



HARVARD UNIVERSITY • UNIVERSITY OPERATIONS SERVICES

Environmental Health & Safety

uos

Ladders and Scaffolds

Revised: 5/28/2010



Ladders and Scaffolds

Copyright © 2010 President and Fellows of Harvard University

Revised May 28, 2010

Harvard University
Department of Environmental Health & Safety
46 Blackstone Street
Cambridge MA, 02139
Phone: (617) 495-2060 / FAX: (617) 496-5509





TABLE OF CONTENTS

1.0	INTRODUCTION	1
2.0	SCOPE AND APPLICATION	1
3.0	ROLES AND RESPONSIBILITIES.....	2
3.1	<i>GENERAL RESPONSIBILITIES</i>	<i>2</i>
3.1.1	SUPERVISOR.....	2
3.1.2	EMPLOYEE.....	2
3.1.3	DEPARTMENT OF ENVIRONMENTAL HEALTH AND SAFETY.....	3
3.2	<i>STANDARD SPECIFIC RESPONSIBILITIES.....</i>	<i>3</i>
4.0	GENERAL REQUIREMENTS.....	3
4.0.1	PORTABLE STEPLADDERS	4
4.0.2	PORTABLE RUNG LADDERS	5
4.0.3	SPECIAL LADDERS.....	6
4.0.4	FIXED LADDERS	6
4.0.5	SCAFFOLDS.....	10
4.0.5.1	SUPPORTED SCAFFOLDS	10
4.0.5.2	SUSPENDED SCAFFOLDS.....	10
4.0.5.3	VEHICLE MOUNTED SCAFFOLDS.....	10
4.1	<i>PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS.....</i>	<i>11</i>
4.2	<i>OPERATING REQUIREMENTS.....</i>	<i>11</i>
4.3	<i>MAINTENANCE REQUIREMENTS.....</i>	<i>12</i>
5.0	INSPECTIONS	12
5.1	<i>OPERATIONAL INSPECTIONS</i>	<i>13</i>
5.2	<i>PHYSICAL INSPECTIONS.....</i>	<i>13</i>
6.0	STANDARD DOCUMENTATION	13
7.0	TRAINING.....	13



1.0 INTRODUCTION

Ladders and scaffolds are frequently used to reach heights in order to perform a variety of operations, tasks and work-related activities. Any University employee who may be expected to use a ladder must be able to recognize potential hazards and appropriately select, set up and use ladders. University employees are not qualified to erect or dismantle scaffolding.

The Ladders and Scaffolds Standard has been developed to assist University personnel with identification and mitigation of hazards and to promote a safe, efficient work environment.

2.0 SCOPE AND APPLICATION

Many job related activities at the University require employees to follow specific procedures and protocols aimed at managing hazards, and protecting themselves and members of the community. The Ladders and Scaffolds Standard is applicable to all persons employed by Harvard University that may use any ladder or scaffold during the course of work (including portable ladders, extension ladders, fixed/permanent ladders and scaffolds).

All Harvard University employees who use or may use ladders or scaffolds during their employment must first complete appropriate safety training and then comply with all elements of this Standard.

This Standard shall be used in conjunction with other Harvard University Environmental Health and Safety Standards and associated safe work practices including but not limited to:

- Fall protection
- Walking and working surfaces
- Handling of hazardous materials
- Control of hazardous energy

OSHA has established specialized safety requirements for employees using ladders and scaffolds.

This standard incorporates the requirements of OSHA 29CFR1910.25-.28 Subpart D: “Walking-Working Surfaces”.

The major provisions of the regulations are:



- Portable wood ladders
- Portable metal ladders
- Safety requirements for scaffolding

3.0 ROLES AND RESPONSIBILITIES

In order for the Ladders and Scaffold Standard to be effective all Harvard University employees must clearly understand and take an active role in meeting their responsibilities. All affected Harvard University employees (including supervisors) must understand their roles, meet designated responsibilities, and adhere to practices and procedures as outlined in the Standard.

The Environmental Health and Safety Department will provide expert technical guidance to support the implementation of the Ladders and Scaffold Standard, and will review the standard annually.

Due to the potential hazards associated with various types of work activities, the specific responsibilities outlined below must be followed.

3.1 GENERAL RESPONSIBILITIES

3.1.1 SUPERVISOR

The following are the responsibilities of the Supervisor under the provisions of the Harvard University Ladders and Scaffolds Standard:

- Ensure employees attend training
- Provide proper type, rated and OSHA/ANSI compliant ladders for employees
- Ensure that all affected employees comply with this Standard
- Conduct periodic inspections of work areas
- Take ladders out of service if defective
- Evaluate Standard implementation annually
- Maintain inspection records

3.1.2 EMPLOYEE

The following are the responsibilities of Employees under the provisions of the Harvard University Ladders and Scaffolds Standard:

- Attend required training
- Ensure ladders meet OSHA standards



- Use proper type, rated and OSHA/ANSI compliant ladders
- Conduct inspections of ladders
- Identify defects, remove faulty ladders from service, and communicate to supervisor
- Maintain inspection record
- Tag defective ladders as “Do Not Use”
- Properly maintain and use ladders in a safe manner

3.1.3 DEPARTMENT OF ENVIRONMENTAL HEALTH AND SAFETY

The following are the responsibilities of the Department of Environmental Health and Safety under the provisions of the Harvard University Ladders and Scaffolds Standard:

- Develop and provide ladder safety training to affected University personnel
- Provide regulatory guidance and technical assistance to University personnel
- Evaluate and update the written Ladders and Scaffolds Standard on an annual basis
- Assist supervisors conducting hazard assessments

3.2 STANDARD SPECIFIC RESPONSIBILITIES

4.0 GENERAL REQUIREMENTS

Ladders vary by type, length, construction and application and service capability. Prior to purchasing or using a ladder, first decide what type of activities and work will be performed and the length needed. All ladders used at the University must be constructed and used in accordance with Occupational Safety and Health Administration (OSHA) regulations and American National Standard Institute (ANSI) standards for ladders. A commercially manufactured portable ladder should have a label indicating it meets the requirements of the ANSI Standard. If a ladder is not labeled, check with the manufacturer. When selecting a ladder, be sure to consider the proper duty rating, service capability, ladder type, and length to safely accommodate the combined weight of the user and material.

The use of aluminum ladders is prohibited. The Occupational Safety Group at Harvard University recommends sole purchase and use of portable non-conductive, composite materials, such as fiberglass when replacing wooden ladders. Only non-conductive



composite material ladders are to be used around electrical energy, components, and sources.

Portable ladders are primarily used to reach and conduct work while at elevations or for gaining access to lower elevations (below grade). Portable ladders should not be routinely used for gaining access to higher elevations where climbing off the ladder is necessary. Whenever possible, access to elevations above grade should be accomplished by using an interior or exterior stairway, aerial lift or fixed ladder and approved fall protection systems must be in place.

Employees will be permitted to perform work from portable ladders without use of fall protection when all of the following criteria are met:

- The working height of the employee (height of step or top rung on which the employee is standing) is less than 10 feet
- The work can be performed without employees having to reach (hips remain within vertical plane of side rails)
- The ladder is properly tied off (sectional/extension ladder), the spreaders are fully extended and locked (stepladder)
- The ladder is no closer than 15 feet from an open edge, window, hole or shaft, regardless of guardrails, and
- The employee can maintain 3 points of contact continuously while ascending and descending the ladder

4.0.1 PORTABLE STEPLADDERS

Stepladders are suitable for most jobs below 20 feet. Stepladders are shorter than extension ladders and when opened they have an 'A-shaped', self-supporting design. Stepladders can be easily folded for storage and their steps are wider than straight ladders and extension ladders. The length of a stepladder is measured by the length of the front rail. A Platform Stepladder is a variation of the traditional stepladder with a platform at the top for resting tools and materials. Stepladders shall not exceed 20 feet in length. The maximum working height of a stepladder is its height plus 3 feet.

1. Stepladder selection and use must be in accordance with the following rating:

- **Type 1A (Extra Heavy Duty Industrial):** 3-20 feet for heavy duty, such as utilities, contractors, and industrial use. Load capacity not to exceed 300 pounds
- **Type I (Industrial):** 3-20 feet for heavy duty, such as utilities, contractors, and industrial use. Load capacity not to exceed 250 pounds



- **Type II (Commercial):** 3-12 feet for medium duty, such as painters, offices, and light industrial use. Load capacity not to exceed 225 pounds
- **Type III (Household):** 3-6 feet for light duty, such as light household use. Load capacity not to exceed 200 pounds

2. The bottoms (feet) of the 4 rails must be supplied with insulating non-slip material for the safety of the user.

3. A metal spreader or locking device of sufficient size and strength to securely hold the front and back sections in the open position shall be a component of each stepladder. The spreader shall have all sharp points or edges covered or removed.

4.0.2 PORTABLE RUNG LADDERS

A Portable Rung Ladder is a non-self-supporting ladder that consists of two side rails and several crosspieces. Types of portable rung ladders include straight ladders, single ladders, and sectional/extension ladders. Safe and compliant use of portable rung ladders requires proper identification of working height and calculation of ladder length needed.

Prior to selecting a portable rung ladder, factor in the following height considerations: Identify the highest standing point - the ladder must extend at least three clear rungs above that surface.

Consider that the foot of the ladder must be away from the base one quarter the height of the ladder (Figure 1).

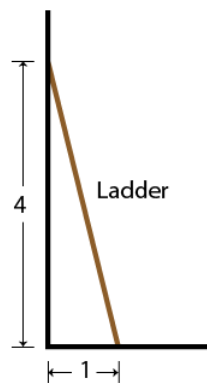


Figure 1

Sectional/Extension Ladders must overlap (Table 1).

Single Ladder - Single ladders shall be no longer than 30 feet.

Sectional/ Extension Ladders - Sectional/Extension ladders are used for working at height and allow for selectable heights. Ladders generally consist of two or three sections and have a sliding mechanism for adjustment to appropriate working height.

All ladders of this type shall consist of no more than two sections, one to fit within the side rails of the other and arranged in such a manner that the upper section can be raised and lowered. Two-section ladders must not exceed 60 feet in length.

Overlap Sectional/Extension Ladders - Based on the nominal length of the ladder, each section of a multi-section ladder shall overlap the adjacent section and be equipped with positive stops which will ensure the overlap specified in the table below.

Table 1

Normal length of ladder (feet)	Overlap (feet)
Up to and including 36	3
Over 36, up to and including 48	4
Over 48, up to 60	5

4.0.3 SPECIAL LADDERS

Trestle Ladders - Trestle ladders, extension sections or base sections of extension trestle ladders longer than 20 feet shall not be supplied.

Painter's stepladder- Painter's stepladders longer than 12 feet shall not be supplied.

Mason's ladder- A mason's ladder is a special type of single ladder intended for use in heavy construction work. Mason's ladders longer than 40 feet shall not be supplied.

Trolley and side-rolling ladders - Trolley ladders and side-rolling ladders longer than 20 feet shall not be supplied.

4.0.4 FIXED LADDERS

A Fixed Ladder is a vertical ladder mounted permanently to a structure - the structure can be a building or a piece of equipment. When the length exceeds 20 feet fixed ladders are required to be equipped with cages. When length exceeds 30 feet unbroken length, rest platforms or ladder landings are required.

General



- All splices made by whatever means shall meet design requirements as noted in OSHA 29 CFR 1910.27(a). All splices and connections shall have smooth transitions with original members and with no sharp or extensive projections.
- All welding shall be in accordance with the "Code for Welding in Building Construction" (AWS D1.0-1966).
- The pitch of fixed ladders at the University must be 90° with the horizontal.
- Ladders having a pitch in excess of 90° with the horizontal are prohibited.

Rung Design and Specifications

- The minimum design live load shall be a single concentrated load of 200 pounds.
- All rungs shall have a minimum diameter of $\frac{3}{4}$ inch for fixed metal ladders and a minimum diameter of $1\frac{1}{8}$ inches for fixed wooden ladders.
- The distance between rungs, cleats and steps shall not exceed 12 inches, and shall be uniform throughout the length of the ladder.
- The minimum clear length of rungs or cleats from side rail to side rail shall be 16 inches.
- Rungs, cleats and steps shall be free of splinters, sharp edges, burrs or projections which may be a hazard.
- The rungs of an individual-rung ladder shall be so designed that the user's foot cannot slide off the end.

Clearance and Climbing Side

- The required clearance to the nearest permanent object on the climbing side of the fixed ladder from the center line of the rungs is 30 inches for a pitch of 90°.
- **Ladders without Cages or Wells:** A clear width of at least 15 inches shall be provided each way from the centerline of the ladder in the climbing space, except when cages or wells are necessary.
- **Clearance in Back of Ladder:** The distance from the centerline of rungs, cleats or steps to the nearest permanent object in back of the ladder shall be not less than seven (7) inches, except that when unavoidable obstructions are encountered.



- **Clearance in Back of Grab Bar:** The distance from the centerline of the grab bar to the nearest permanent object in back of the grab bars shall be not less than 4 inches. Grab bars shall not protrude on the climbing side beyond the rungs of the ladder which they serve.
- **Step-Across Distance:** The step-across distance from the nearest edge of ladder to the nearest edge of equipment or structure shall be not more than 12 inches or less than 2½ inches.
- **Hatch Cover:** Counterweighted hatch covers shall open a minimum of 60° from the horizontal. The distance from the centerline of rungs or cleats to the edge of the hatch opening on the climbing side shall not be less than 24 inches for offset wells or 30 inches for straight wells.

Requirements for Cages or Wells

- Cages or wells (except on chimney ladders) shall be built per OSHA 29 CFR 1910.27(d)(1).
- Cages or wells conforming to the dimensions for OSHA 29 CFR 1910(d)(1)(ii) shall be provided on ladders of 20 feet to a maximum unbroken length of 30 feet.
- Cages shall extend a minimum of 42 inches above the top of a landing, unless other acceptable protection is provided.
- Cages shall extend down the ladder to a point not less than seven (7) feet nor more than eight (8) feet above the base of the ladder, with bottom flared not less than four (4) inches, or portion of cage opposite ladder shall be carried to the base.

Requirements for Landing Platforms

- When ladders ascend to heights exceeding 30 feet (except on chimneys), landing platforms shall be provided for each 30 feet of height. Each ladder section shall be offset from adjacent sections. Where installation conditions require that adjacent sections be offset, landing platforms shall be provided at each offset.
- Where a person has to step a distance greater than 12 inches from the centerline of the rung of a ladder to the nearest edge of structure or equipment, a landing platform shall be provided. The minimum step-across distance shall be 2½ inches.



- All landing platforms shall be equipped with standard railings and toeboards, so arranged as to give safe access to the ladder. Platforms shall be not less than 24 inches in width and 30 inches in length.
- One rung of any section of ladder shall be located at the level of the landing laterally served by the ladder. Where access to the landing is through the ladder, the same rung spacing as used on the ladder shall be used from the landing platform to the first rung below the landing.

Ladder Extensions

- The side rails of through or side-stepladder extensions shall extend 3½ feet above parapets and landings. For through ladder extensions, the rungs shall be omitted from the extension and shall have not less than 18 inches nor more than 24 inches clearance between rails.
- For side-step or offset fixed ladder sections, at landings the side rails and rungs shall be carried to the next regular rung beyond or above the 3½ feet minimum.

Grab Bars

Grab bars shall be spaced by a continuation of the rung spacing when they are located in the horizontal position. Vertical grab bars shall have the same spacing as the ladder side rails. Grab bar diameters shall be the equivalent of the round-rung diameters.

Safety Devices

- Ladder safety devices may be used on tower, water tank and chimney ladders over 20 feet in unbroken length in lieu of cage protection. No landing platform is required in these cases.
- All ladder safety devices, such as those that incorporate life belts, friction brakes and sliding attachments, shall meet the design requirements of the ladders which they serve.
- The distance from the center line of the rung, cleat, or step to the nearest permanent object behind the ladder must be at least 7 inches.
- The distance from the center line of the grab bar to the nearest permanent object behind the grab bar at must be least 4 inches.
- Side rails which might be used as a climbing aid shall be of such cross-sections as to afford adequate gripping surface without sharp edges, splinters or burrs.



- Fastenings shall be an integral part of fixed ladder design.

4.0.5 SCAFFOLDS

Scaffolds are temporary, elevated work platforms commonly used in maintenance and construction activities. There are three basic types of scaffolding; supported (including mobile), suspended and vehicle mounted.

Scaffolding must be erected, moved or dismantled under the supervision of a competent person. The competent person must have the ability to identify existing and predictable hazards and have the authority to make necessary corrections; including stopping the job, until such corrections are made. OSHA requires that the competent person be capable of making decisions on issues regarding fall protection, scaffolding integrity and safe access to the scaffolding. The competent person must be familiar with the manufacturer's specifications and instructions for the safe use of scaffolding. The competent person must have a combination of on-the-job experience and specialized training.

Employees of the University are not competent to erect or dismantle scaffolding.

4.0.5.1 SUPPORTED SCAFFOLDS

Supported scaffolds consist of platforms held upright by rigid supports such as outrigger beams, poles, posts or legs. Common types include fabricated frame and mobile scaffolds and pump or ladder jacks.

4.0.5.2 SUSPENDED SCAFFOLDS

Suspended scaffolds consist of platforms suspended by non-rigid, overhead supports such as rope or cable. Common types include single point, two-point and multipoint adjustable suspension scaffolds, catenary scaffolds, needle beam scaffolds and float or ship scaffolds. Harvard University employees are not allowed to work from suspended scaffolds without additional, specific training.

4.0.5.3 VEHICLE MOUNTED SCAFFOLDS

Vehicle mounted scaffolds are vehicles or machinery that have work platforms to elevate, rotate or otherwise support workers such as man lifts, personnel hoists, or aerial lifts (not including work platforms suspended by a crane or derrick). All vehicle mounted scaffolds are considered aerial lifts for which a separate Aerial Lifts Standard and training exists.



4.1 PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

Employees using a ladder or scaffold are required to wear shoes with full heels and non-slip soles. Dependant on type of operation, location, material used, other personal protective equipment may be required as prescribed by the University Personal Protective Equipment Standard. If ladder or scaffold use requires fall protection, or fall arrest equipment to perform work from fixed ladders or scaffolds, employees shall do so in accordance with OSHA and Harvard requirements.

4.2 OPERATING REQUIREMENTS

Workers must observe the following practices when using portable ladders:

- Before using a ladder, inspect it for defects.
- **Do Not** use a defective ladder. Tag or mark it so that it will be repaired or destroyed.
- **Do Not** use ladders in a horizontal position as runways or as scaffolds.
- **Do Not** tie or fasten ladders together to provide longer sections unless specifically designed and equipped with proper hardware.
- **Do Not** place ladders in front of a door that opens toward the ladder unless the door is locked, blocked, or guarded.
- **Do Not** use ladders to gain access to a roof unless the top of the ladder extends at least 3 feet above the point of support, at eave, gutter or roofline. Roof access by ladder should be a last resort, only when other methods are not available.
- **Do Not** lean ladders against unstable backing, such as loose boxes or barrels.
- **Do Not** place a ladder close to live electric wiring or against any operational piping (acid, chemical, sprinkler system, etc.) where damage may occur.
- **Do Not** leave placed ladders unattended, unless they are anchored at top and bottom.
- Portable ladders **Shall Be** used at such a pitch that the horizontal distance from the top support to the foot of the ladder is $\frac{1}{4}$ of the working length of the ladder (Figure 1). The ladder shall be so placed as to prevent slipping, or it shall be lashed or held in position.



- **Do Not** use the top two steps of a stepladder for standing; the highest working height shall be clearly marked.
- **Do Not** climb on stepladder leg bracing.
- **Do Not** stand on top two rungs of a straight or extension ladder.
- Ladder use **Shall Be** restricted to the purpose for which the ladder is designed.
- Portable ladders **Shall Be** placed so that both side rails have secure footing and provided solid footing on soft ground to prevent the ladder from sinking.
- Ladders used for access to heights above 10 feet **Shall Be** securely lashed or otherwise fastened to prevent slipping.
- On two-section extension ladders the minimum overlap for the 2 sections in use shall be in accordance with Table 1 (Section 4.0.2).

4.3 MAINTENANCE REQUIREMENTS

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. 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.
- Ladder repairs must restore the ladder to a condition meeting its original design criteria before the ladder is returned to use.

5.0 INSPECTIONS

Ladders shall be inspected by owners on a 12 month interval. Pre-Use Operational Checks are required prior to ladder use. Inspection checklists are available on the Occupational Safety Website. Employees are responsible for conducting a thorough preoperational check of ladders before use, looking for signs of damage, deformation, cracks and other indications of excessive wear. Inspection includes harnesses, lanyards and all components of ladder safety devices.



5.1 OPERATIONAL INSPECTIONS

Operational Inspections are observations of work procedures. These inspections are intended to identify and acknowledge safe work practices and to discover and correct unsafe work practices. Proper ladder use includes selecting the right ladder for a task, setting up the ladder at the work site and using ladders for their designed purposes.

5.2 PHYSICAL INSPECTIONS

Physical Inspections are required on a 12 month interval. To minimize portable ladder damage not related to use, store ladders in areas protected from the elements. Do not store near radiators, stoves, or steam pipes or in other places subjected to excessive heat or dampness. Ladders can be hung on brackets against a wall, with more than two supports for long ladders to prevent warping.

6.0 STANDARD DOCUMENTATION

7.0 TRAINING

Every employee assigned to use ladders will be required to successfully complete the Working at Elevation training program prior to assignment to that job function. Each employee will be asked to demonstrate proficiency with the equipment during a practical inspection exercise. For the Working at Elevation Training schedule please visit the EH&S Website.