

## MODULE 4: OTHER FALL HAZARDS: LADDERS

---

### Overview

- Why is ladder safety important?
- What safety devices are used on ladder systems?
- What are the general requirements for ladder safety?
- What are the rules for use of different types of ladders?
- What inspection and maintenance requirements apply to ladders?

January 2020

Susan B. Harwood Grant SH05121-SH9

86

### **Upon completion of this module, you will be able to:**

- \* Explain why ladder safety in construction is important
- \* Describe safety devices used on ladder systems
- \* Describe the general requirements for ladder safety
- \* Explain the rules for use of different types of ladders
- \* Describe ladder inspection and maintenance requirements

*Disclaimer: This material was produced under grant number Susan Harwood Grant # SH05121-SH9 during Grant Year 2019 from the Occupational Safety and Health Administration, U.S. Department of Labor. It does not necessarily reflect the views or policies of the U.S. Department of Labor, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government*

## Other Fall Hazards - Ladders

---

- The ladder system
- How does the system work?
- Cable and fixed rail systems
- The "climb assist" system

January 2020

Susan B. Harwood Grant SH05121-SH9

87

### Other Fall Hazards - Ladders

Other fall hazards like Ladders or ladder systems contribute to falls and deaths on the job. The system includes a body harness, carabiner, carrier rail, and safety sleeve. Ladder safety devices are available as a cable (i.e., vertical lifeline) or fixed rail system.

#### How does the system work?

The worker wears a body harness attached to the system by a carabiner. The system uses a cable/safety sleeve, shuttle, or cable grab specifically designed to attach the climber to the vertical line or rail. The cable grab or shuttle freely travels up or down the lifeline/rail as the worker ascends or descends the ladder, allowing the worker to maintain full contact with the ladder. If the worker falls, a locking cam or friction brake in the cable grab or shuttle locks onto the cable or rail and arrests the fall.

**Typically**, cable and fixed rail systems are permanently attached to the ladder or supporting structure. The cable (flexible carrier) or rail (rigid carrier) is attached by mountings at the top and bottom of the fixed ladder, with intermediate mountings or cable guides for added strength. Existing ladders may be retrofitted with commercially available ladder climbing systems.

**A ladder climbing system** should not be confused with a "climb assist" system, which consists of motorized equipment that ascends the ladder and partially bears the worker's weight. Some, but not all, climb assist systems incorporate fall protection features.

## Stairs and Ladders

---

- General Requirements
- When there is a break in elevation of 19 inches
- When there is only one point of access between levels
- When there are more than two points of access between levels

***Note: The standard does not apply to ladders specifically manufactured for scaffold access and egress but does apply to job-made and manufactured portable ladders intended for general purpose use.***

January 2020

Page 60

Susan B. Harwood Grant SH05121-SH9

88

- General Requirements
- When there is a break in elevation of 19 inches, no ramp, runway, embankment or personnel hoist is available, employers must provide a stairway or ladder at all worker points of access.
- When there is only one point of access between levels, employers must keep it clear of obstacles to permit free passage by workers. If free passage becomes restricted, employers must provide a second point of access and ensure that workers use it.
- When there are more than two points of access between levels, employers must ensure that at least one point of access remains clear. In addition, employers must install all stairway and ladder fall protection systems required by these rules and ensure that their worksite meets all requirements of the stairway and ladder rules before employees use stairways or ladders. See 29 CFR 1926.1050-1060 for the details of the standard.
- Note: The standard does not apply to ladders specifically manufactured for scaffold access and egress, but does apply to job-made and manufactured portable ladders intended for general purpose use. Rules for ladders used on or with scaffolds are addressed in 29 CFR 1926.451 Subpart L.

## Rules for Ladders

---

Important rules for ladders:

- Maintain ladders free of oil, grease and other slipping hazards.
- Do not load ladders beyond their maximum intended load nor beyond their manufacturer's rated capacity.
- Use ladders only for their designed purpose.
- Keep areas clear around the top and bottom of ladders.
- Do not move, shift or extend ladders while in use.

January 2020

Susan B. Harwood Grant SH05121-SH9

89

Here are some additional points addressed in the student textbook:

Use ladders only on stable and level surfaces unless secured to prevent accidental movement.

Do not use ladders on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental movement.

Do not use slipresistant feet as a substitute for exercising care when placing, lashing or holding a ladder upon slippery surfaces.

Secure ladders placed in areas such as passageways, doorways or driveways, or where they can be displaced by workplace activities or traffic to prevent accidental movement. Or use a barricade to keep traffic or activity away from the ladder.

Keep areas clear around the top and bottom of ladders.

Do not move, shift or extend ladders while in use.

Use ladders equipped with nonconductive side rails if the worker or the ladder could contact exposed energized electrical equipment.

Face the ladder when moving up or down.

Use at least one hand to grasp the ladder when climbing.

Do not carry objects or loads that could cause loss of balance and falling.

## Rules for Ladders (includes Jobsite Ladders)

- Double-cleated ladders or 2+ ladders are required if only one access point to work area.
- Ladder rungs, cleats and steps must be parallel, level, and uniformly spaced 10-14 inches apart (step stools 8-12 inches; base section of extension trestle ladders 8-18 inches).
- Ladders must not be tied or fastened together.
- Ladder components must be surfaced.
- Wood ladders must NOT be coated with opaque covering.

January 2020

Susan B. Harwood Grant SH05121-SH9

90

### General Requirements

- Double-cleated ladders or two or more ladders must be provided when ladders are the only way to enter or exit a work area where 25 or more employees work or when a ladder serves simultaneous two-way traffic.
- Ladder rungs, cleats and steps must be parallel, level and uniformly spaced when the ladder is in position for use.
- Rungs, cleats and steps of portable and fixed ladders (except as provided below) must not be spaced less than 10 inches (25 cm) apart, nor more than 14 inches (36 cm) apart, along the ladder's side rails.
- Rungs, cleats and steps of step stools must not be less than 8 inches (20 cm) apart, nor more than 12 inches (31 cm) apart, between center lines of the rungs, cleats and steps.
- Rungs, cleats and steps at the base section of extension trestle ladders must not be less than 8 inches (20 cm) nor more than 18 inches (46 cm) apart, between center lines of the rungs, cleats and steps. The rung spacing on the extension section must not be less than 6 inches (15 cm) nor more than 12 inches (31 cm).
- Ladders must not be tied or fastened together to create longer sections unless they are specifically designed for such use.
- When splicing side rails, the resulting side rail must be equivalent in strength to a one-piece side rail made of the same material.
- Two or more separate ladders used to reach an elevated work area must be offset with a platform
- or landing between the ladders, except when portable ladders are used to gain access to fixed ladders.
- Ladder components must be surfaced to prevent snagging of clothing and injury from punctures or lacerations.
- Wood ladders must not be coated with any opaque covering except for identification or warning labels, which may be placed only on one face of a side rail.

## Specific Types of Ladders

---

- Do not use single-rail ladders.
- Use non-self-supporting ladders at an angle where the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder.
- Use wooden ladders built at the jobsite with spliced side rails at an angle where the horizontal distance is one-eighth of the working length of the ladder.
- The top of a non-self-supporting ladder must be placed with two rails supported equally unless it is equipped with a single support attachment.

January 2020

Susan B. Harwood Grant SH05121-SH9

91

Explain items on slide.

## Stepladders

---

- Do not use the top or top step of a stepladder as a step.
- Do not use cross bracing on the rear section of stepladders for climbing unless the ladders are designed and provided with steps for climbing on both front and rear sections.
- Metal spreader or locking devices must be provided on stepladders to hold the front and back sections in an open position when ladders are being used.

Discuss the safe use of stepladders.

## Portable Ladders

---

- The minimum clear distance between side rails for all portable ladders must be 11.5 inches.
- The rungs and steps of portable metal ladders must be corrugated, knurled, dimpled, coated with skid-resistant material or treated to minimize slipping.
- A ladder extension must not deflect under a load that would cause the ladder to slip off its supports.

January 2020

Susan B. Harwood Grant SH05121-SH9

93

- When portable ladders are used for access to an upper landing surface, the side rails must extend at least 3 feet above the upper landing surface
- 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.
- To determine whether a self-supporting ladder can sustain a certain load, apply the load to the ladder in a downward vertical direction with the ladder placed at a horizontal angle of 75.5 degrees.

## Fixed Ladders

---

- If the total length of the climb on a fixed ladder equals or exceeds 24 feet, the ladder must be equipped with ladder safety devices.
- Fixed ladders must be able to support at least two loads of 250 pounds (114 kg) each, concentrated between any two consecutive attachments.

January 2020

Susan B. Harwood Grant SH05121-SH9

94

Fixed ladders must be provided with cages, wells, ladder safety devices or self-retracting lifelines where the length of climb is less than 24 feet (7.3 m) but the top of the ladder is at a distance greater than 24 feet (7.3 m) above lower levels. Fixed ladders must be able to support at least two loads of 250 pounds (114 kg) each, concentrated between any two consecutive attachments. Additional points:

- Landing platforms must be provided at maximum intervals of 50 feet (15.2 m).
- Each step or rung of a fixed ladder must be able to support a load of at least 250 pounds
- Minimum clear distance between the sides of individual rung/step ladders and between the side rails of other fixed ladders must be 16 inches (41 cm).
- Rungs of individual rung/step ladders must be shaped to prevent slipping off the end of the rungs.
- Rungs and steps of fixed metal ladders manufactured after March 15, 1991, must be corrugated, knurled, dimpled, coated with skid-resistant material or treated to minimize slipping.
- Minimum perpendicular clearance between fixed ladder rungs, cleats, and steps and any obstruction behind the ladder must be 7 inches (18 cm), except that the clearance for an elevator pit ladder must be 4.5 inches (11 cm).
- Minimum perpendicular clearance between the centerline of fixed ladder rungs, cleats and steps, and any obstruction on the climbing side of the ladder must be 30 inches (76 cm). If obstructions are unavoidable, clearance may be reduced to 24 inches (61 cm), provided a deflection device is installed to guide workers around the obstruction.
- Step-across distance between the center of the steps or rungs of fixed ladders and the nearest edge of a landing area must be no less than 7 inches (18 cm) and no more than 12 inches (30 cm). A landing platform must be provided if the step-across distance exceeds 12 inches (30 cm).
- Fixed ladders without cages or wells must have at least a 15-inch (38 cm) clearance width to the nearest permanent object on each side of the centerline of the ladder.
- Side rails of through or side-step fixed ladders must extend 42 inches (1.1 m) above the top level or landing platform served by the ladder.
- Fixed ladders must be used at a pitch no greater than 90 degrees from the horizontal, measured from the back side of the ladder.

## Defective Ladders

---

Ladders needing repairs are subject to the following rules:

- Portable ladders with structural defects must be marked or tagged.
- Fixed ladders with structural defects must be withdrawn from service
  - Fixed ladders are considered withdrawn from use when tagged with "Do Not Use" or similar language, or marked as defective.
- Ladder repairs must restore the ladder to a condition meeting its original design criteria before the ladder is returned to use.

January 2020

Susan B. Harwood Grant SH05121-SH9

95

Ladders needing repairs are subject to the following rules:

- Portable ladders with structural defects—such as broken or missing rungs, cleats or steps, broken or split rails, corroded components or other faulty or defective components—must immediately be marked defective or tagged with "Do Not Use" or similar language and withdrawn from service until repaired.
- Fixed ladders with structural defects—such as broken or missing rungs, cleats or steps, broken or split rails or corroded components— must be withdrawn from service until repaired.
- Defective fixed ladders are considered withdrawn from use when they are immediately tagged with "Do Not Use" or similar language, or marked in a manner that identifies them as defective, or blocked—such as with a plywood attachment that spans several rungs.
- Ladder repairs must restore the ladder to a condition meeting its original design criteria before the ladder is returned to use.

## Wooden Ladders

---

- Never paint wooden ladders. Paint hides signs of deterioration and may accelerate rotting by trapping moisture in the wood.
- Coat wooden ladders with a clear, non-toxic wood preservative or varnish.
- Inspect wooden ladders frequently for splits, shakes, and cracks in the side rails and rungs, warping or loosening of rungs, loosening of metal hardware, and deformation of metal parts.

January 2020

Susan B. Harwood Grant SH05121-SH9

96

Discuss key points for use of wooden ladders.

## Aluminum Ladders

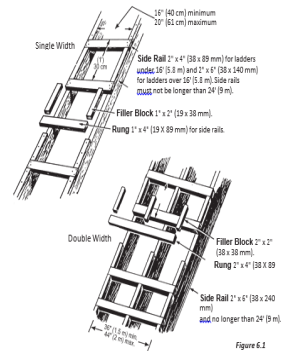
---

- Treat aluminum ladders with care. They are more susceptible to damage than wooden ladders.
- Because they conduct electricity well, never use aluminum ladders where electrical contact is possible.
- Check side rails and rungs regularly for dents, bends, and loose rungs.
- If repair by a qualified person is not possible, the ladder must be destroyed.

Discuss key points for use of aluminum ladders.

## Job-Built Ladders

- Wood used for job-built ladders should be straight-grained and free of loose knots, sharp edges, splinters, and shakes.
- The ladder should not be longer than 24 feet in working length.
- Job-built ladders should be inspected every day and, if defective, repaired immediately or taken out of service and destroyed.



January 2020

Susan B. Harwood Grant SH05121-SH9

98

Discuss key points for use of job-built ladders.

## Ladder Use #1

---

- Check ladder for defects before use.
- Clear scrap and material away from the base and top of ladder.
- Secure the top and base against movement.
- Set the ladder on a firm, level surface. On soft, uncompacted or rough soil, use a mud sill.

The next three slides emphasize key points for ladder use.

## Ladder Use #2

---

- Make sure that rails on ladders extend at least 3 feet above the landing. This allows for secure grip while stepping on or off.
- A ladder used as a regular means of access must:
  - Extend 3 feet above the landing or floor.
  - Have a clear toe space of at least 10 inches behind every rung.
  - Have sufficient clearance from obstructions on the climbing side.
  - Be located so that an adequate landing area is clear of obstructions at the top and bottom.
  - Be secured at the top and bottom to prevent movement.

January 2020

Susan B. Harwood Grant SH05121-SH9

100

Key points for ladder use (slide 2).

## Ladder Use #3

---

- Set straight or extension ladders one foot out for every 4 feet up, depending on length of ladder.
- Before setting up ladders, always check for overhead power lines.
- Do not position ladders against flexible or moveable surfaces.

January 2020

Susan B. Harwood Grant SH05121-SH9

101

Key points for ladder use (slide 3).

### ADDITIONAL POINTS IN STUDENT TEXT:

Always face the ladder when climbing up or down and while working from it.

Maintain 3- point contact when climbing up or down. That means two hands and one foot or two feet and one hand on the ladder at all time.

Keep your center of gravity between the side rails. Your belt buckle should never be outside the side rails.

When climbing up or down, do not carry tools or materials in your hands. Use a hoist rope instead.

Keep boots clean of mud, grease, or any slippery materials which could cause loss of footing.

Never erect ladders on boxes, carts, tables, or other unstable surfaces.

Never use ladders horizontally as scaffolds planks, runaways, or for any other purpose for which they have not been designed.

Stand no higher than the third or fourth rung from the top. Maintain knee contact for balance.

Do not splice short ladders together to make a long ladder. The side rails will not be strong enough for the extra loads.

Do not use ladders for bracing. They are not designed for this type of loading.

Do not set up ladders in doorways, passageways, driveways, or any other location where they can be struck or knocked over.

Never rest a ladder on its rungs. Ladders must rest on their side rails.

To erect long, awkward or heavy ladders, get help to avoid injury from overexertion.

## Ladder Inspection and Maintenance

---

- Ladders shall be inspected by a competent person for visible defects on a periodic basis and after any occurrence that could affect their safe use.
- Ladders should only be repaired by qualified persons.
- Defective ladders must be taken out of service and both locked and tagged for repair or scrapped.
- Inspect ladders for structural rigidity.
- Inspect non-skid feet for wear, imbedded material, and proper pivot action on swivel feet.

January 2020

Susan B. Harwood Grant SH05121-SH9

102

Discuss requirements for ladder inspection and maintenance (Slide 1 of 2).

## **Ladder Inspection and Maintenance (continued)**

---

- Replace frayed or worn ropes on extension ladders with types and sizes equal to manufacturer's original rope.
- Check aluminum ladders for dents and bends in side rails, steps, and rungs.
- Do not use metal pipe to replace rungs.
- Check wooden ladders for cracks, slits, and rot.
- Check all ladders for grease, oil, caulking, imbedded stone and metal, or other materials that could make them unsafe.

January 2020

Susan B. Harwood Grant SH05121-SH9

103

Discuss requirements for ladder inspection and maintenance (Slide 2 of 2).

## Ladder Safety Checklist

---

To prevent falls from ladders, make sure you have the following controls in place:

- Use only ladders that are in good condition and designed to handle the climbing job that needs to be done.
- Train employees on proper ladder use.
- Make proper ladder use a performance requirement for the job.
- Require employees to complete a ladder inspection before each use.

This is a brief “big-picture” ladder safety checklist.

## Criteria for Ladder Purchase and Care

---

- Check OSHA standards for the type of ladder you are using.
- Use only Underwriter's Laboratory approved ladders (will have the UL seal).
- Protect wood ladders with a clear sealer, such as varnish, shellac, linseed oil or wood preservative because paint can hide defects.

Discuss items on slide related to ladder purchase and care.

## Hands-on Skills

---

- Skill Assessment #5 - Using the proper steps to set up and use a ladder.
  - Students must properly set up and demonstrate proper ladder climbing techniques
  - Climb both up and down
  - Using 3 points of contact
  - Demonstrate the 4-foot rule

Document the successful completion of the skill assessment using the forms provided.

## MODULE 4 NOW YOU KNOW...

---

- Fixed ladders includes a body harness, carabiner, carrier rail, and safety sleeve.
- Stairways and ladders are major sources of injuries and fatalities.
- Employers must provide a stairway or ladder at all worker points of access, 19in or more.
- Use ladders only for their designed purpose.
- Do not move, shift or extend ladders while in use.
- Ladders should only be repaired by qualified persons.
- Maintain 3- point contact when climbing up or down.
- Use only Underwriter's Laboratory approved ladders (will have the UL seal).

January 2020

Susan B. Harwood Grant SH05121-SH9

107

- Ladder safety devices or systems are used to climb fixed ladders includes a body harness, carabiner, carrier rail, and safety sleeve.
- Stairways and ladders are major sources of injuries and fatalities among construction workers.
- When there is a break in elevation of 19 inches or more and no ramp, runway, embankment or personnel hoist is available, employers must provide a stairway or ladder at all worker points of access.
- Use ladders only for their designed purpose.
- Keep areas clear around the top and bottom of ladders. Do not move, shift or extend ladders while in use.
- Ladders should only be repaired by qualified persons.
- Maintain 3- point contact when climbing up or down.
- Use only Underwriter's Laboratory approved ladders (will have the UL seal).