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Ladder Safety for Engineers

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Portable ladders

How to use them so they won't let you down



Oregon OSHA

About this guide

“Portable ladders: How to use them so they won’t let you down” is an Oregon OSHA Standards and Technical Resources publication. Thanks to the following individuals for advice and technical assistance:

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Topic category: Ladders



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Portable ladders: Don't let them let you down

We take portable ladders for granted because they're so easy to use. Yet 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.

This guide tells you key practices for using portable ladders safely; they're not difficult to understand but they're easy to ignore. If you use the right type of ladder for your work, if you set it up properly, and if you know how to work safely when you're on a ladder you can be pretty confident that it won't let you down. Take a few minutes and learn about how to use a portable ladder in this guide!

Construction-industry employers. If you have employees who use ladders, make sure that a **competent person** has trained them. Their training must cover ladder hazards, how to use ladders, ladder capacities, and Oregon OSHA's requirements for the ladders they use. A competent person is one who can identify existing and predictable hazards where employees work and who has authority to correct the hazards promptly.

How to select your ladder

Which ladder is the right one for your job? You'll save time and energy and reduce your risk of injury if you know how to select the correct one. Key factors are type and style, length, duty rating, and the material from which the ladder is made.

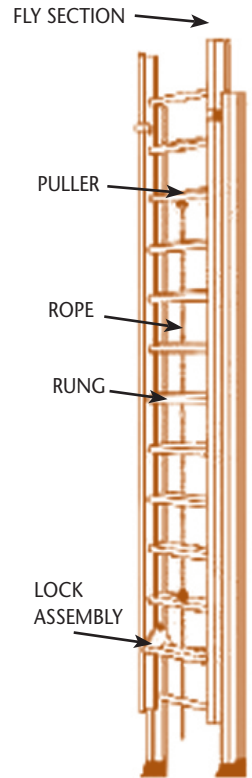
Choose the right type and style

Most portable ladders are either non-self-supporting, such as an extension ladder, or self-supporting, such as a standard stepladder. But there are also combination ladders that convert quickly from a stepladder to an extension ladder. You're likely to find the right size, shape, and type of ladder to accomplish your task within one of these categories.

Extension ladders (non-self-supporting)

Extension ladders offer the greatest length in a general purpose ladder. The ladder consists of two or more sections that travel in guides or brackets, allowing adjustable lengths. The sections must be assembled so that the sliding upper section is on top of the lower section. Each section must overlap its adjacent section a minimum distance, based on the ladder's overall length. The overall length is determined by the lengths of the individual sections, measured along the side rails. The table below shows the minimum overlap for two-section ladders up to 60 feet long.

Ladder length	Overlap
Up to 36 feet	3 feet
36 to 48 feet	4 feet
48 to 60 feet	5 feet



Extension ladder

Most extension ladders are made of wood, aluminum, or reinforced fiberglass. Wood ladders can't have more than two sections and must not exceed 60 feet. Aluminum and fiberglass ladders can have as many as three sections; however, the overall length must not exceed 72 feet. Individual sections of any extension ladder must not be longer than 30 feet. Extension ladders can be used only by one person at a time.

► ***Is it necessary to "tie off" an extension ladder to prevent it from slipping?***

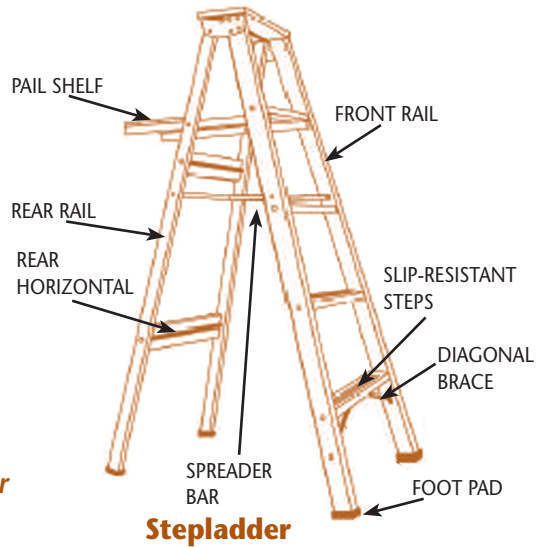
You don't have to tie off the ladder but you do have to ensure that the ladder cannot be accidentally moved or displaced. Tying off the top or bottom of a ladder is one way to ensure that it cannot be accidentally moved or displaced.

Standard stepladders (self-supporting)

The standard stepladder has flat steps and a hinged back. It is self-supporting and nonadjustable. Standard stepladders should be used only on surfaces that have a firm, level footing such as floors, platforms, and slabs. They're available in aluminum, wood, or reinforced fiberglass and are intended to support only one worker at a time. Remember not to stand on the top step. Stepladders must have metal spreaders or locking arms and can't be longer than 20 feet, measured along the front edge of the side rails.

► ***Can I use a standard stepladder like a straight ladder?***

Using a standard stepladder in a closed position is not a safe practice because it's more likely to slip on surfaces such as concrete and wood than a straight ladder. Standard stepladders are designed to be used only when the spreader arms are open and locked. If a standard stepladder doesn't meet your needs, choose an appropriate straight ladder or a combination ladder.

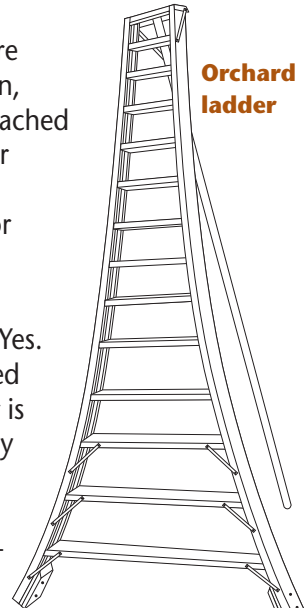


Other types of stepladders include:

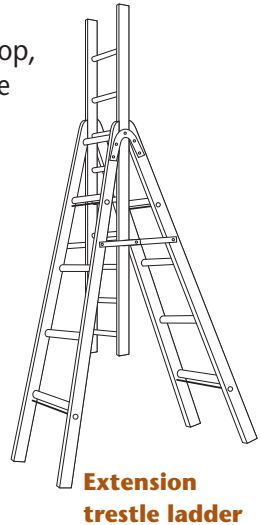
- **Two-way stepladder.** The two-way stepladder is similar to the standard stepladder; however, each side of this ladder has a set of steps. One person can work from either side or two people can work from the ladder at the same time — one on each side.
- **Platform ladder.** The platform ladder is a special-purpose ladder that has a large, stable work platform. The ladder's length is determined by the length of the front edge of the side rail from the bottom of the ladder to the base of the platform; it can't exceed 20 feet.
- **Orchard ladder.** The orchard ladder is a special-purpose ladder for pruning and harvest work. It has a flared base and a single back leg that offers support on soft, uneven ground. Orchard ladders are intended for use by only one person at a time and can't be longer than 16 feet. Wood, aluminum, and reinforced fiberglass versions are available. A more rigid orchard ladder, the so-called double base version, incorporates a triangular box brace with stub rails attached to the bottom step. The ladder is available in wood or with a combination wood or fiberglass rail and metal step. Maximum length is 16 feet and it is intended for use by one person. Do not stand on the top step of an orchard ladder.

► **Can orchard ladders be used on construction sites?** Yes.

In fact, orchard ladders are often safer on uneven or sloped ground than conventional stepladders. An orchard ladder is designed to be used on soil or turf so that each leg slightly penetrates the ground. Orchard ladders should never be used on concrete or hard surfaces. **Tripod ladders** that have spreader braces — also called electrician's ladders — are common on construction sites, too.



- **Trestle ladder.** A trestle ladder is a self-supporting portable ladder that has two sections hinged at the top, forming equal angles with the base. A variation of the trestle ladder, the extension trestle ladder includes a vertically adjustable single ladder that can be locked in place. (The single extension section must lap at least 3 feet into the base section.) Trestle ladders are used in pairs to support planks or staging. The rungs are not intended to be used as steps. The angle of spread between open front and back legs must be $5\frac{1}{2}$ inches per foot of length. The length can't be more than 20 feet, measured along the front edge of the side rails. Rails must be beveled at the top and have metal hinges to prevent spreading. Metal spreaders or locking devices are required to keep the rails in place.



Combination ladders and multipurpose ladders

These ladders share many of the features of stepladders and extension ladders. Most quickly convert from standard stepladders to extension ladders, and many can be used in three or more variations — such as a stairway ladder, two-way stepladder, or a self-supporting scaffold base.

Determine the proper length

Standard stepladders

You should be able to reach about 4 feet above the top of the ladder when you're standing two steps down from the top. For example, you should be able to reach an 8-foot ceiling on a 4-foot ladder. Never use the top of a stepladder as a step.

Extension ladders

The total length of an extension ladder should be 7-10 feet longer than the vertical distance to the upper contact point on the structure — a wall or roofline, for example. Never stand on the ladder rungs that extend above a roofline.

Determine the duty rating

Manufacturers give ladders duty ratings, based on the maximum weight they can safely support. The worker's weight plus the weight of any tools and materials that are carried onto the ladder must be less than the duty rating. Before you purchase a ladder consider the maximum weight it will support. Don't subject it to a load greater than its duty rating. Duty ratings for portable ladders:

- Special duty (IAA) 375 pounds
- Extra heavy duty (I-A) 300 pounds
- Heavy duty (I) 250 pounds
- Medium duty (II) 225 pounds
- Light duty (III) 200 pounds

Determine the right material

Wood

Wood provides a natural feel and good insulation against heat and cold. However, untreated wood ages quickly; wood ladders need a protective coat of clear varnish to keep the wood from drying and splitting. Also, wood ladders are heavy, particularly longer ones.

Aluminum

Aluminum ladders are lightweight and corrosion resistant. Aluminum will not crack or chip with rough handling; however, aluminum doesn't insulate well against heat and conducts electricity. Never use aluminum ladders for work near energized electrical lines.

Fiberglass

Fiberglass is durable, weather resistant, and nonconductive when clean and dry. Unlike wood, fiberglass won't dry out or split and provides better insulation against heat than aluminum. However, fiberglass ladders are heavier than comparable aluminum or wood ladders and can chip or crack with improper handling.

Fiberglass ladders must also be handled and maintained with more care than wood ladders. After a few years, the reinforcing fibers in fiberglass rails may become exposed, resulting in a condition known as “fiber bloom.” High humidity and exposure to strong sunlight can accelerate the condition. Fiber bloom doesn’t affect a ladder’s strength but it will affect the appearance and may cause users mild discomfort if exposed fibers penetrate their skin. Regular washing and waxing with a commercial non-slip paste wax will protect the ladder and reduce the potential for fiber bloom. Periodically coating the ladder with acrylic lacquer or polyurethane also will protect it.

How to set up your ladder

Setting up the ladder

- Move the ladder near your work. Get help if the ladder is too heavy to handle alone.
- Lock the spreaders on a stepladder. Secure the lock assembly on extension ladders.
- Make sure there are no electrical wires overhead.
- Use traffic cones or other barriers to protect the base of the ladder if vehicles or pedestrians could strike it.
- Make sure that a non-self-supporting ladder extends at least 3 feet above the top support point for access to a roof or other work level. Do not step on rungs above the upper support.
- Angle non-self-supporting ladders properly. The length of the side rails from the ladder's base to the top support points (the working length) should be four times the distance from ladder's base to the structure (the set-back distance). Done correctly, this results in a 4:1 set-up angle.

Achieving a 4:1 set-up angle

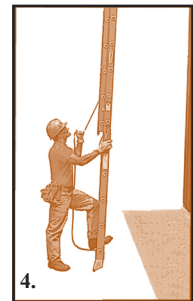
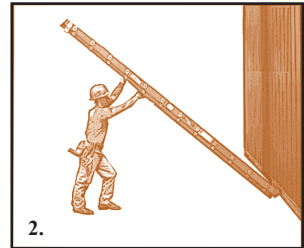
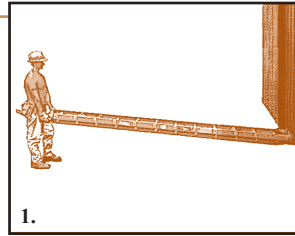
A non-self-supporting ladder should have a set-up angle of about 75 degrees — a 4:1 ratio of the ladder's working length to set-back distance.

Here's how to achieve 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 fingers just touch the rung nearest your shoulder level, the angle of your ladder has a 4:1 ratio.



Five steps for setting up an extension ladder

1. The ladder should be closed. Position the ladder with the base section on top of the fly section. Block the bottom of the ladder against the base of the structure.
2. Make sure there is clearance and no electrical lines are overhead. Carefully “walk” the ladder up until it is vertical.
3. Firmly grip the ladder, keep it vertical, and carefully move back from the structure about one quarter the distance of the ladder’s working length. This allows you to place it at the correct angle against the structure.
4. Raise the fly section. After the bottom rung of the fly section clears the bottom rung of the base section, place one foot on the base rung for secure footing.
5. Lean the ladder against the structure. The distance from the base of the ladder to the structure should be one quarter the distance of the ladder’s working length. Make sure the ladder extends 3 feet above the top support points for access to a roof or other work level. Both rails should rest firmly and securely against the structure.



How to work safely on your ladder

- Wear shoes that have non-slip soles; make sure they are free of mud, oil, or anything else slippery.
- Climb facing the ladder. Center your body between the rails and keep your hips square to the rungs. Hold the side rails with both hands; you have a better chance of avoiding a fall if a rung or step fails.
- Hold the ladder with one hand and work with the other hand whenever possible.
- Attach light, compact tools or materials to the ladder or to yourself.
- Raise and lower heavy, awkward loads with a hand line or a hoist.
- Use extreme caution when you're pushing or pulling materials.

How to inspect your ladder

Neglected ladders quickly become unsafe ladders. Step bolts loosen, sockets and other joints work loose, and eventually the ladder becomes unstable. Periodic maintenance extends a ladder's life and saves replacement costs. Maintenance includes regular inspection, repairing damage, and tightening step bolts and other fastenings.

- Inspect your ladder each time you use it. (A competent person must periodically inspect ladders for defects and after any occurrence that could make them unsafe.)
- Replace lower steps on wooden ladders when one-fourth of the step surface is worn away. Typically, the center of a step receives the most wear. Mineral abrasive or other skid-resistant material reduces wear.
- Don't paint wood ladders; paint conceals defects.
- Clean and lightly lubricate moving parts such as spreader bars, hinges, locks, and pulleys.
- Inspect and replace damaged or worn components and labels according to the manufacturer's instructions.
- Inspect the rails of fiberglass ladders for weathering, fiber bloom, and cracks.
- Keep the ladder away from heat sources and corrosive materials.

How to store your ladder

You'll extend a ladder's life by storing it properly:

- Use a well-ventilated storage area.
- Store wood and fiberglass away from excessive moisture, heat, and sunlight.
- Keep them away from stoves, steam pipes, or radiators.
- Store non-self-supporting ladders in flat racks or on wall brackets that will prevent them from sagging. Store stepladders vertically, in a closed position, to reduce the risk of sagging or twisting.
- Secure them so that they won't tip over if they are struck.
- Keep material off ladders while they are stored.

How to transport your ladder

When you carry a ladder, keep the front end elevated, especially around blind corners, in aisles, and through doorways. You'll reduce the chance of striking another person with the front of the ladder.

When you transport a ladder in a truck or a trailer, make sure that it's properly supported parallel to the bed. Pad the support points with soft, nonabrasive material such as rubber or carpeting and tie the ladder securely to eliminate chafing and road shock.

Safe practices checklist

- When portable ladders are used for access to an upper landing, the side rails extend at least 3 feet above the upper landing. When this is not possible, the ladder is secured to a rigid support at its top and a grab rail is available to help employees get off the ladder.
- Ladders are free of oil, grease, and other hazards that could cause slips.
- Ladders are not loaded beyond the manufacturer's duty rating.
- Ladders are used only for the purpose for which they were designed.
- Extension ladders are placed so that the working length of the ladder is four times the horizontal distance from the ladder's base to the structure — a 4:1 ratio.
- Ladders are used on stable, level surfaces or they are secured so that they cannot be displaced.
- Ladders are not used on slippery surfaces unless they are secured or they have slip-resistant feet.
- All ladders, except stepladders, have non-slip safety feet.
- Employees are prohibited from placing ladders on boxes, barrels, and other unstable objects.
- Ladders used near passageways, doorways, or driveways are protected so that vehicles or pedestrians do not strike them.
- The area around the top and bottom of a ladder is free from slipping and tripping hazards.
- The top of a non-self-supporting ladder is placed so that both rails are supported equally.
- Ladders are not moved, shifted, or extended when they are occupied.
- Ladders that could contact exposed energized electrical equipment have nonconductive side rails.
- Portable aluminum ladders have legible signs reading "CAUTION: Do Not Use Around Electrical Equipment" or equivalent wording.

Safe practices checklist continued

- The top step of a stepladder is not used as a step.
- Cross bracing on the rear section of a stepladder is not used for climbing unless the ladder is designed for that purpose.
- Employees are prohibited from using ladders that are missing steps, rungs, cleats, or have broken side rails or other faulty parts.
- A competent person inspects ladders periodically for defects and after any occurrence that could damage them.
- Defective ladders are marked as defective, or are tagged “Do Not Use” and removed from service until they are repaired.
- Repaired ladders meet their original design criteria before they are returned to service.
- Employees face ladders while climbing or descending.
- Employees use at least one hand to grasp the ladder when they are climbing and descending.
- Employees do not carry objects or loads that could cause them to lose their balance.
- Employees who use ladders receive training by a competent person in proper use, placement, and handling.
- Employees know the hazards associated with ladder use and follow procedures that minimize the hazards.
- Retraining is provided periodically to ensure that employees maintain their knowledge of proper ladder use, placement, and handling.

Oregon OSHA's requirements for portable ladders

General Industry 2/D - Walking-working surfaces

437-002-0026 Portable Ladders

Construction 3/X - Ladders and stairways

1926.1051 General requirements

1926.1053 Ladders

1926.1060 Training requirements

437-003-0065 Extension ladders

Appendix A - Ladders (non-mandatory guidelines)

Agriculture 4/D - Work surfaces

437-004-0340 Portable Ladders

437-004-0350 Orchard Ladders

Ladder requirements frequently cited by Oregon OSHA

1926.1053(b)(1), Portable ladders do not extend 3 feet above an upper landing.

1926.1053(b)(4), Ladders not used for their designed purpose.

1926.1053(b)(13), Top of ladder may not be used as a step.

Definitions

Check	A lengthwise separation of the wood that occurs across the rings of annual growth.
Cleat	A rectangular ladder crosspiece placed on edge, upon which a person may step while ascending or descending.
Competent person	One who can identify existing and predictable hazards where employees work and who can take prompt corrective measures to eliminate the hazards.
Decay	Disintegration due to action of wood-destroying fungi. Also known as dote or rot.
Extension ladder	A non-self-supporting portable ladder that is adjustable in length. It consists of two or more sections in guides or brackets that permit length adjustment. Length is designated by the sum of the lengths of each section, measured along the side rails.
Extension trestle ladder	A self-supporting portable ladder that is adjustable in length, consisting of a trestle ladder base and a vertically adjustable single ladder with means for locking the ladders together. Length is designated by the length of the trestle ladder base.
Fastening	A device that attaches a ladder to a structure, building, or equipment.
Platform ladder	A self-supporting ladder of fixed size with a platform at the working level.
Rungs	Ladder crosspieces on which a person steps when ascending or descending.
Sectional ladder	A non-self-supporting portable ladder, nonadjustable in length, consisting of two or more sections that function as a single ladder. Its length is designated by the overall length of the assembled sections.

Single (or straight) ladder	A single section non-self-supporting portable ladder, nonadjustable in length. Its length is measured along a side rail.
Special-purpose ladder	A general-purpose portable ladder with modified features for specific uses.
Stepladder	A self-supporting portable ladder, nonadjustable in length, that has flat steps and a hinged back. Length is measured along the front edge of a side rail.
Steps	The flat crosspieces of a ladder on which a person steps when ascending or descending.
Tread	The horizontal member of a step.
Tread width	The horizontal distance from front to back of the tread, including nosing.
Trestle ladder	A self-supporting portable ladder, nonadjustable in length, that consists of two sections hinged at the top to form equal angles with the base. Length is measured along the front edge of a side rail.

Oregon OSHA Services

Oregon OSHA offers a wide variety of safety and health services to employers and employees:

Consultative Services

- Offers no-cost, on-site safety and health assistance to help Oregon employers recognize and correct workplace safety and health problems.
- Provides consultations in the areas of safety, industrial hygiene, ergonomics, occupational safety and health programs, assistance to new businesses, the Safety and Health Achievement Recognition Program (SHARP), and the Voluntary Protection Program (VPP).

Enforcement

- Offers pre-job conferences for mobile employers in industries such as logging and construction.
- Provides abatement assistance to employers that have received citations and provides compliance and technical assistance by phone.
- Inspects places of employment for occupational safety and health hazards and investigates workplace complaints and accidents.

Appeals, Informal Conferences

- Provides the opportunity for employers to hold informal meetings with Oregon OSHA on concerns about workplace safety and health.
- Discusses Oregon OSHA's requirements and clarifies workplace safety or health violations.
- Discusses abatement dates and negotiates settlement agreements to resolve disputed citations.

Standards & Technical Resources

- Develops, interprets, and provides technical advice on safety and health standards.
- Provides copies of all Oregon OSHA occupational safety and health standards.
- Publishes booklets, pamphlets, and other materials to assist in the implementation of safety and health standards and programs.
- Operates a Resource Center containing books, topical files, technical periodicals, a video and film lending library, and more than 200 databases.

Public Education & Conferences

- Conducts conferences, seminars, workshops, and rule forums.
- Coordinates and provides technical training on topics such as confined space, ergonomics, lockout/tagout, and excavations.
- Provides workshops covering management of basic safety and health programs, safety committees, accident investigation, and job safety analysis.
- Manages the Safety and Health Education and Training Grant Program, which awards grants to industrial and labor groups to develop training materials in occupational safety and health for Oregon workers.

For more information, call the Oregon OSHA office nearest you.

(All phone numbers are voice and TTY.)

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503-229-5910

Consultation: 503-229-6193

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1340 Tandem Ave. NE, Ste. 160
Salem, OR 97303
503-378-3274

Consultation: 503-373-7819

Eugene

1140 Willagillespie, Ste. 42
Eugene, OR 97401-2101
541-686-7562

Consultation: 541-686-7913

Bend

Red Oaks Square
1230 NE Third St., Ste. A-115
Bend, OR 97701-4374
541-388-6066

Consultation: 541-388-6068

Medford

1840 Barnett Road, Ste. D
Medford, OR 97504-8250
541-776-6030

Consultation: 541-776-6016

Pendleton

721 SE Third St., Ste. 306
Pendleton, OR 97801-3056
541-276-9175

Consultation: 541-276-2353

