



# Stairway and Ladder Safety

Stairways and ladders are a major source of injuries and fatalities among workers. OSHA estimates there are as many as 36 fatalities per year due to falls from stairways and ladders used in construction. This course is designed to provide both employers and employees with the knowledge needed to work safely on stairways and ladders.

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# OSHAcademy Course 603 Study Guide

## Stairway and Ladder Safety

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This study guide is designed to be reviewed off-line as a tool for preparation to successfully complete OSHAcademy Course 603.

Read each module, answer the quiz questions, and submit the quiz questions online through the course webpage. You can print the post-quiz response screen which will contain the correct answers to the questions.

The final exam will consist of questions developed from the course content and module quizzes.

We hope you enjoy the course and if you have any questions, feel free to email or call:

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## Course Introduction

Stairways and ladders are a major source of injuries and fatalities among workers.

According to the Bureau of Labor and Statistics (2012), 14 percent of all work-related deaths are due to falls, with 20 percent of these deaths being related to the use of ladders.

The Occupational Safety and Health Administration (OSHA) estimates there are more than 24,000 injuries and as many as 36 fatalities per year due to falls from stairways and ladders used in construction. Nearly half of these fall-related injuries are serious enough to require time off the job.

These statistics are a sobering reminder of the dangers faced when work on or around ladders and stairways. More importantly, most, if not all, of these injuries and deaths could have been prevented.

This course is designed to provide both employers and employees with the knowledge needed to work safely on stairways and ladders.

## Module 1: Types of Ladders

### Introduction

Ladders are often the first tool we choose when working at elevation. This may explain why more workers are injured in falls from ladders than from any other elevated surface - roofs, scaffolds, balconies, even stairs. Why do workers fall from ladders?

Most falls happen because workers select the wrong type of ladder for their job or they set up the ladder improperly and the ladder shifts or slips unexpectedly. Workers also fall when they're not working safely on the ladder - their foot slips, they lose their balance, they overreach, or something knocks the ladder over.

### Ladder Selection

Be sure the ladder being used has the proper duty rating to carry the combined weight of the user and the material being installed. A ladder's duty rating tells you its maximum weight capacity. There are five type classifications with associated duty ratings:

- **Type IAA** - These are special duty ladders. Type IAA ladders are for extra-heavy-duty professional use only.
- **Type IA** - These ladders have a duty rating of 300 pounds. Type IA ladders are recommended for extra-heavy-duty industrial use.
- **Type I** - These ladders have a duty rating of 250 pounds. Type I ladders are manufactured for heavy-duty use.
- **Type II** - These ladders have a duty rating of 225 pounds. Type II ladders are approved for medium-duty use.
- **Type III** - These ladders have a duty rating of 200 pounds. Type III ladders are rated for light-duty use.

Check out this short audio clip by [Dan Clark](#) of the [theSafetyBrief.com](http://theSafetyBrief.com). Here Dan reviews the two types of ladders, freestanding and self-supporting, and how employees can be safe using each.

### Quiz Instructions

After each section, there is a quiz question. Make sure to read the material in each section to discover the correct answer to these questions. Circle the correct answer. When you are

finished go online to take the final exam. This exam is open book, so you can use this study guide.

**1. Why do most falls from ladders occur?**

- a. Too many workers on a ladder
- b. Selecting the wrong ladder for the job
- c. Rungs on the ladder break
- d. Unstable ground

**Necessary Questions**

Ask these questions before deciding on a ladder:

- Will heavy items be held while on the ladder?
- Does the elevated area require a long ladder that can be unstable?
- Will work be performed at this height over an extended period of time?
- Will working on a ladder require standing sideways or reaching?
- Are there any obstructions preventing safe ladder use?

If the answer to any of these questions is “Yes,” then you may need to consider using something other than a ladder. If possible, bring in other equipment such as a scissor lift or scaffolding.

**2. Each of the following situations is a reason to reconsider using a ladder EXCEPT \_\_\_\_.**

- a. if you must work more than 15 feet in elevation
- b. if you must work on the ladder sideways
- c. if you must use heavy items while on the ladder
- d. if the ground is uneven or unstable and can't be corrected

**Portable Ladders**

Portable ladders help you access a work area or provide support while you work. Portable ladders make getting to a work area easy, but they can increase the potential for falls if not used properly.

Portable ladders are versatile, economical, and easy to use. However, workers sometimes use them without thinking safety. The Bureau of Labor and Statistics reports that 20 percent of fatal

falls at work occur from heights less than 15 feet (4.5 m), and 50 percent of fatal falls are from height less than 35 feet (10.6 m).

Here are some OSHA requirements for using portable ladders:

- The minimum clear distance between side rails for all portable ladders must be 11.5 inches (29 cm).
- The rungs and steps of portable metal ladders must be corrugated, knurled, dimpled, coated with skid-resistant material or treated to minimize slipping.
- Non-self-supporting and self-supporting portable ladders must support at least four times the maximum intended load; extra heavy-duty type 1A metal or plastic ladders must sustain 3.3 times the maximum intended load.
- When portable ladders are used for access to an upper landing surface, the side rails must extend at least 3 feet (.9 m) above the upper landing surface. When such an extension is not possible, the ladder must be secured and a grasping device such as a grab rail must be provided to assist workers in mounting and dismounting the ladder.
- A ladder extension must not deflect under a load that would cause the ladder to slip off its supports.

**3. When portable ladders are used for access to an upper landing surface, the side rails must extend \_\_\_\_\_ above the upper landing surface.**

- a. four rungs
- b. a minimum of 4 feet (1.3 m)
- c. at least 3 feet (.9 m)
- d. two rungs

### Extension Ladders

We use ladders to do all sorts of tasks, so it's not surprising that many types of ladders are available. Let's look at the most common types. Characteristics of extension ladders include:

- They offer the most length in a general-purpose ladder.
- They have two or more adjustable sections.
- The sliding upper section must be on top of the lower section.

- They are made of wood, metal, or fiberglass.
- The maximum length of extension depends on material
- They support only one worker.

**4. Which type of ladder offers the most length for general purpose jobs?**

- a. Straight ladder
- b. Extension ladder
- c. Articulating ladder
- d. Folding ladder

**Folding and Platform Ladders**

**Standard folding ladders** have flat steps, a hinged back, and are not adjustable.

- Use them only on firm, level surfaces.
- They are available in metal, wood, or reinforced fiberglass.
- they must have a metal spreader or locking arm and cannot exceed 20 feet.
- They only support one worker.

**Platform Ladders.** The platform ladder is a self-supporting portable ladder that is non-adjustable in length, with a platform provided at the highest intended standing level.

- It has a hinged design for ease of storage and is intended for use by one person.
- The top platform is surrounded on three sides by a railing that is at least 20 inches higher than the platform surface.
- A folding Bucket (Pail) Shelf may also be provided.

**5. How many persons may work on a folding or platform ladder?**

- a. 4
- b. 3
- c. 2
- d. 1

## Straight or Single Ladders

The most common type of portable ladder is a straight or single ladder. It is a non-self-supporting portable ladder that is non-adjustable in length, consisting of one section. Unlike a stepladder that requires level support for all four of its side rails, the Single Ladder requires only two level ground support points in addition to a top support. Ladder levelers may be used to achieve equal rail support on uneven surfaces. (American Ladder Institute)

- It is intended for use by one person.
- The length cannot exceed 30 feet.
- It is available in wood, metal and reinforced fiberglass.
- It supports only one worker.
- The top support allows tie off the top of the ladder to increase stability.

### 6. Which of the following is a non-self-supporting ladder?

- a. Platform ladder
- b. Folding ladder
- c. Straight ladder
- d. Articulating ladder

## Articulated Ladders

An Articulated Ladder is a portable ladder with one or more pairs of locking hinges which allow the ladder to be set up in several configurations such as a single or extension ladder, with or without a stand-off, a stepladder, a trestle ladder, scaffold or work table. (American Ladder Institute)

- Each pair of articulated joints in the ladder can be locked in one or more positions to accommodate the various configurations.
- The locking positions of the hinges allow set-up at the proper angles to accommodate each configuration that the manufacturer has designated.
- When set up in the stepladder configuration, Articulated Ladders range in size from 3 to 15 feet maximum.
- When set up as a Single or Extension Ladder, Articulated Ladders may have a length of no more than 30 feet.

- Heavy duty, extra heavy duty, and special duty types (I, IA, and IAA) multipurpose ladders are designed for one or two persons. (Werner Ladders)

**7. Which type of articulated (multipurpose) ladder is designed for one or two persons?**

- a. Types I, IA, and II
- b. Types IA, III, and IV
- c. Types I, IA, and IAA
- d. Types I, II, and III

**Double-Cleated Ladders**

Double-Cleated ladders are built with a center rail and two cleats that allow travel up and down the ladder at the same time.

- This ladder is useful when ladders are the only way to enter or exit a working area that has more than 25 employees.
- More than one person is allowed on the ladder at any time.

**8. What is an advantage when using double-cleated ladders?**

- a. Allows workers to exit and enter a work area at the same time
- b. Allows two persons to work on the ladder
- c. It is designed for left- and right-handed workers
- d. It is easy to make with scrap lumber

**Tripod Ladders**

Tripod (Orchard) Ladder have a flared base and a single back leg that provides support on soft, uneven ground. Those who use tripod ladders include tree surgeons, topiary specialists, institutional and estate gardeners, orchard owners, hedging contractors, permaculturists and landscapers.

- The length cannot exceed 16 feet.
- Metal and reinforced fiberglass versions are available.
- It supports only one worker.

**9. How high may a tripod ladder extend?**

- a. 12 feet
- b. 16 feet
- c. 20 feet
- d. 25 feet

### Extension Trestle Ladders

The Extension Trestle Ladder is a self-supporting portable ladder that is adjustable in length, consisting of a Trestle Ladder base and a vertically adjustable Extension section with a means for locking the ladders together. These ladders are often used in pairs to support a scaffold plank. They are intended for use by one person.

- They have two sections that are hinged at the top and form equal angles with the base.
- They are used in pairs to support planks or staging.
- The rungs are not used as steps.
- The length cannot exceed 20 feet.

For more information on extension trestle ladders, see the [American Ladder Institute's](#) webpage.

#### 10. Which type of ladder is often used in pairs to support a scaffold plank?

- a. Straight ladder
- b. Standard folding ladder
- c. Scaffold ladder
- d. Extension trestle ladder

### Job-Made Ladders

A job-made wooden ladder is a ladder constructed at the construction site. It is not commercially manufactured. A job-made wooden ladder provides access to and from a work area. It is not intended to serve as a work platform. These ladders are temporary, and are used only until a particular phase of work is completed or until permanent stairways or fixed ladders are installed.

#### Side Rails:

- Side rails of single-cleat ladders up to 24 ft. long should be made with at least 2x6 in. lumber.

- Single-rung ladder width should be at least 16 in., but not more than 20 in. btw. rails measured inside to inside.
- Rails should extend above the top landing between 36 in. (91.5 cm) and 42 in. to provide a handhold for mounting and dismounting, and cleats must be eliminated above the landing level.

**Cleats:**

- Must be equally spaced 12 inches on center from the top of one cleat to the top of the next cleat.
- Cleats should be fastened to each rail with three 12d common nails, nailed directly to the side rails.
- Cleats should be at least 1x4 in. for ladders 16 to 24 ft. long.

**Filler Blocks:**

- Minimum 2x2 in. wood strips inserted btw. cleats
- The ladder is complete when filler is nailed at the top of each rail.

For more information on job-built ladders, see [OSHA Fact Sheet 3661, Reducing Falls in Construction: Safe Use of Job-made Wooden Ladders.](#)

- 11. Each of the following statements regarding job-made ladders is true EXCEPT \_\_\_\_\_.**
- a. they are not to be used as work platforms
  - b. they are meant as temporary ladders
  - c. they are commercially manufactured
  - d. Extension trestle ladder

## Module 2: General Requirements – Ladders

### Introduction

Falls from portable ladders are one of the leading causes of occupational fatalities and injuries. Before using a ladder, read and follow all the labels and markings on the ladder. Below are some ladder do's and Don'ts:

- Do keep ladders in a safe condition and store ladders appropriately.
- Do keep the area around the top and bottom of a ladder clear.
- Do replace all frayed or badly worn ropes.
- Do make sure rungs, cleats, and steps are level and uniformly spaced.
- Do use ladders only for their designated purpose.
- Don't tie ladders together to make longer sections.
- Don't use single rail ladders.
- Don't load ladders beyond the maximum load for which they were built.
- Don't use damaged or defective ladders.
- Don't climb too high on the ladder.
- Don't hand carry loads or equipment while on a ladder.
- Don't reach to the point where you lose your balance.
- Don't stand or work on the top cap or the step below the top cap of a stepladder.
- Don't stand or work on the top 3 rungs of an extension ladder.
- Don't place ladders on boxes, barrels, pick-up truck beds, scaffolds, or equipment.
- Don't use portable ladders in a horizontal position as a plank, platform, or scaffold etc.
- Don't splice together short ladders to make longer ladders.

- Don't use ladders in high winds.
- Don't use extension ladders without maintaining minimum overlap.
- Don't use a ladder that does not meet the required duty rating.
- Don't use a metal ladder when working on or near electrical circuits.

**1. Don't stand or work on the \_\_\_\_\_ of an extension ladder.**

- a. top half
- b. top 3 rungs
- c. top 4 treads
- d. side rails

### Securing Ladders

There is a significant risk of falling if portable ladders are not safely positioned each time they are used. Unsecured ladders can slip or shift due to the weight load or lack of friction between the ladder and contact points. It is very easy to lose your balance while getting on or off an unsteady ladder. Be sure to evaluate the situation; do not use a ladder on slippery surfaces unless it is secured or has slip-resistant feet.

### Inspecting Ladders

It is important to inspect any ladder before it is put into use. If the ladder is damaged in any way, it must be removed from service and tagged until it is either repaired or thrown away.

- Ladders should not have any damage, lack of structural integrity, missing components or loose parts.
- Damaged or worn ladders should be destroyed.
- The steps or rungs must be tight and secure to the side rails.
- All hardware and fittings need to be properly and securely attached.
- Movable parts must be tested to see that they operate without binding or without too much free play.
- All labels should be intact and readable.

- Ladders shall be free of oil, grease, or slippery materials.
- A ladder that has been exposed to fire or strong chemicals should be discarded.
- All accessories such as leg levelers, paint shelves, stand-off shelves, etc. are in good condition.
- The ladder base shall be placed on a secure and level footing. When necessary, ladder levelers shall be used to achieve equal rail support on uneven surfaces.
- The ladder base must have the slip resistant material.

**2. All of the following are important things to look for when conducting a ladder inspection EXCEPT \_\_\_\_\_.**

- a. movable parts that bind or have too much free play
- b. making sure steps or rungs are tight and secure to the side rails
- c. oil, grease, or slippery materials on rungs
- d. dried paint splatter or drippings on side-rail surfaces

### Real Life Scenario

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On August 3, 2010 a 23-year-old male laborer was electrocuted, and two co-workers were severely shocked when the 32-foot aluminum ladder that was part of a ladder platform hoist came in contact with energized overhead power lines.

The victim and the two co-workers were in the process of raising the ladder from a horizontal position on the ground to a vertical position against a building. While raising the ladder to the vertical position, the workers lost their footing and the ladder fell towards and came in contact with energized overhead power lines. Two co-workers were shocked and thrown to the ground.

The victim was electrocuted, and the ladder fell to the ground landing on top of him. Once the two co-workers regained mobility, they went to assist the victim. One of the coworkers placed a call for emergency medical services (EMS) and then placed a second call to the employer.

The local police arrived followed by EMS within minutes of the call. The victim was transported to a local hospital where he was pronounced dead.

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**Recommendations:**

- Eliminate the use of conductive tools and equipment, including ladders, in proximity to energized overhead power lines
  - Conduct job site surveys prior to the start of construction projects to identify potential hazards, such as energized overhead power lines, and implement appropriate control measures for these hazards.
- 

**3. When working around overhead energized power lines, never use \_\_\_\_\_.**

- a. Type E hard hats
- b. metal ladders or conductive tools
- c. arc flash protective clothing
- d. insulated gloves and shoes

### Three-Point-Control vs. Three-Point-Contact

#### Three-Point-Contact

What is the difference between the three-point control method and the three-point contact method? The three-point control method requires a worker to use 3 limbs for reliable, stable support, while the three-point contact method requires a worker only depend upon 3 points of contact with the ladder.

Using the stomach or palm are examples of unstable points of contact; these points of contact are unreliable and lead to a false sense of stability.

Though some argue leaning against a surface is acceptable as a point of contact, there is a significant problem with this assumption. For example, if a worker has both feet on a ladder while resting one palm on the roof (three-point contact) they will not be able to prevent a fall if both feet were to slip.

**Because the three-point contact method does not require reliable, stable support, it is not the preferred method to use when on a ladder.**

**4. Which of the following is TRUE about the 3-point-contact method when working on ladders?**

- a. The worker must use feet and hands for support
- b. The worker only needs to depend on three points of bodily contact
- c. It is the preferred method while working on ladders
- d. It is the most reliable in preventing falls

### Three-Point-Control

On the other hand, the three-point-control method requires a worker to use three of his or her four limbs for reliable, stable support. This climbing strategy could prevent many of the ladder falls and deaths occurring throughout the United States and world. The three-point control method requires the worker to place his hand on the ladder in a way to support the full weight of the body if needed in an emergency. The breakaway force from a vertical rail is too great for a worker, male or female, to fully support their weight if only gripping with one hand. During a fall, the hand would slide down the bar until it contacts a rung on the ladder. The hand would most likely disconnect from the ladder when it collides with the rung. A vertical grip can only support approximately 50 percent of person's bodyweight.

If a worker, using the three-point control method, has both feet on the ladder and is gripping a horizontal rung (three-point control), they are much less likely to fall if both of their feet were to slip. When a worker uses a horizontal grip, it allows for about a 75 percent to 94 percent increase in breakaway force when compared to gripping a vertical rail. A horizontal grip allows the worker to hold their bodyweight and prevent a fall.

There are seven conditions for using three-point control while working from ladders. They include:

1. Work only for short periods of time
2. Use light tools and materials designed for single-hand use
3. Make sure the ladder is stabilized
4. Keep the ladder at the lowest height possible
5. Make sure belly button remains between side rails

6. Keep both feet at the same level
7. Maintain a horizontal one-hand grip (power grip).

Keeping three-point-control for good support is critical while a worker is climbing, moving or working at an elevation.

It is important to note, the three-point control method is not a substitution for the use of fall protection equipment.

**5. Which of the following is TRUE about of the 3-point-control method when working on ladders?**

- a. The worker must use feet and hands for support
- b. The worker only needs to depend on three points of bodily contact
- c. It is not the preferred method while working on ladders
- d. It is the least reliable in preventing falls

### Ladder Angle

A non-self-supporting ladder should have a set-up angle of about 75 degrees — a 4:1 ratio of the ladder's working length to set-back distance.

**Here's how to do it:**

- Stand at the base of the ladder with your toes touching the rails. Extend your arms straight out in front of you.
- If the tips of your finger just touch the rung nearest your shoulder level, the angle of your ladder has a 4:1 ratio.

**Important Consideration!** When your upper-support surface is an eave or other surface that projects out from the primary vertical surface, the 4-to-1 set-back distance must be calculated from directly below the upper-support point, not from the recessed vertical surface.

The National Institute for Occupational Safety and Health (NIOSH) has developed an easy-to-use interactive ladder safety application for smart phones. The [NIOSH Ladder Safety application](#) features a multimodal indicator, which uses visual and sound signals to assist the user in positioning an extension ladder at an optimal angle. The application provides graphic-oriented interactive reference materials, safety guidelines and checklists for extension ladder selection, inspection, accessorizing, and use. The application is intended to help a wide range of ladder users, employers, and safety professionals, with their ladder-related safety needs.

6. Non-self-supporting ladders should have a set-up angle of \_\_\_\_\_ to the horizon.

- a. 60 degrees
- b. about 75 degrees
- c. at least 85 degrees
- d. less than 90 degrees

### Real Life Scenario

On January 13, 2007, a 43-year-old male carpenter was injured when he fell from a ladder that slipped away from the drip edge of a house. The victim positioned the fiberglass extension ladder diagonally across the inside corner of the roof to secure a 2-inch by 4-inch piece of wood to the fascia under the drip edge to protect the drip edge. The ladder's safety feet were in an up position on the frozen soil. He called to his coworker to hold the ladder while he accessed the roof area. The coworker stood underneath the ladder and held rung #5 with his right hand and rung #7 with his left hand. The victim climbed the ladder holding the wood, to either rung #8 or #9 when the base of the ladder slipped away from the house. The falling ladder struck the coworker on his shoulder and arm and knocked him to the ground. The decedent fell to the coworker's left and landed on his back. Emergency crews transported the victim to the hospital where he died six days later.



### **Recommendations:**

- Employers should ensure that ladders are used in accordance with the requirements of existing safety standards and good standard practice.
- Employers should develop and implement a comprehensive written safety program.
- Construction employers should conduct a daily hazard assessment to determine if environmental working conditions have changed or will change. They should inform their employees of their findings and how the changing conditions may affect the work to be performed.

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- Employers should consider having at least one person on the jobsite certified in First Aid/CPR, should strongly consider having an individual certified as a Medical First Responder or Emergency Medical Technician (EMT), and hold at least semi-annual workplace rescue/first aid practices.
- 

**7. To make sure ladders are being used correctly on the construction worksite, what action should be taken?**

- a. Observe all activities throughout the day
- b. Tell workers to use common sense
- c. Conduct daily hazard assessments
- d. Encourage workers to use the correct ladder

## Module 3: General Requirements – Stairways

### Introduction

The rules covering stairways depend on how and when the stairs are used. For example, there are requirements for stairs used during construction and stairs used temporarily during construction.

### Stairways Used During Construction

The following requirements apply to all stairways used during construction:

- Stairways that will not be a permanent part of the structure on which construction work is performed must have landings at least 30 inches deep and 22 inches wide (76 x 56 cm) at every 12 feet (3.7 m) or less of vertical rise.
- Stairways must be installed at least 30 degrees, and no more than 50 degrees, from the horizontal.
- Variations in riser height or stair tread depth must not exceed 1/4 inch in any stairway system, including any foundation structure used as one or more treads of the stairs.
- Where doors or gates open directly onto a stairway, a platform must be provided that is at least 20 inches (51 cm) in width beyond the swing of the door.
- Metal pan landings and metal pan treads must be secured in place before filling.
- All stairway parts must be free of dangerous projections such as protruding nails.
- Slippery conditions on stairways must be corrected.
- Spiral stairways that will not be a permanent part of the structure may not be used by workers.

**1. Stairways used during construction must be installed at least \_\_\_\_\_, and no more than \_\_\_\_\_, from the horizontal.**

- a. 30 degrees, 40 degrees
- b. 30 degrees, 50 degrees
- c. 40 degrees, 50 degrees
- d. 40 degrees, 60 degrees

### Temporary Stairways Used During Construction

The following requirements apply to all temporary stairways used during construction:

- Except during construction of the actual stairway, stairways with metal pan landings and treads must not be used where the treads and/or landings have not been filled in with concrete or other material, unless the pans of the stairs and/or landings are temporarily filled in with wood or other material. All treads and landings must be replaced when worn below the top edge of the pan.
- Except during construction of the actual stairway, skeleton metal frame structures and steps must not be used (where treads and/or landings are to be installed at a later date) unless the stairs are fitted with secured temporary treads and landings.
- Temporary treads must be made of wood or other solid material and installed the full width and depth of the stair.

**2. During construction, what must the treads of temporary stairs be made of?**

- a. Wood or other solid material
- b. Only galvanized metal is allowed
- c. Any type of hardwood
- d. Any material that is corrosion resistant

### Stair Rail Requirements

- A *handrail* means a rail to provide employees with a handhold for support. A *stair rail* or stair rail system means a barrier erected along the exposed or open side of stairways to prevent employees from falling to a lower level.
- Four or more risers will generally require a stair rail.

- The following general requirements apply to stair rails and handrails (1926.1052(c)):
  - Stairways with four or more risers or rising more than 30 inches (76 cm) in height—whichever is less—must be installed with:
    - at least one handrail, and
    - one stair rail system along each unprotected side or edge.
- Winding and spiral stairways must be equipped with a handrail offset sufficiently to prevent walking on those portions of the stairways where the tread width is less than 6 inches (15 cm).
- Stair rails must be not less than 36 inches (91.5 cm) from the upper surface of the stair rail system to the surface of the tread, in line with the face of the riser at the forward edge of the tread.
- Unprotected sides and edges of stairway landings must have standard 42-inch (1.1 m) guardrail systems.
- The following general requirements apply to systems in which a stair rail also serves as a handrail:
  - When the top edge of a stair rail system also serves as a handrail, the height of the top edge must be not more than 37 inches (94 cm) nor less than 36 inches (91.5 cm) from the upper surface of the stair rail system to the surface of the tread, in line with the face of the riser at the forward edge of the tread.

**3. Stair rails installed after March 15th, 1991 must not be less than \_\_\_\_ in height.**

- a. 30 inches
- b. 33 inches
- c. 36 inches
- d. 39 inches

### Handrail Requirements

Requirements for handrails are as follows (1926.1052(c)):

- Handrails and top rails of the stair rail systems must be able to withstand, without failure, at least 200 pounds (890 n) of weight applied within 2 inches (5 cm) of the top edge in any downward or outward direction, at any point along the top edge.
- The height of handrails must be not more than 37 inches (94 cm) nor less than 30 inches (76 cm) from the upper surface of the handrail to the surface of the tread, in line with the face of the riser at the forward edge of the tread.
- Handrails must provide an adequate handhold for employees to grasp to prevent falls.
- Temporary handrails must have a minimum clearance of 3 inches (8 cm) between the handrail and walls, stair rail systems and other objects.
- Stairways with four or more risers or that rise more than 30 inches (76 cm) in height, whichever is less, must have at least one handrail.
- Winding or spiral stairways must have a handrail to prevent use of areas where the tread width is less than 6 inches (15 cm).

**4. Handrails must be able to withstand, without failure, how many pounds of weight applied with 2 inches of the top edge in any downward or outward direction?**

- a. At least 150 lbs
- b. At least 200 lbs
- c. At least 250 lbs
- d. At least 300 lbs

### Mid Rail Requirements

Mid rails, screens, mesh, intermediate vertical members or equivalent intermediate structural members must be provided between the top rail and stairway steps to the stairrail system. When mid rails are used, they must be located midway between the top of the stair rail system and the stairway steps.

In addition:

- Stair rail systems and handrails must be surfaced to prevent injuries such as punctures or lacerations and to keep clothing from snagging.
- The ends of stair rail systems and handrails must be built to prevent dangerous projections, such as rails protruding beyond the end posts of the system.

- Intermediate vertical members, such as balusters used as guardrails, must not be more than 19 inches (48 cm) apart.
- Other structural members, when used, must be installed such that there are no openings in the stair rail system that are more than 19 inches (48 cm) wide.

### Stairs and 3-Point Control

Applying three-point control to stairs requires two continuous handrails to allow a constant grip while moving up and down the stairway. Arms and hands should be free of materials, enabling them to support the full body weight if necessary. Stairs, such as those found on ships, can be very steep and present a serious fall hazard.

#### **5. Why are two handrails required on stair systems such as those on ships?**

- a. To ensure both left- and right-handed persons can climb the stairs
- b. To make three-point-contact while carrying objects down the stairs
- c. Because the U.S. Coast Guard requires it
- d. To allow for three-point-control methods when climbing the stairs

## Glossary

**Cleat** — a ladder crosspiece of rectangular cross section placed on edge upon which a person may step while ascending or descending a ladder.

**Double-cleat ladder** — a ladder with a center rail to allow simultaneous two-way traffic for employees ascending or descending.

**Failure** — Load refusal, breakage or separation of components.

**Fixed ladder** — a ladder that cannot be readily moved or carried because it is an integral part of a building or structure.

**Handrail** — a rail used to provide employees with a handhold for support.

**Job-made ladder** — a ladder that is fabricated by employees, typically at the construction site; non-commercially manufactured.

**Load refusal** — the point where the structural members lose their ability to carry the load.

**Point of access** — all areas used by employees for work-related passage from one area or level to another.

**Portable ladder** — a ladder that can be readily moved or carried.

**Riser height** — the vertical distance from the top of a tread or platform/landing to the top of the next higher tread or platform/landing.

**Side-step fixed ladder** — a fixed ladder that requires a person to get off at the top to step to the side of the ladder side rails to reach the landing.

**Single-cleat ladder** — a ladder consisting of a pair of side rails connected together by cleats, rungs or steps.

**Stair rail system** — a vertical barrier erected along the unprotected sides and edges of a stairway to prevent employees from falling to lower levels.

**Temporary service stairway** — a stairway where permanent treads and/or landings are to be filled in at a later date.

**Tread depth** — the horizontal distance from front to back of a tread, excluding nosing, if any.