported scaffolds:** the type that consist of one or more platforms elevated on poles and beams, which are placed upon a solid ground. They can be broken

down into the following subcategories: Frame or fabricated; mobile; pump jack; and more.
6. **Specialty scaffolds**: includes decorators', plasterers', and large-area scaffolds, among others.

Lesson 2: Overview of OSHA Directives for the Construction of Scaffolds

Lesson Focus

At the end of this lesson, students will be able to:

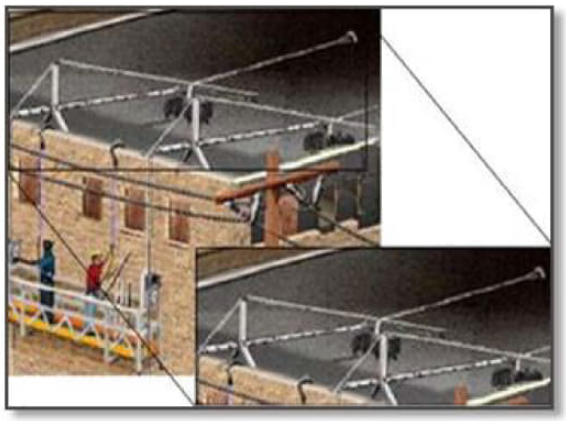
- Describe how suspension scaffolds may be safely constructed
- Describe how supported scaffolds may be safely constructed

Suspension Scaffolds

The regulations presented for the two-point (swing stage) scaffold are applicable to all other types of suspension scaffolds, unless stated otherwise.

Two-Point (Swing Stage) Anchorage

The anchorage is a key component contributing to the safety of a suspension scaffold. Because a suspension scaffold is, in effect, hanging from a structure, its weight must be sufficiently supported and balanced to ensure that it doesn't plummet to the ground. The anchorage that the tieback is secured to must be capable of withstanding four times the intended load of the scaffold. The tiebacks should therefore not be secured to objects such as vents or piping but rather to structural members (foundation beams, for example).



Support: Suspension scaffolds are designed for vertical motion (that is, they move up and down); as such, the scaffold must be capable of supporting its own weight as well as that of the personnel and materials on it both while it is stationary and while it is in motion. The scaffold and its anchorage must be capable of handling up to four times the maximum intended load, and the support ropes must be capable of handling up to six times the intended maximum weight of the scaffold and its load. Scaffold components that have been manufactured by different manufacturers should not be mixed, unless specified. In addition, no modifications should be made to the scaffold components for any reason without approval from the manufacturer.

Access: Though it is possible for suspension scaffolds to be accessed using ladders, it is a preferred practice to access the scaffold from the roof. Safe access methods are discussed in more detail in the next lesson.

Fall Protection: Personnel working from suspension scaffolds may be a great distance above the ground; as such, a common accident is falls by workers from elevated positions. Both fall arrest systems and guardrails should be provided on any scaffold that is expected to be elevated to more than ten feet above the ground. This will be discussed in more detail in the next lesson.

Platform: The platform is the part of the scaffold where the personnel work and the materials are placed. Each scaffold platform must be at least 18 inches wide and should be able to support its own weight in addition to four times the maximum allowed weight. For a two-point scaffold. The platform should be no more than 36 inches wide unless designed by a qualified person to prevent unstable conditions. The platform must be checked regularly to ensure that it meets the applicable safety standards.

Stability: The scaffold must be designed in such a manner that it does not sway while it is being raised or lowered. In addition to the engineering methods that are employed to minimize horizontal movement of the scaffold, the employees working on the scaffold must exercise caution at all times.

Electrical Hazards: Due to the fact that scaffolds are typically constructed primarily of metal, it is important that they remain clear of any electrical power sources, as this would increase the risk of electrocution. A minimum clearance to maintain from all electrical lines up to 50 kV is 10 feet. Unless the line is insulated and carrying less than 300 volts, in which case the minimum clearance to maintain is 3 feet. Lines carrying more than 50 kV require greater clearance distances as determined by OSHA 1926.451(f)(6).

Personnel Training: One of the most important OSHA requirements relating to scaffolds is proper training by competent persons of the scaffold builders and those who are expected to work on the scaffold.

Single-Point Adjustable

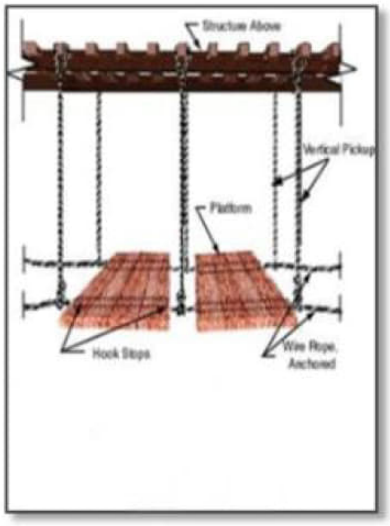
On a single-point adjustable scaffold, the support rope (the rope that is between the scaffold and the suspension device) must be maintained in a vertical position unless all of the following conditions are met:

- The rigging has been designed by a qualified person.
- The scaffold is accessible to rescuers.
- The supporting rope is protected to ensure that it will not chafe at any point where a change in direction occurs.
- The scaffold is positioned so that swinging cannot bring the scaffold into contact with another surface.



Catenary

Catenary scaffolds should not have more than two interconnected platforms at any one time. Furthermore, because catenary scaffolds do not usually have guardrails, all employees on a scaffold must be protected with personal fall arrest systems if operated at a height in excess of ten feet.



Multi-Point Adjustable

On a multi-point adjustable scaffold, if bridges are not used, passage from one platform to another is only allowed when the platforms abut and are at the same height. These scaffolds should be suspended from metal outriggers, brackets, wire rope slings, hooks, or other means that meet the equivalent criteria for strength and durability. Furthermore, multiple multi-point scaffolds must not be bridged together unless the design of the scaffolds allows them to, the bridge connections are articulated, and the hoists are properly sized.

Interior Hung

Because interior hung scaffolds can only be suspended from the roof structure or other structural members, these structures must be inspected to ensure that they possess sufficient strength.

Needle Beam

Ropes or hangers must be used to support one end of a needle beam scaffold. The other end may be supported by ropes, hangers, or a permanent structural member. Needle beams need to be properly secured to ensure that they do not roll or are displaced. In addition, the platform needs to be securely attached to the needle beams with bolts or equivalent means.

Float (Ship)

Platforms for a float or ship scaffold must be secured to a minimum of two bearers (such as wooden beams) that extend to at least six inches beyond the platform on each side.

Rope connections must be secure so that the platform does not shift or slip. Each employee on a float scaffold must be protected by a personal fall arrest system if working at an elevation above ten feet.

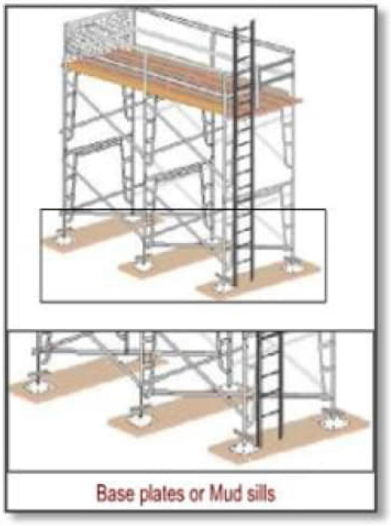


Supported Scaffolds

The regulations presented for the frame or fabricated scaffold are applicable to all other types of supported scaffolds, unless stated otherwise.

Fabricated Frame or Tubular Welded Frame

Base Section: Supported scaffolds must be set on base plates or mud sills to ensure the stability of the structure. The footings of the scaffold must be capable of withstanding the load weight that is set upon it without movement or displacement. Frames and panels must be braced by cross, horizontal, or diagonal braces, or a combination of these. These frames and panels secure vertical members together laterally. The cross braces should be of the proper length to ensure that vertical members are square and aligned. With this system properly used, the completed scaffold is always plumb, level, and square. All brace connections should also be secured.



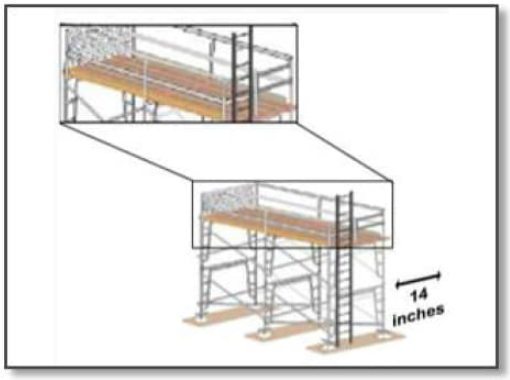
Support Structure: Two important factors in ensuring that the scaffold is stable and is not prone to swaying are its strength and the structural integrity of its supports. The supports of the scaffold must be capable of withstanding up to four times their intended maximum weight load as well as the weight of the structure.

Access: Personnel are subject to accidents while they are climbing on or off a scaffold. The mode of accessing the scaffold must therefore be designed to ensure that employees are not needlessly being endangered, either while accessing the scaffold or by putting undue pressure on the structure. Employees are prohibited from climbing the cross-braces as a means of accessing the scaffold. This is extremely dangerous and may undermine the structural integrity of the structure.

Fall Protection: Falls are a common hazard to the employees on scaffolds. The installation of proper fall protection minimizes the risk of such an occurrence. This may include the installation of guardrails on the platform or the use of personal fall arrest systems. Employees on scaffold platforms that are higher than 10 feet above the next level must be adequately protected from falling through the use of proper protective systems and practices.



Platform: The platform is the work area of the scaffold. It supports both the employees and the equipment and materials that they use. It is essential that the platform conform to safety measures to ensure that the employees are not endangered in the course of their work. The platform should be fully planked, and the gaps between the planks should not exceed 1 inch. The platform should not be more than 14 inches from the structure being worked on unless guardrail systems are erected along the front edge and/or personal fall arrest systems are in use for all exposed employees. The maximum distance from the structure for plastering and lathing operations is 18 inches.



Keeping Upright: Scaffolds that exceed a height four times their minimum base dimension must be restrained from tipping with ties, braces, guys, or equivalent means. Unless they have been designed for the specific purpose, scaffolds should not be moved horizontally while employees are on them.

Electrical Hazards: As with suspension scaffolds, the height of supported scaffolds often means that they may be built within close proximity of power lines. In addition, the fact that scaffolds are often built using metal parts makes the risk of electrocution particularly high. As a result, specific measures must be taken to minimize the risk to employees.

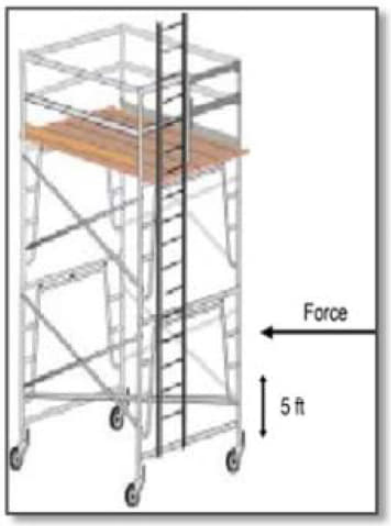
Personnel Training: One of the most important OSHA requirements is the proper training, by qualified experts, of both the scaffold builders and those that are expected to work on the scaffold.

Mobile

While in motion, mobile scaffolds must be stabilized to prevent tipping over. When the scaffold is being moved manually, the force must be applied to an area that is as close to the base as possible and no more than five feet above the ground. If the scaffold is moved using a powered system, the system must be designed for that purpose.

Scaffolds should not be moved horizontally while employees are on them, unless all of the following conditions are met:

- The surface on which the scaffold is being moved is within 3 degrees of level and free of pits, holes, and obstructions.
- The height to base-width ratio of the scaffold is two to one or less, unless the scaffold is designed and constructed to meet or exceed nationally recognized stability test requirements.
- Required outrigger frames are installed on both sides of the scaffold.
- When power systems are used, the force is applied directly to the wheels and generates a speed less than 1 foot per second.
- No employee is present on any part of the scaffold that extends outward beyond the wheels, casters, or other supports.



Pump Jack

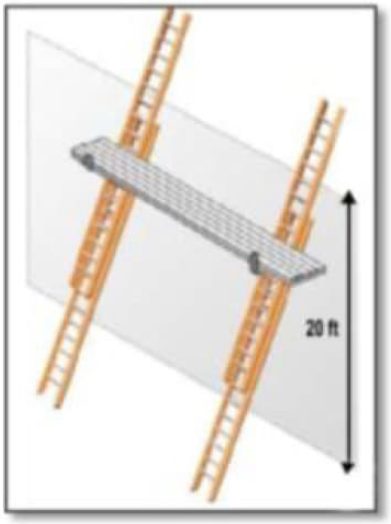
The bracket and braces of the pump jack must be made from metal plates and angles to ensure strength. Each bracket must be fitted with two positive gripping mechanisms to prevent slippage. Poles must be secured to the structure by rigid triangular bracing at the bottom, top, and other points as needed.

If the pump jack has to pass bracing that is already installed, an additional brace must be installed approximately four feet above the brace to be passed and must be left in place until the pump jack has been moved and the original brace reinstalled. If wood is used for poles, it must be straight-grained and free of shakes, dead knots, and other defects.

Ladder Jack

Support: Ladders that are used to support ladder jack scaffolds must be placed, fastened, or otherwise equipped with devices in such a manner so as to prevent the scaffold from slipping. They should also be appropriately fastened to ensure overall stability.

Platforms: The maximum height at which a platform can be placed is 20 feet.



Lesson Summary

- There are safety requirements applicable to all scaffolds and additional standards applicable to specific types of scaffolds. Unless otherwise stated, the safety regulations for the two-point scaffold apply to all other types of suspension

scaffolds. With suspended scaffolding, a primary factor to consider in terms of safety is the anchorage of the scaffold from the building (or other structure).

- Additional requirements focus on how the scaffold is supported, how it can be accessed (preferably from the roof, rather than a ladder); fall protections, such as arrest systems and guardrails, which are required for any scaffold higher than ten feet in the air; and the platform, which must be at least 18" wide and able to support at least its own weight plus four times the maximum allowed weight. Many of these (not suspension-specific) requirements apply to supported scaffolds, as well.
- Further safety requirements (which apply to both supported and suspended scaffolds) address stability (so the scaffold does not sway during its raising or lowering); control of electrical hazards (meeting the minimum 10-foot clearance from all electrical lines up to 50 kV, and other controls); and of vital importance to OSHA and worker safety, proper training to those building and working on scaffolds.

Lesson 3: Scaffold Safety Measures

Lesson Focus

At the end of this lesson, students will be able to:

- Explain how to minimize the risks associated with scaffolds
- Describe how and why guardrails should be installed on scaffolds
- Describe how and why a personal fall arrest system should be used
- Describe the personnel requirements for scaffolding safety

Introduction

One out of every three deaths in construction results from a fatal fall. This high fatality rate indicates the importance of ensuring that scaffold workers are well protected against accidental falls. Generally, precautions must be taken for employees expected to work at heights above six feet. Fall protection is not required (but may be an excellent practice) for employees working on scaffolding at a height of ten feet or less.

There is often very little space on a scaffold for a person to maneuver, especially when space is also taken up by the various materials that the employee needs to complete his or her job. This lack of space can be hazardous to anyone not taking the appropriate safety precautions.

All employees must be trained by a qualified person to recognize the hazards associated with the type of scaffold being used and how to control or minimize those hazards. The training must cover fall hazards, falling object hazards, electrical hazards, the proper use of the scaffold, and the proper handling of materials.



How Do You Minimize the Risks?

There are various strategies employers can use to minimize the risks to their employees of working on scaffolds.

Uniformity

- Ensure that the scaffold has been erected in accordance with the instructions of the manufacturer.
- Do not alter or modify any of the components of the scaffold. If you are faced with a problem, contact the manufacturer.
- If you have scaffolding components from two or more manufacturers, do not under any circumstances mix the components.
- Do not use incompatible metals for the components of the scaffold.

Guardrails

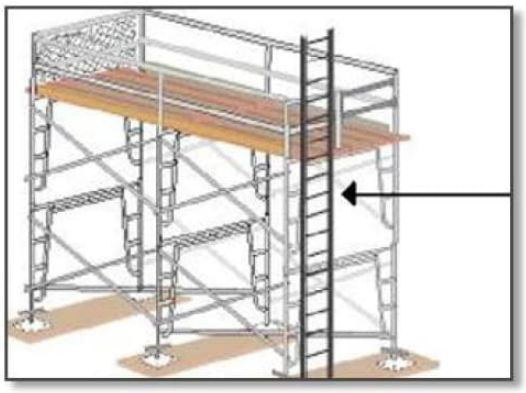
All open and exposed sides of the scaffold at levels above ten feet should be fitted with guardrails to prevent falls or all exposed employees should be provided with proper fall arrest systems. The guardrails should consist of at least a top-rail, a mid-rail, and when necessary, a toe-board.

Prohibit Climbing

Prohibit climbing on the cross-braces of the scaffold because it is extremely dangerous and against OSHA regulations to use the cross-braces as a means of accessing the scaffold. Climbing the cross-brace can destabilize the scaffold and cause it to tip over. In addition, employees climbing up or down will not be protected by a personal fall arrest system and would be at an increased risk of falling.

Provide safe ways to access the scaffold

Provide the employees with personal fall arrest systems when appropriate (this will be discussed in more detail later in the lesson).



Guardrails

If an employee is expected to work on scaffolding at heights that exceed ten feet, the employer must ensure that the scaffold is fitted with guardrails or that proper personal fall arrest systems are in use. If using guardrails, they should be installed along all open sides and ends before releasing the scaffold for use by employees, other than the erection and dismantling crews. However, guardrails are not required on the front end in the following instances:

- When the front end of all platforms are less than 14 inches from the face of the work
- When outrigger scaffolds are 3 inches or less from the front edge
- When employees are plastering and lathing 18 inches or less from the front edge

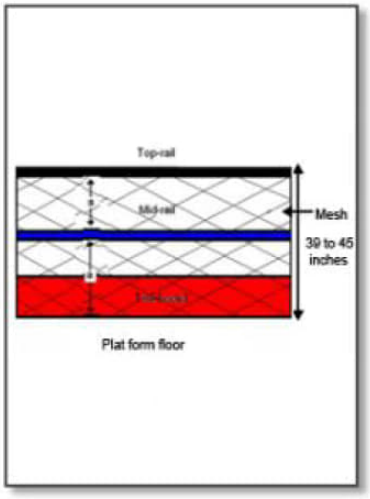
The following provisions must be met when installing guardrails.

Top- and Mid-Rails

The top-rail (the topmost part of the guardrail) must be between 39 and 45 inches above the platform or walking level of the scaffold.

A mid-rail is the portion of the guardrail between the top-rail and the work platform. The mid-rail must be halfway between the top-rail and the surface of the platform. In case other structural panels must be installed (such as additional mid-rails), they should be installed so as not to leave openings that are wider than 19 inches.

Toe-boards or mesh screening may also be installed, especially if there is any concern of accidentally falling objects striking workers below.



Strength of Guardrails

Guardrails must be capable of withstanding up to 200 pounds of force applied to the top-rail at any point and from any direction. Mid-rails must be capable of withstanding up to 150 pounds of force applied at any point and from any direction.

Smoothness

The guardrails must not have any jagged or protruding surfaces that could cause punctures (either in clothing or in skin). In addition, the top-rail and mid-rails must be constructed in such a manner so as not to overhang the scaffold, thereby causing a projection hazard.

Personal Fall Arrest Systems

Personal fall arrest systems are one of the options that can be used to minimize the risks of injuries related to falls from an elevation. They should be used in the absence of, or instead of, a guardrail system if the employee is expected to work at heights exceeding ten feet. The following are some of the types and components of a personal fall arrest system.

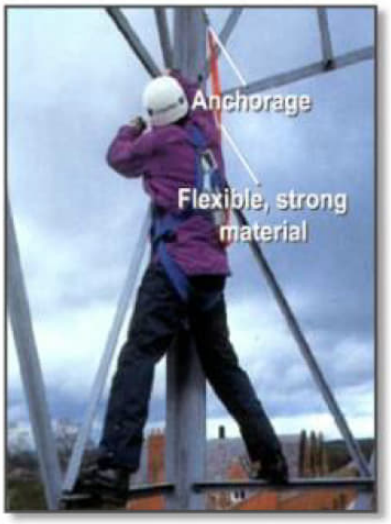
Body Harness

Full body harnesses are designed to minimize the stress on the body that is induced by a fall. Employees must be trained by a competent person in fall protection systems prior to using a full body harness. Harnesses should be inspected prior to each use for mildew, wear, damage, and other deterioration. Defective harnesses should be removed from service.

Note: Due to high incidences of internal injuries suffered during falls, OSHA has concluded that body belts used for fall protection present a danger to workers and are no longer allowed.

Lanyards/Vertical Lifelines

Vertical lifelines consist of a line made of a strong material that is attached to an appropriate anchorage at one end and attached to the full body harness at the other end. Advances in synthetic materials have led to the creation of shock-absorbing lanyards with increased strength.



Self-Retracting Lifelines (SRLs)

SRLs are commonly used as an attractive alternative to fixed-length lanyards. The line is encased in a protective housing that extends and retracts automatically, which increases mobility and may reduce the risk of tripping. SRLs can be anchored to an appropriate anchorage point above an employee's head for increased safety and mobility. These devices are also commonly called "yo-yos."



Horizontal Lifelines

Horizontal lifelines may be practical in areas where the possible anchorage points are otherwise limited or difficult to access. They are easy to transport and relatively quick to set up. The idea is pretty simple: Two anchorage points are connected to both ends of an extended cable that is run between them.

PFAS Use Requirements

The following are requirements for using a personal fall arrest system:

- When stopping a fall, personal fall arrest systems should limit the maximum arresting force to no more than 900 pounds.
- The line should be rigged to ensure that a worker does not freefall for more than 6 feet and does not come into contact with any surface.
- The fall arrest system must have sufficient strength to withstand twice the potential impact energy of a worker freefalling for six feet.
- Any systems that have been involved in a fall impact (that is, have been involved in arresting a falling worker) should be removed immediately and not used again until they have been inspected by a competent person to ensure that they are undamaged.
- Workers who have been involved in a fall must be assisted immediately, or at least be in a position to rescue themselves—otherwise suspension trauma or other harm may result. This is a condition where pooling of the blood in the extremities may cause loss of consciousness or even death. To avoid this, when suspended, the worker must limit restriction points and move their arms and legs to maintain circulation. If the worker is unconscious when rescued, proper treatment and medical attention should be provided immediately.

- Ensure that regular checks are conducted on the systems for wear and tear and that any defective items are immediately replaced.
- Do not, under any circumstances, attach a fall arrest system to guardrails. They are not designed for that purpose and are unlikely to withstand a fall impact.

Case Studies

There are numerous cases of severe injuries and death occurring when personnel working on scaffolds did not take the necessary safety measures or were not equipped properly. Here are some examples:

- An employee was taking measurements from a scaffold not fitted with guardrails. He tripped and fell 14 feet to the ground. He died instantly.
- A worker was working on a snow- and ice-covered scaffold with no guardrails or fall arrest system. He slipped and fell approximately 20 feet. He died instantly.
- An employee was working on a scaffold during stormy weather. It is suspected he lost balance due to a strong gust of wind. He was not wearing a personal fall arrest system and fell 15 feet to his death.

Personnel Requirements for Scaffolding Safety

When is a competent person required for scaffolding?

The OSHA standard pertaining to scaffolding requires a competent person to perform the following duties:

- Select and direct employees who erect, dismantle, move, or alter scaffolds
- Determine if it is safe for employees to work on or from a scaffold during storms or high winds and to ensure that a personal fall arrest system or wind screens protect these employees
- Train employees involved in erecting, disassembling, moving, operating, repairing, maintaining, or inspecting scaffolds to recognize associated work hazards
- Inspect scaffolds and scaffold components for visible defects before each work shift and after any occurrence which could affect the structural integrity and to authorize prompt corrective actions
- Determine the feasibility and safety of providing fall protection and access for scaffold erectors and dismantlers

When is a qualified person required for scaffolding?

A qualified person must perform the following duties:

- Design scaffolds and load them in accordance with that design
- Train employees working on the scaffolds to recognize the associated hazards and understand procedures to control or minimize those hazards

- Design the rigging for single-point adjustable suspension scaffolds
- Design platforms on two-point adjustable suspension types that are less than 36 inches wide to prevent instability
- Make swaged attachments or spliced eyes on wire suspension ropes
- Design scaffold components construction in accordance with the design

When is an engineer required for scaffolding?

The OSHA standard requires a registered professional engineer to perform the following duties:

- Design the direct connections of masons' multi-point adjustable suspension scaffolds
- Design scaffolds that are to be moved when employees are on them
- Design pole scaffolds over 60 feet in height
- Design tube and coupler scaffolds over 125 feet in height
- Design fabricated frame scaffolds over 125 feet in height above their base plates
- Design brackets on fabricated frame scaffolds used to support cantilevered loads in addition to workers
- Design outrigger scaffolds and scaffold components

Lesson Summary

- A scaffold must not just be anchored properly and be strong and stable; the workers themselves must be trained in how to safely use and maneuver (themselves and their equipment) in the often small space.
- Employers can minimize the risk to employees by making sure all scaffolding construction, materials, and other elements are compatible. Scaffolds must contain safe, well-constructed guardrails that consist of three rails: top, mid, and, when necessary, a toe board or employees must be provided with appropriate personal fall arrest systems; guardrails must be sufficiently strong and smooth according to OSHA guidelines.
- If an employee is expected to work on scaffolding at heights that exceed ten feet, the employer must ensure that the scaffold is fitted with guardrails or that proper personal fall arrest systems are in use. If using guardrails, they should be installed along all open sides and ends before releasing the scaffold for use by employees, other than the erection and dismantling crews.
- Employers must also prohibit climbing on a scaffold's cross braces, and if there are no guardrails, provide personal fall arrest systems for workers. These systems may include body harnesses, vertical lifelines, self-retracting lifelines and horizontal lifelines, and must meet other OSHA requirements.
- Personal fall arrest systems are one of the options that can be used to minimize the risks of injuries related to falls from an elevation. They should be used in the absence of, or instead of, a guardrail system if the employee is expected to work at heights exceeding ten feet.

Module 17: Tools - Hand and Power

Module Description

This module gives you a basic understanding about OSHA's role in the prevention and elimination of work-related illnesses and injuries. Hand and power tools are a part of our everyday lives and help us to perform tasks that otherwise would be difficult or impossible. However, these simple tools can be hazardous and have the potential for causing severe injuries when used or maintained improperly. Special attention to hand and power tool safety is necessary to reduce or eliminate these hazards.

Module Learning Objectives

At the conclusion of this module, students will be able to:

- Discuss OSHA standards and rules associated with hand and power tools
- Explore guarding techniques or principles that apply to hand and power tools
- Identify the precautions that are essential for safe use of hand and power tools

Lesson 1: Safe Use of Hand and Power Tools

Lesson Focus

At the end of this lesson, students will be able to:

- Describe the general requirements for safely using hand and power tools
- Describe the common hazards associated with hand and power tools
- Describe the different kinds of switches and know which is appropriate

Introduction

Hand and power tools help us perform tasks that otherwise would be difficult or impossible. These tasks range from hanging a picture on your living room wall to cutting through slabs of concrete at a construction site. One thing that all tools—from hammers and handheld drills to hydraulic jacks and walk-behind saws—have in common is that they present hazards. Using them improperly or failing to properly maintain them can have dangerous consequences, both for you and for those around you.

Some common hazards employees might encounter when using hand and power tools include falling, flying, abrasive, and splashing objects, as well as harmful dusts, fumes, mists, vapors, or gases. Employees who might encounter these hazards must be provided with the proper personal protective equipment (PPE) to keep them safe.



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